GW - 1

WORK PLANS

2002

SUPPLEMENT TO BLOOMFIELD REFINERY DISCHARGE PLAN APPLICATION, SITE INVESTIGATION AND ABATEMENT PLAN CMS

Volume I

September 2002

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ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Submitted to:
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Road, Building 1
Santa Fe, New Mexico 87505

New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Prepared by:
Bloomfield Refinery
111 Country Road
Bloomfield, New Mexico 87413

September 12, 2002

David Cobrain, Staff Manager
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Road, Building E
Santa Fe, New Mexico 87505

SEP 2002

William C. Olson, Hydrologist
Environmental Bureau
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Corrective Measures Study (Site Investigation and Abatement Plan)
Giant Refining Company, Bloomfield Refinery
EPA ID# NMD089416416
HWB-GRCB-01-001

Dear Mr. Cobrain and Mr. Olson:

This letter responds to the May 28, 2002 *Request for Supplemental Information* (RSI) issued by the Hazardous Waste Bureau (HWB) of the New Mexico Environment Department (NMED) regarding the *Corrective Measures Study (Site Investigation and Abatement Plan)*[1] submitted by San Juan Refining Company (SJRC) - Bloomfield Refinery (BRC) to NMED in September 2001. This letter also responds to the July 17, 2002 letter referencing the *Site Investigation Report and Abatement Plan* issued by the New Mexico Oil Conservation Division (OCD) of the New Mexico Energy, Minerals and Natural Resources Department which issued comments and request for information.

Bloomfield Refinery has combined the requests by NMED and OCD into a single response that will become a supplement to the September 2001 Discharge Plan. NMED has requested that the September 2001 *Discharge Plan Application, Site Investigation and Abatement Plan, CMS,* ***Volume II*** be changed to *Discharge Plan Application, Site Investigation and Abatement Plan, CMS,* ***Volume I***. The name change will be made to this document (the Plan) along with this supplement.

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[1] The title of the document submitted to NMED HWB was *Discharge Plan Application, Site Investigation and Abatement Plan CMS* . The document was the abatement plan and included the revised CMS .

BRC is providing this response to the NMED and the OCD based upon the Plan, the ongoing remediation at BRC, events associated with the Hammond Ditch [January 2002], and a commitment by BRC to provide information as requested in the above referenced letters.

The information provided in response to the NMED and OCD requests is organized into sections and attachments to this letter. Section 1 contains general information requested by NMED. Section 2 contains more technical information requested by NMED. Section 3 contains the requests for information from OCD. The number of the attachments within each of the sections exactly corresponds to the numbering sequence in the NMED and OCD requests. In addition, the following outline as well as the attachments repeat the original request and summarizes, in a Facility Response, the information provided in the attachments.

I. NMED requested the following general information in order to complete the assessment and conditional approval of the Corrective Measures Study (CMS).

NMED RSI

A facility map that includes
- monitoring well locations and refinery features including
- labeled process units;
- above-ground storage tanks; and
- other refinery and terminal features.

Facility Response

Attachment 1 includes a facility site map with monitoring well locations, labeled process units, above-ground storage tanks, and other refinery and terminal features. This map is provided in both 11" by 17" and 24" by 36" (D) sizes. The D size has been included because so much information is being presented that some information may not be legible in the reduced version. In addition, an 8 ½" by 11" copy of an October 9, 1997 satellite image of the facility has been included for reference. This image may also be found at: http://terraserver.homeadvisor.msn.com/image.asp?S=10&T=1&X=1171&Y=20327&Z=13&=2.

NMED RSI

As-built construction drawings of the Hammond Ditch presenting the
- groundwater recovery system,
- groundwater treatment system (the refinery wastewater treatment system); and
- all ancillary equipment and piping.

Facility Response

Attachment 2 includes:

- An as-built (cross-section) drawing of the Hammond Ditch that shows the embankments, ditch, concrete lining, bedding, and French Drain. This drawing provided in both 8½" by 11" and 11" by 17" sizes.
- As-built drawings (9 pages - 8½" by 11" size) of the groundwater collection system from the Hammond Ditch French Drain to the API separator, and includes:
    - gravity-flow piping from the French Drain into Recovery Tank 37
    - details of Recovery Tank 37
    - all piping and instruments for the system
    - site plan showing the layout of the system
    - an 8½" by 11" copy of a photograph of Recovery Tank 37

NMED RSI

NMED requested a site plan presenting

- Monitoring well locations and significant refinery features; and
- Water/product (SPH) level measurements obtained since 2001.
- A site plan for each monitoring event.

Facility Response

Attachment 3 includes:

- Monitoring wells and significant refinery features are clearly identified on the site map provided in Attachment 1. An 11" by 17" size reproduction of that site plan is included in Attachment 3 highlighting the monitoring wells, recovery wells, and seeps for which water/product (SPH) level measurements are being provided.

- Water/product level measurements were taken by refinery personnel throughout 2002. This information is presented in tabular and graphic form.

- An individual site plan has not been included for each monitoring event. However, the tabulated data from all sampling events have been graphed showing the ground water levels across the site.

NMED RSI

The results of all groundwater recovery and treatment system monitoring and sampling. The results must include

- Treatment system influent and effluent sampling analytical results,
- Remediation system flow rates and volume estimates,
- Product recovery volume estimates,
- All groundwater quality field measurements and laboratory chemical analytical results.

Facility Response

Attachment 4 includes a table of the flow rates from the flow meter shown in Figure 6 of the Hammond Ditch French Drain groundwater collection system (Attachment 2). The monitored flow rates from the meter on Tank 37 and a graph of the information are included.

Groundwater quality field observations are included in the Water/Product Level Tables included in Attachment 3 and laboratory chemical analysis results are provided in Attachment 3.2.2

BRC does not measure the volume/flow rate of water removed from the recovery wells. This water and the water recovered from the Hammond Ditch French Drain joins process water in the API separator; therefore, there is no method to provide individual product recovery rates from the wells and French Drain.

NMED RSI

Site plan presenting the location of proposed monitoring wells to be placed downgradiant of the Hammond Ditch to monitor the effectiveness of the groundwater recovery and treatment system [the Hammond Ditch French Drain].

Facility Response

Attachment 5 includes 8 ½" by 11" copies of photographs of the monitoring points located at the San Juan River sheet piling and Monitoring Well (MW) 24. One new monitoring well is proposed downgradiant of the Hammond Ditch to monitor the effectiveness of the Hammond

Ditch French Drain, and BRC will continue to monitor the downgradient seeps along the bluff, MW-24, and the points at the sheet piling. Water level information on Seep 5 and MW-24 are included in Attachment 3.

NMED RSI

An updated groundwater monitoring and sampling plan that includes facility-wide groundwater monitoring and incorporates monitoring of the newly installed groundwater recovery and treatment system [the Hammond Ditch French Drain].

Facility Response

Attachment 6 includes an updated facility-wide groundwater monitoring and sampling plan. This plan incorporates monitoring the flow meter on the newly installed groundwater recovery and treatment system (the Hammond Ditch French Drain).

NMED RSI

A site plan that includes the location(s) or proposed locations of monitoring wells in the vicinity of the barrier at the San Juan River to monitor BETX, TPH as GRO and DRO, and OCD general chemistry parameters (major cations and anions).

Facility Response

Attachment 7 includes an 8 ½" by 11" copy of a photograph of the monitoring points at the San Juan River sheet piling and an 11" by 17" site plan with these points highlighted. These monitoring points are also included in the site plan provided in Attachment 1. The groundwater monitoring and sampling plan included in Attachment 6 identifies a plan for the requested sampling at these points.

II. NMED requested the following additional information corresponding to the CMS section numbers.

NMED RSI

A map showing Hammond Ditch sediment sample locations and the locations of San Juan River and Hammond Ditch water sample collection points.

Facility Response

Attachment 3.1.1 includes the 1999 Hammond Ditch Investigation Report, which contains a site plan that shows all of the borings in the ditch.

NMED RSI

Eight borings were drilled in the vicinity of the river in 1997...but soil samples were obtained for laboratory analysis from only two of the borings.... Provide a copy of the investigation report if one was not previously submitted.

Facility Response

Attachment 3.1.2 includes the 1997 River Bank Investigation Report. Information in this report includes results of borings above and below the bluff and laboratory analysis of soil samples.

NMED RSI

Soil samples obtained from beneath the aeration lagoon liners in 1985 ... Provide a site plan presenting facility features and boring locations. ....add boring SHB-2 to Plate 10.

Facility Response

Attachment 3.1.3 includes the report and locations of the borings below the North and South API ponds (referred to as the "aeration lagoon" above). In addition, this information has been transferred to the site plan provided in Attachment 1, which includes the ponds and the boring locations in the ponds.

NMED RSI

The text and Table 6 reference 1999 groundwater sampling. Provide the results of all monitoring and sampling conducted since 1999. Submit copies of all groundwater monitoring reports generated since 1999 to NMED.

Facility Response

Attachment 3.2.2 includes copies of lab analysis for years 1999, 2000, 2001, and 2002 to-date.

NMED RSI

Plate 20 presents year 2000 benzene isopleths. Provides a summary table presenting the 2000 groundwater sampling data.

Facility Response

Attachment 3.2.2.1 includes a summary table of the VOC information provided in Attachment 3.2.2.

NMED RSI

The last paragraph in the "Naphthalene" section mentions a reduction in dissolved iron concentrations as being indicative on biodegradation of hydrocarbons along with decreased dissolved oxygen, nitrate, and sulfate. Iron and manganese reducing bacteria transform these metals from an insoluble to a more soluble state which would result in increased dissolved iron concentrations therefore decreased dissolved iron concentrations are not indicative of biodegradation.

Background concentrations for RCRA metals and OCD groundwater quality parameters must be established in soil and groundwater. Background sampling should be conducted at a location upgradient of the new evaporation ponds. In addition, the causes for the detection of elevated concentrations of concentrations of constituents in groundwater samples obtained from monitoring well MW-8 should be discussed.

Facility Response

BRC is installing a new well to establish background concentrations. Information on this well is provided in the monitoring and sampling plan provided in Attachment 6. Result from the new well will be used to establish the background concentrations for RCRA metals and OCD groundwater quality parameters.

NMED RSI

New exposure pathways were the only pathways considered in the remedial options evaluated instead of all exposure pathways. The CMS cites the evaluation summarized in the 1995 Groundwater Technologies, Inc. risk assessment as the reason for not discussing exposure pathways and receptors beyond considering those associated with each remedial option. Provide an updated discussion of potential receptors and exposure pathways.

Facility Response

Attachment 4.3.3 includes an updated discussion of the potential receptors and exposure pathways.

NMED RSI

Biodegradation is occurring at the site but its effectiveness is not directly measurable.... Giant Refining Company should collect site-wide dissolved oxygen and oxidation-reduction potential (ORP) measurements to determine whether biodegradation is occurring. In addition, dissolved iron and manganese, nitrate, sulfate, dissolved carbon dioxide, and methane concentrations could be measured to document the existence of some of the types of microbial activity occurring beneath the site. Background well measurements of biodegradation parameters must be obtained to determine whether biodegradation of hydrocarbons is occurring beneath the facility.

Facility Response

Attachment 6.0 is the monitoring and sampling plan that outlines BRC intention to verify natural attenuation activity along the primary groundwater flow path. The results will be compiled and evaluated to demonstrate that natural attenuation is occurring.

III. In addition to the NMED request for supplemental information dated May 28, 2002, the OCD sent a request dated July 17, 2002, containing the following comments and request for supplemental information.

OCD-1

Most of the information the OCD requires to complete an evaluation of the...[CMS] has already been requested by the...NMED in their May 28, 2002 correspondence....In order to answer OCD's concerns and prevent duplicative information, Giant shall submit to the OCD a copy of their response to NMED's request of information.

Facility Response

BRC has structured this response to incorporate all of the requested information from both NMED and OCD so both agencies get all information requested.

OCD-2

The OCD still does not have complete information regarding seepage control actions for the San Juan River... In order to resolve this issue, the OCD requires that Giant submit a report on all remediation actions conducted in the river bank area. The report shall provide

- summary of all remediation and monitoring actions;
- information on how Giant has complied with the OCD's March 6, 1998 conditions of approval;
- maps and as-built construction specifications for the items requested in OCD's July 2, 1999 correspondence; and
- a recommended remediation plan for the river bank areas.

Facility Response

Attachment OCD-2 includes a timeline of remediation, construction, and monitoring activities in relation to the Hammond Ditch; a brief summary description of the activities depicted in the timeline; a copy of the *San Juan River Unit, Hammond Project Portion, Final Planning Report/Environmental Assessment/Finding of No Significant Impact* by the United States Department of the Interior, December 1994; and a reference to the soil characterization between Hammond Ditch and the San Juan River (both above and below the bluff) included in Attachments 3.1.1 and 3.1.2.

Attachment OCD-2 also includes photographs of the sheet piling at the San Juan River and the bluff/seep area between the Hammond Ditch and the San Juan River; a copy of a correspondence with OCD dated May 27, 1999 in which the sheet pilings and slurry wall at the San Juan river are outlined; and a reference to the seep monitoring section in the facility wide monitoring plan provided in Attachment 6.

BRC does not anticipate further intrusive measures between Hammond Ditch and the San Juan River. The facility wide monitoring plan (Attachment 6) calls for careful monitoring of the existing MW24, seeps, and the points at the sheet piling and for corrective actions if a condition should develop that poses a threat to the San Juan River.

OCD-3

The main text of the document discusses the need for additional upgradient and downgradient monitoring wells in order to determine background water quality and complete the delineation of the extent of groundwater contamination at the refinery. Please provide a work plan to accomplish this task.

Facility Response

BRC is currently installing a new background well to establish background water quality and contamination concentrations. Information on this well is provided in the monitoring and sampling work plan provided in Attachment 6.

OCD-4

The OCD defers comment on Giant's conclusions regarding the source of the total dissolved solids (TDS), chloride, nitrate, and metals contamination of groundwater and the need for remediation of these constituents until the OCD has the opportunity to review information on background quality for the site.

Facility Response

BRC will provide additional background groundwater analytical results as soon as this information becomes available from the new background well.

OCD-5

Please provide a work plan for the proposed enhanced in-situ bioremediation pilot study for remediation of dissolved phase hydrocarbon contamination of groundwater.

Facility Response

BRC has included the work plan for natural attenuation in Attachment 6.

OCD-6

The recommended monitoring plan does not include a plan for monitoring potential migration of contaminants into surface water in the San Juan River. Please submit such a surface-water monitoring plan.

Facility Response

BRC has included a monitoring plan in the facility monitoring and sampling plan included in Attachment 6.

BRC is committed to providing NMED and OCD with the information requested. If you have any questions or need additional information please call me, Barry Holman, at (505) 632-4168.

Sincerely,

Barry Holman
Environmental Manager

BH/cb

cc:
- file
- Dave Cobrain, NMED
- Bill Olsen, NMOCD
- Bill Wilkinson, EPA
- Dave Kerby, Giant Refining Company

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

1912

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

May 28, 2002

Mr. Barry Holman
Environmental Manager
Giant Refining Company
P.O. Box 159
Bloomfield, New Mexico 87413

Mr. David Pavlich
Environmental Superintendent
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

SUBJECT: **REQUEST FOR SUPPLEMENTAL INFORMATION (RSI)**
CORRECTIVE MEASURES STUDY (SITE INVESTIGATION AND ABATEMENT PLAN)
GIANT REFINING COMPANY, BLOOMFIELD REFINERY
EPA ID# NMD089416416
HWB-GRCB-01-001

Dear Mr. Holman and Mr. Pavlich:

The Hazardous Waste Bureau of the New Mexico Environment Department (NMED) has completed a review of the above-referenced Corrective Measures Study (CMS) for technical adequacy as required under 20.4.2.201.7 NMAC. The CMS was submitted to fulfill the requirements of a 1992 EPA Administrative Order on Consent for the refinery. The consent order required that contamination be addressed on a facility-wide basis. The primary areas of concern were the San Juan River, the process areas, the tank farm, the fuel loading facilities and off-site, downgradient of the Refinery. Solid Waste Management Units (SWMUs) were not directly addressed in the Order but are included in this CMS at the request of the NMED.

NMED understands that the Hammond Ditch irrigation canal has been lined and that a groundwater recovery system was installed in conjunction with the lining of the ditch. After notification of the Hammond Ditch construction activities and reviewing the CMS, NMED requests additional information. The information that must be addressed is described in Attachment A.

The requested information must be submitted to NMED within ninety days of receipt of this RSI. Failure to respond within this time period will result in issuance of a Notice of Deficiency.

Please call this office at 505-428-2553 if you have questions or need additional information regarding this RSI.

Sincerely,

Dave Cobrain
Project Leader

attachment

cc: James Bearzi, NMED HWB
John Kieling, NMED HWB
Pam Allen, NMED HWB
Bob Wilkinson, EPA Region VI
Wayne Price, NMOCD
Bill Olson, NMOCD

file: Red/RSI/05-29-02/CMS report/GRCB-01-001

ATTACHMENT A
REQUEST FOR SUPPLEMENTAL INFORMATION
TECHNICAL ADEQUACY REVIEW

CORECTIVE MEASURES STUDY
(SITE INVESTIGATION AND ABATEMENT PLAN)
SEPTEMBER 2001

GIANT REFINING COMPANY BLOOMFIELD REFINERY
EPA ID NO. NMD089416416

May 28, 2002

The NMED requests the following general information in order to complete it's assessment of the Corrective Measures Study (CMS):

✓1. A facility map that includes monitoring well locations and refinery features including labeled process units, ASTs and other refinery and terminal features.

✓2. As-built construction drawings of the Hammond Ditch presenting the ①groundwater recovery system, the groundwater ②treatment system (the refinery wastewater treatment system) and all ancillary ③equipment and ④piping.

* 3. Site plans presenting monitoring well ①locations, significant ②refinery features and water/product level measurements ③obtained since 2001. A site plan should be included for each monitoring event.

4. The results of all groundwater recovery and treatment system monitoring and sampling. The results must include ①treatment system influent and effluent sampling analytical results, remediation ②system flow rates and volume estimates, product ③recovery volume estimates and all groundwater ④quality field measurements and laboratory chemical ⑤analytical results.

5. A site plan presenting the locations of proposed monitoring wells to be placed ①downgradient of the Hammond Ditch ~~to~~ ②monitor the effectiveness of the groundwater recovery and treatment system.

6. An updated groundwater monitoring and sampling plan that includes ①facility-wide groundwater monitoring and incorporates ②monitoring of the newly installed groundwater recovery and treatment system.

7. A site plan that includes the location(s) or proposed locations of monitoring wells in the vicinity of the barrier at the San Juan River to monitor for BETX, TPH as GRO and DRO, and OCD general chemistry parameters (major cations and anions).

Please provide the following additional information corresponding to the CMS section number:

3.1.1 A map showing Hammond Ditch sediment sample locations and the locations of San Juan River and Hammond Ditch water sample collection points.

3.1.2 Eight borings were drilled in the vicinity of the river in 1997 at an artificially low river stage but soil samples were obtained for laboratory analysis from only two of the borings. Total petroleum hydrocarbon (TPH) analytical results are reported for the two samples. Identify whether additional chemical analyses were conducted on the two soil samples or on samples obtained from the other borings and the results of the additional analyses, if available. Provide the title and date of the investigation report that summarizes the results of the investigation. Provide a copy of the report to NMED if one was not previously submitted.

3.1.3 Soil samples obtained from beneath the aeration lagoon liners in 1985 were likely composite samples therefore a lack of significant volatile organic compound (VOC) detections is not unexpected. TPH and VOCs were detected during drilling investigations conducted within the process areas; however, no site plan is provided showing the boring locations relative to facility features including the aeration lagoons. Provide a site plan presenting facility features and boring locations. In addition, Boring SHB-2 is not shown on Plate 10 (boring locations). Please add Boring SHB-2 to Plate 10.

3.2.2 The text and Table 6 reference 1999 groundwater sampling. Provide the results of all monitoring and sampling conducted since 1999. Submit copies of all groundwater monitoring reports generated since 1999 to the NMED.

3.2.2.1 Plate 20 presents year 2000 benzene isopleths. Provide a summary table presenting the 2000 data groundwater sampling data.

The last paragraph in the "Naphthalene" section mentions a reduction in dissolved iron concentrations as being indicative of biodegradation of hydrocarbons along with decreased dissolved oxygen, nitrate and sulfate. Iron and manganese reducing bacteria transform these metals from an insoluble to a more soluble state which would result in increased dissolved iron concentrations therefore decreased dissolved iron concentrations are not indicative of biodegradation.

Background concentrations for RCRA metals and OCD groundwater quality parameters must be established in soil and groundwater. Background sampling should be conducted at a location upgradient of the new evaporation ponds. In addition, the causes for the detection of elevated concentrations of constituents in groundwater samples obtained from monitoring well MW-8 should be discussed.

inves. HC profile & respond in Phase II

SW area - wants new well
- arc of wells already clean

4.3.3 New exposure pathways were the only pathways considered in the remedial options evaluation instead of all exposure pathways. The CMS cites the evaluation summarized in the 1995 Groundwater Technologies, Inc. risk assessment as the reason for not discussing exposure pathways and receptors beyond considering those associated with each remedial option. Provide an updated discussion of potential receptors and exposure pathways.

4.7.2 Biodegradation is occurring at the site but its effectiveness is not directly measurable. The stable/shrinking plume described in the CMS is more likely the result of the continuing total fluids and product recovery and the containment caused by the formerly unlined Hammond ditch. The total fluids recovery system that is currently operating is likely an effective method for product recovery. Giant Refining Company should collect site-wide dissolved oxygen and oxidation-reduction potential (ORP) measurements to determine whether biodegradation is occurring. In addition, dissolved iron and manganese, nitrate, sulfate, dissolved carbon dioxide and methane concentrations could be measured to document the existence of some of the types of microbial activity occurring beneath the site. Background well measurements of biodegradation parameters must be obtained to determine whether biodegradation of hydrocarbons is occurring beneath the facility.

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Betty Rivera
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

July 17, 2002

CERTIFIED MAIL
RETURN RECEIPT NO. 7001-1940-0004-7923-0476

Mr. Barry Holman
Giant Refining Company
50 County Rd. 4990
Bloomfield, New Mexico 87413

RE: SITE INVESTIGATION REPORT AND ABATEMENT PLAN
GIANT BLOOMFIELD REFINERY (GW-001)

Dear Mr. Holman:

The New Mexico Oil Conservation Division (OCD) has reviewed Giant Refining Company's (Giant) January 2, 2002 correspondence titled "SAN JUAN REFINING COMPANY DISCHARGE PLAN" and accompanying September 2001 "DISCHARGE PLAN APPLICATION, SITE INVESTIGATION AND ABATEMENT PLAN, CMS, VOLUME II". These documents contain Giant's summary report on soil and ground water investigative actions conducted at the refinery to date and Giant's proposal for remediation of contaminated soil and ground water.

The OCD has the following comments and requests for information regarding the above referenced document:

1. Most of the information the OCD requires to complete an evaluation of the above referenced document has already been requested by the Hazardous Waste Bureau of the New Mexico Environment Department (NMED) in their May 28, 2002 correspondence to Giant titled "REQUEST FOR SUPPLEMENTAL INFORMATION (RSI), CORRECTIVE MEASURES STUDY (SITE INVESTIGATION AND ABATEMENT PLAN), GIANT REFINING COMPANY, BLOOMFIELD REFINERY, EPA ID#NMD089416416, HWB-GRCB-01-001". In order to answer OCD's concerns and prevent duplicative information, Giant shall submit to the OCD a copy of their response to NMED's request for information.

2. The OCD still does not have complete information regarding seepage control actions for the San Juan River. On February 17, 1998 Giant submitted a remediation plan for the river bank contamination which included installation of a sheet piling system, installation of a recovery/monitor well and enhanced bioremediation of contaminated soils. This work plan was conditionally approved by the OCD on March 6, 1998. Giant submitted requested modifications to the sheet piling system work plan on May 27, 1999, June 21, 1999 and June 22, 1999. The OCD requested additional information on the proposed modifications on July 2, 1999. This information was never submitted and Giant implemented the proposed modifications in the summer of 1999 without OCD approval. To date the OCD has not received either the July 2, 1999 requested information nor any reports on the remediation and monitoring activities as required in the OCD's initial March 6, 1998 approval. In addition, the recommended abatement plan for the river bank area in Section 9 does not include some of the proposed remedial actions which were previously approved (ie. remediation of contaminated soils and installation of a recovery well). In order to resolve this issue the OCD requires that Giant submit a report on all remedial actions conducted in the river bank area. The report shall provide a summary of all remediation and monitoring actions; information on how Giant has complied with the OCD's March 6, 1998 conditions of approval; maps and as built construction specifications for the items requested in the OCD's July 2, 1999 correspondence; and a recommended remediation plan for the river bank areas.

3. The main text of the document discusses the need for additional upgradient and downgradient monitor wells in order to determine background water quality and complete the delineation of the extent of ground water contamination at the refinery. Please provide a work plan to accomplish this task.

4. The OCD defers comment on Giant's conclusions regarding the source of the total dissolved solids (TDS), chloride, nitrate and metals contamination of ground water and the need for remediation of these constituents until the OCD has the opportunity to review information on background water quality for the site.

5. Please provide a work plan for the proposed enhanced in-situ bioremediation pilot study for remediation of dissolved phase hydrocarbon contamination of ground water.

6. The recommended monitoring plan does not include a plan for monitoring potential migration of contaminants into surface water in the San Juan River. Please submit such a surface water monitoring plan.

Please submit the above information to the OCD Santa Fe Office by August 30, 2002 with a copy provided to the OCD Aztec District Office. Submission of the above information will allow the OCD to complete a review of Giant's abatement plan for the Bloomfield Refinery.

If you have any questions, please contact me at (505) 476-3491.

Sincerely,

Will Olson

William C. Olson
Hydrologist
Environmental Bureau

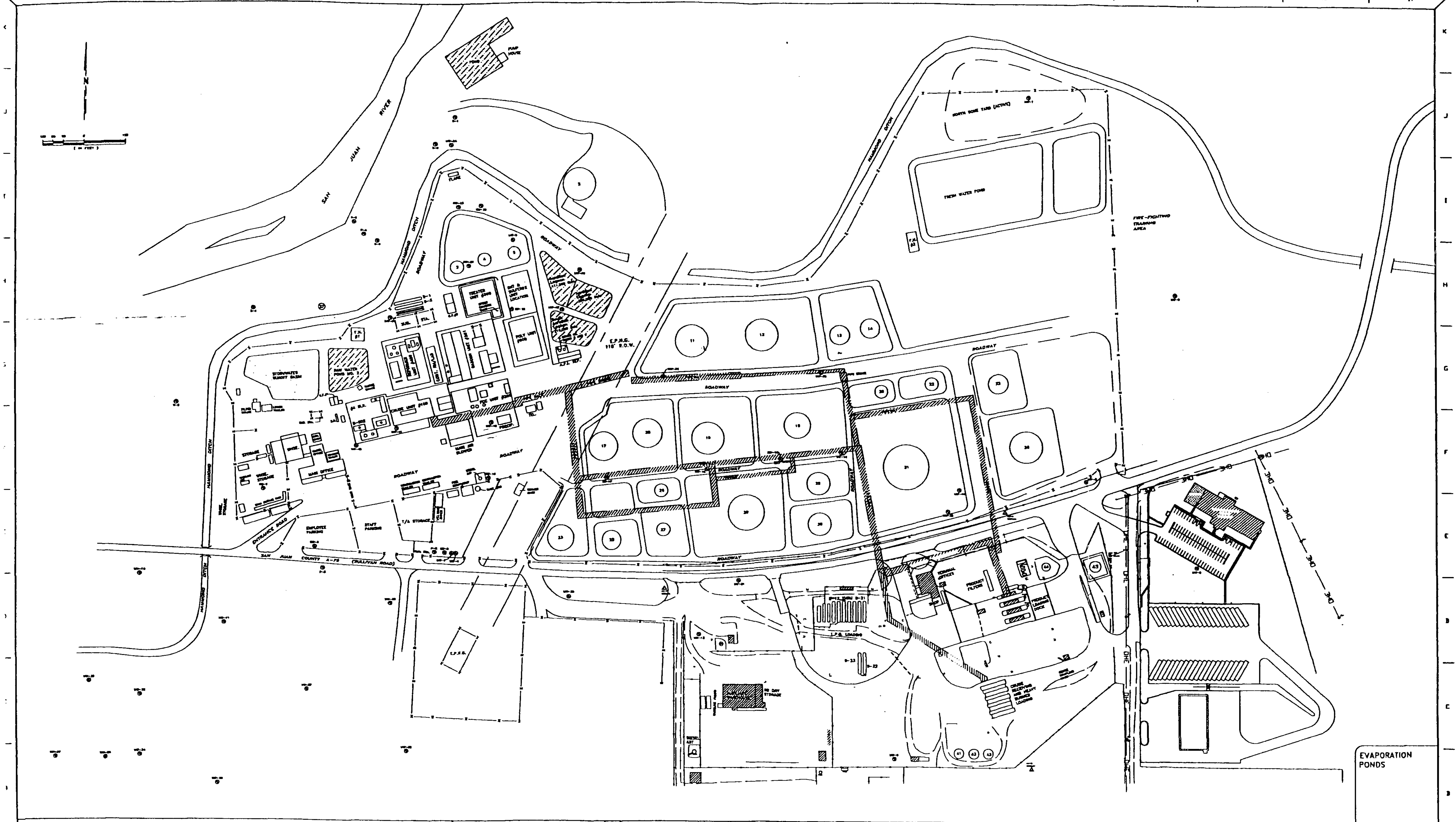
cc: Denny Foust, OCD Aztec District Office
Dave Cobrain, NMED Hazardous and Radioactive Materials Bureau

1.0

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested a facility map that includes monitoring well locations and refinery features including labeled process units, ASTs, and other refinery and terminal features.

Response

Attachment 1 includes a facility site map/site plan with monitoring well locations, labeled process units, above-ground storage tanks, and other refinery and terminal features. This map is provided in both 11" by 17" and 24" by 36" (D) sizes. The D size has been included because with the amount of information that is being presented some information may not be legible in the reduced version. In addition, an 8 ½" by 11" copy of an October 9, 1997 USGS aerial photograph of the facility has been included for reference. This image may also be found on the internet at: http://terraserver.homeadvisor.msn.com/image.asp?S=10&T=1&X=1171&Y=20327&Z=13&W=2.



NOTES

"MW-XX" – Monitoring Wells Locations
"RW-XX" – Recovery Well Locations
"S-XX" – Seep Locations
"P" – Piezometer

NO.	REVISION	JOB No.	DRAWN BY	DRAWN DATE	CHECKED BY	CHECKED DATE	APPROVED BY	APPROVED DATE
1	Updated As Per Enviromental Dept. Mark Up							

REFERENCE DWGS.

SCALE As Noted
DRAWN BY NHB — DATE 8/29/02
INITIAL CHK.
FINAL CHK.
ENGR.
APPR. BY
AFE/WO No.

Giant Bloomfield Refinery
Area Plot Plan
Recovery Well & Monitoring Well Locations

GIANT REFINING CO.
BLOOMFIELD REFINERY
BLOOMFIELD NEW MEXICO

DWG. NO D-000-900-023
REV. 1

NOTES
"MW-XX" - Monitoring Wells Locations
"RW-XX" - Recovery Well Locations
"S-XX" - Seep Locations
"P" - Piezometer

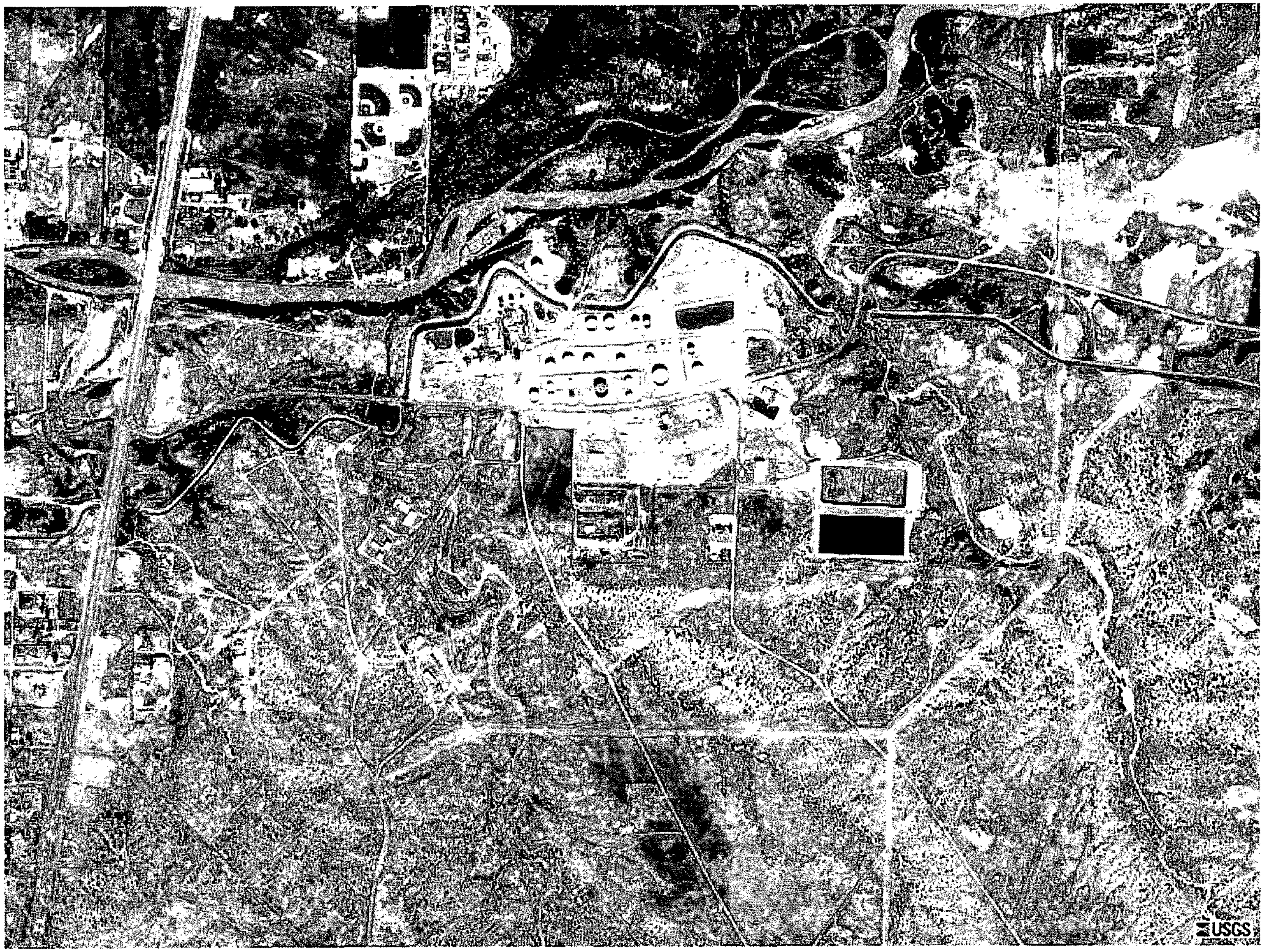
NO.	REVISION	JOB No.	BY	DATE	BY	DATE	BY	DATE
1	Updated As Per Enviromental Dept. Mark Up							
			DRAWN		CHECKED		APPROVED	

REFERENCE DWGS.

SCALE As Noted
DRAWN BY NHB — DATE 8/29/02
INITIAL CHK.
FINAL CHK.
ENGR.
APPR. BY
AFE/WO No.

Giant Bloomfield Refinery
Area Plot Plan
Recovery Well & Monitoring
Well Locations

GIANT
REFINING CO.
BLOOMFIELD REFINERY
BLOOMFIELD NEW MEXICO
DWG. NO. D-000-900-023
REV. 1



October 9, 1997
Bloomfield Refinery USGS Aerial Photograph

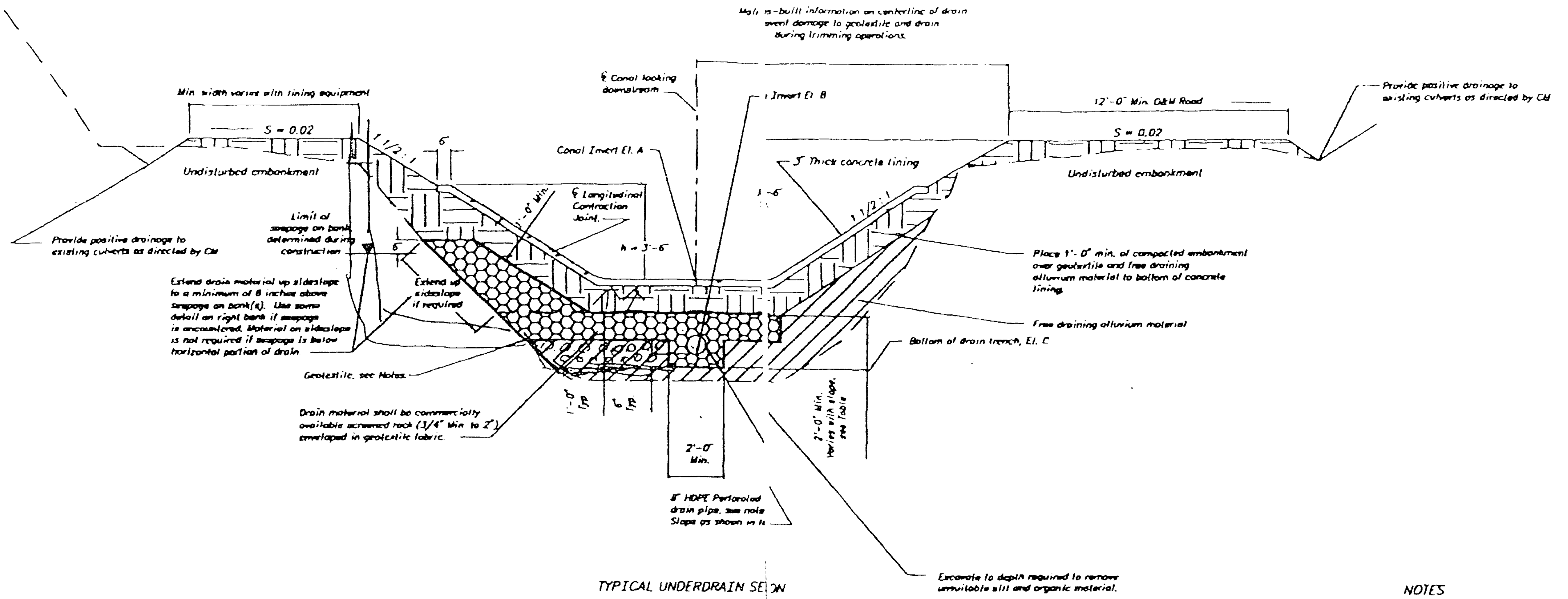
2.0

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested as-built construction drawings of the Hammond Ditch presenting the groundwater recovery system, the groundwater treatment system (the refinery wastewater treatment system); and all ancillary equipment and piping.

Response

This attachment includes an as-built, cross-sectional drawing of the Hammond Ditch in both 8½" by 11" and 11" by 17" sizes. The drawing includes the ditch embankments, the ditch, concrete lining, bedding, and the French Drain.

This attachment also includes a series of 9 as-built drawings (Figures 1 – 9) of the groundwater collection system from the Hammond Ditch French Drain to the API Separator. The series of drawings include the north and south collection systems; the gravity flow piping from the French Drain into Recovery Tank 37; the piping and instruments for the system; details of Recovery Tank 37; and a site plan showing the layout of the system. A copy of a photograph of Recovery Tank 37 is inserted at the end of this section.



TYPICAL UNDERDRAIN SE ON
WITH GROUNDWATER SEEPING FROM EX.ING CANAL BANK

TABLE OF LOCATIONS AND ELEVATIONS

BEGIN STATION	END STATION	DRAIN SLOPE	LINING ELEV. A	PIPE ELEV. B	DRAIN ELEV. C	DRAIN LENGTH	NOTES ON DRAIN OUTLET
715+65		– 0.00085	5496.70	5493.95	5493.45	1267	
	728+32	– 0.00085	5496.50	5492.87	5492.37		TO EXISTING CULVERT AND FUTU ANT PUMP SUMP
728+32		+ 0.0005	5496.50	5492.87	5492.37	869	TO EXISTING CULVERT AND FUTU ANT PUMP SUMP
	737+01	+ 0.0005	5496.14	5493.30	5492.80		
737+37		– 0.0005	5496.08	5493.51	5493.01	153	TO FUTURE GIANT PUMP SUMP
	738+90	– 0.0005	5496.35	5493.43	5492.93		
738+90		+ 0.0005	5496.35	5493.43	5492.93	265	TO FUTURE GIANT PUMP SUMP
	741+55	+ 0.0005	5496.31	5493.56	5493.06		

NOTES

For Plan and Profile of new concrete lining, see Drawings 343-406-912 through 917.

For Typical Concrete Lining Sections and Details, see Drawings 343-406-882.

Perforated pipe shall be ADS N-12 with smooth interior or equal.

Geotextile is used to prevent migration of fines from existing bank into drain system. Geotextile shall be Mirafi 600X or equal.

Extend drains to corrugated metal culvert pipes that were installed by HCD to dewater these reaches of canal. Use nonperforated HDPE or PVC pipe from drain pipe through CMPs to drain outlet locations established by HCD and Giant Refinery. Drain outlets shall be monitored for water quality and any contaminated water shall be treated by Giant Refinery in accordance with the agreement.

Fill annulus of CMPs with flowable grout to reduce flow between drain pipe and CMP.

Where concrete paved transitions are to be constructed, extend drain material from stations shown in table to existing structures to provide drainage under hand-placed transitions.

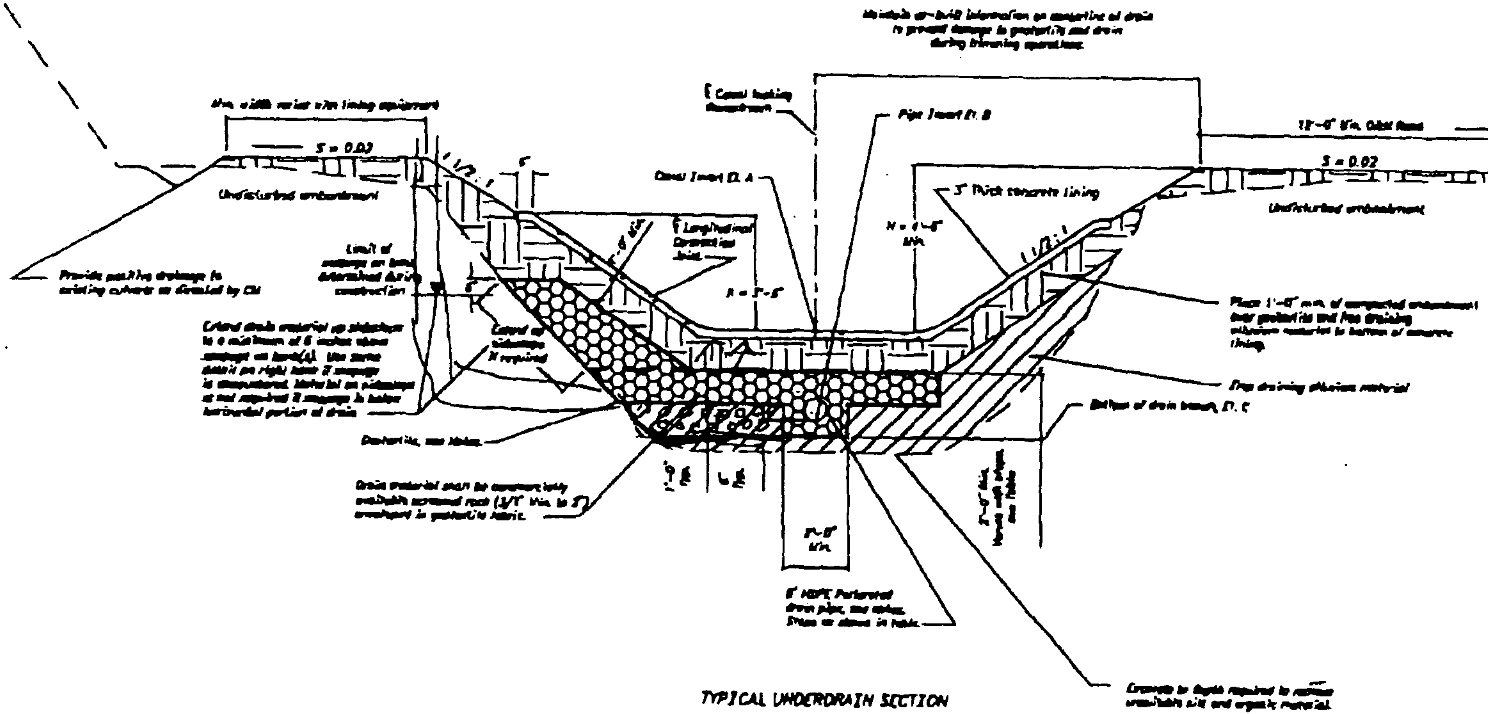
ALWAYS THINK SAFETY

HAMMOND CONSERVANCY DISTRICT
COLORADO RIVER BASIN SALINITY CONTROL PROJECT
HAMMOND PROJECT, NEW MEXICO

MAIN CANAL (REACH M55/45)
Sta. 687+44 to Sta. 737+01
TYPICAL UNDERDRAIN SECTIONS
AND DETAILS

DESIGNED [illegible] USBR TECHNICAL APPROVAL [illegible]
DRAWN [illegible] FIELD APPROVAL
CHECKED Larry [illegible] DISTRICT APPROVED

CADD SYSTEM [illegible]	CADD FILENAME [illegible]	DATE AND TIME PLOTTED [illegible]



TYPICAL UNDERDRAIN SECTION
WITH GROUNDWATER SEEPING FROM EXISTING CANAL BANK

TABLE OF LOCATIONS AND ELEVATIONS

BEGIN STATION	END STATION	DRAIN SLOPE	LINING ELEV. A	PIPE ELEV. B	DRAIN ELEV. C	DRAIN LENGTH	NOTES ON DRAIN OUTLET
715+85		- 0.00085	5496.70	5493.80	5493.15	1287	
	728+32	- 0.00085	5496.30	5492.87	5492.37		TO EXISTING CULVERT AND FUTURE GIANT PUMP SUMP
728+32		+ 0.0005	5496.80	5492.87	5492.37	853	TO EXISTING CULVERT AND FUTURE GIANT PUMP SUMP
	737+01	+ 0.0005	5498.14	5493.30	5492.80		
737+37		- 0.0005	5496.90	5493.51	5493.01	153	TO FUTURE GIANT PUMP SUMP
	738+90	- 0.0005	5496.36	5493.43	5492.93		
738+90		+ 0.0005	5496.45	5493.43	5492.93	246	TO FUTURE GIANT PUMP SUMP
	741+36	+ 0.0005	5498.31	5493.56	5493.06		

NOTES

For Plan and Profile of new concrete lining, see Drawings 343-106-917 through 917.

For Typical Concrete Lining Sections and Details, see Drawings 343-106-882.

Perforated pipe shall be ADS N-12 with smooth interior or equal.

Geotextile is used to prevent migration of fines from existing bank into drain system. Geotextile shall be Mirafi [illegible] or equal.

Extend drains to corrugated metal culvert pipes that were installed by HCD in [illegible] reaches of canal. Use nonperforated HDPE or PVC pipe from drain pipe through CMPs to drain outlet locations established by HCD and Giant Refinery. Drain outlets shall be monitored for water quality and any contaminated water shall be treated by Giant Refinery in accordance with the agreement.

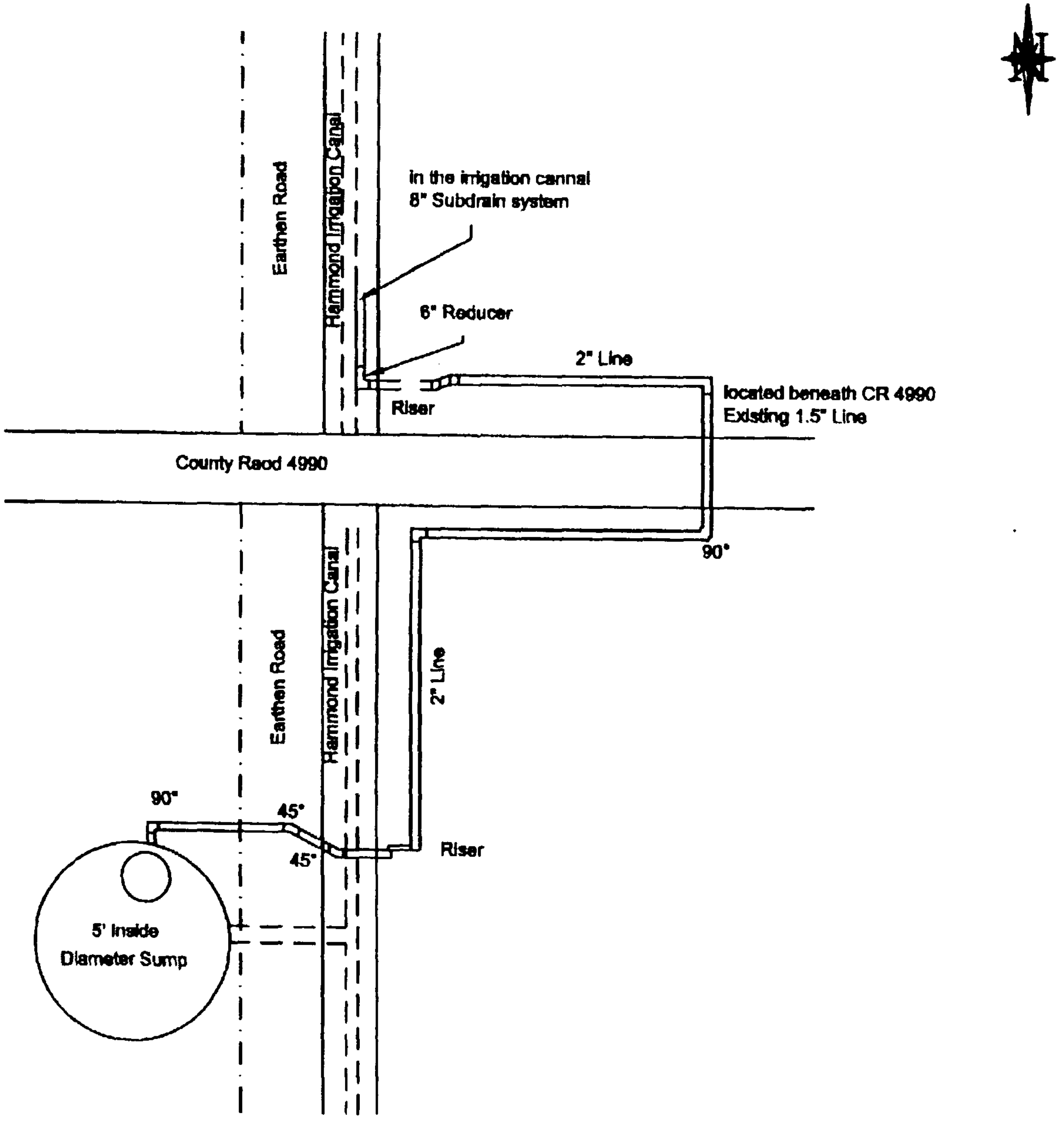
Fill annulus of CMPs with flowable grout to reduce flow between drain pipe and CMP.

Where concrete paved transitions are to be constructed, extend drain material from stations shown in table to existing structures to provide drainage under hand-placed transitions.

SAFETY

MAIN CANAL (REACH N55/45)
Sta. 587+44 to Sta. 737+01
TYPICAL UNDERDRAIN SECTIONS
AND DETAILS

The 5' I.D. sump collects water from a perforated 6" sub-drain beneath the irrigation canal. The water is pumped from the sump into the 2" line located approximately 2' beneath the irrigation canal and approximately 4' beneath ground surface of the ditch bank on each side of the canal.



The 8" sub-drain north of CR 4990 receives the groundwater from the south collection system. From the sub-drain an 8" to 6" reducer is used. At the next 90° (detailed on the side view) a 6" to 4" reducer followed by a 4" line approximately 10' in length is used. A 4" riser approximately 14' in height brings the line to the elevation needed to connect to the existing 1.5" line. A 4" to 2" reducer followed by a 2" line connects the 4" riser to the 1.5" line beneath the road.

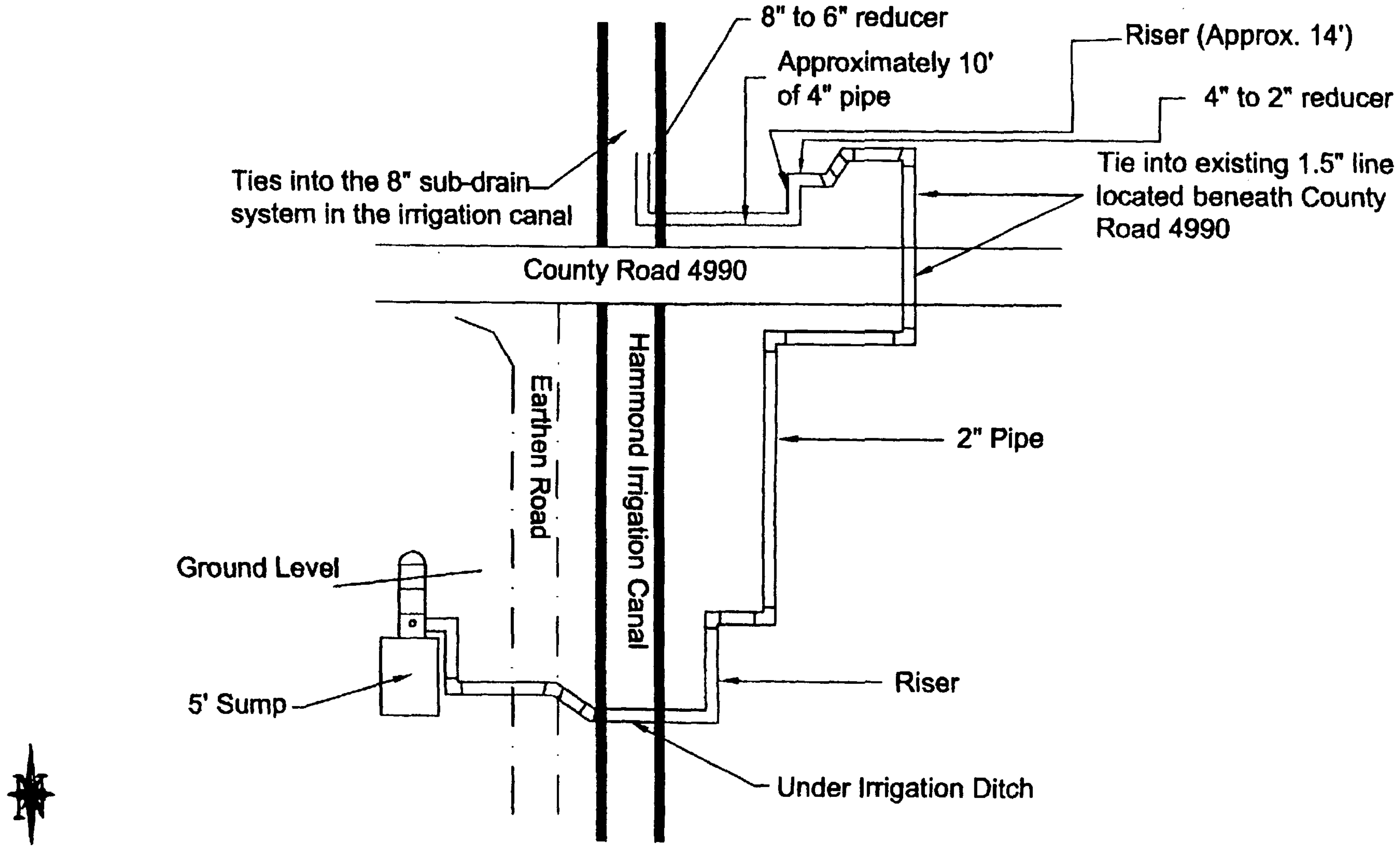
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-517-000001

amec
8519 Jefferson NE
Albuquerque, New Mexico 87113

South Collection System - Top View

Figure No. 1

Date Drawn: 9 July 2002 | Drawn By: RJT | Checked By: LDW



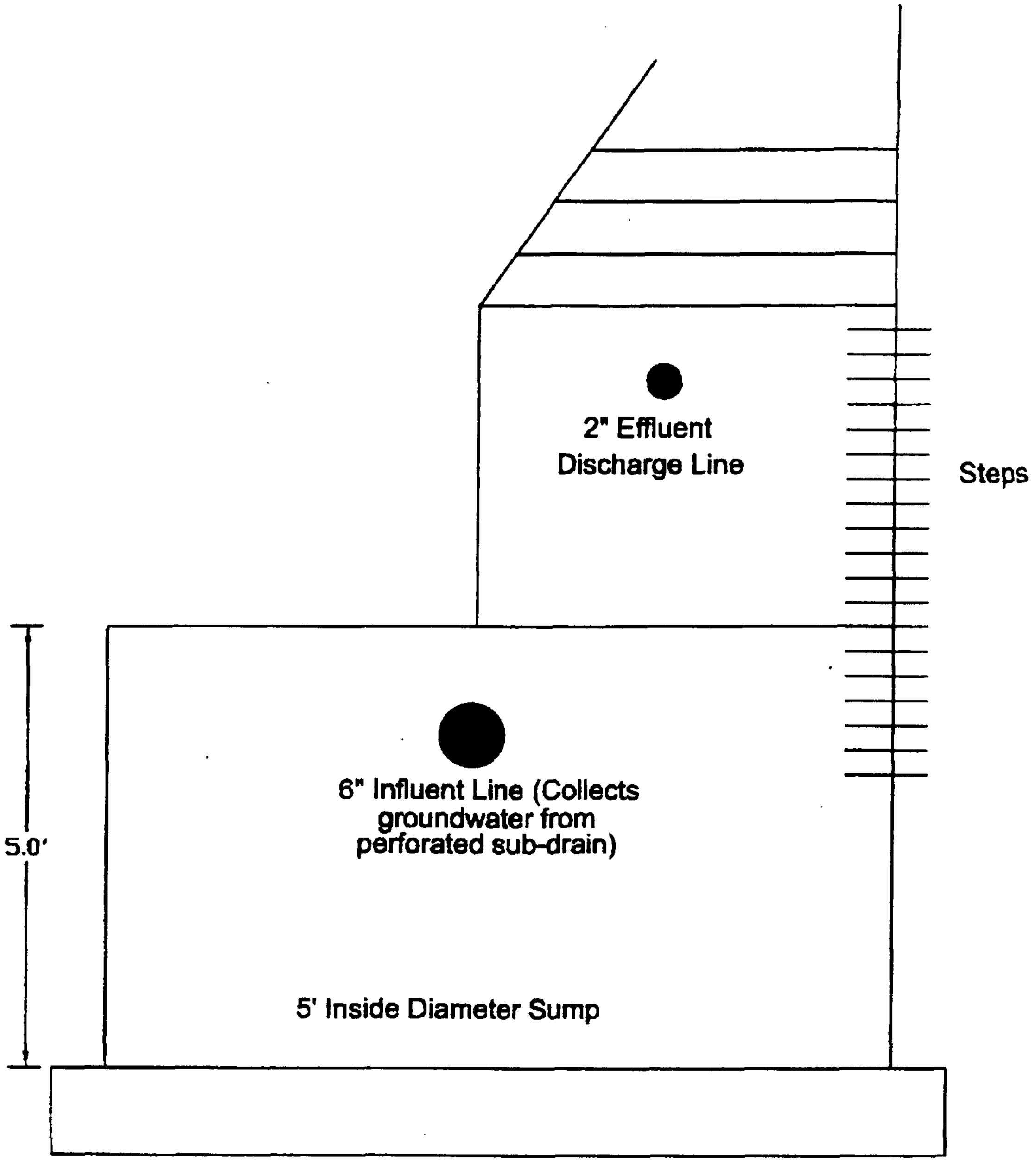
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-517-000001

amec
8519 Jefferson NE
Albuquerque, New Mexico 87113

South Collection System - Side View

Figure No. 2

Date Drawn: 8 July 2002
Drawn By: RJT
Checked By: LW



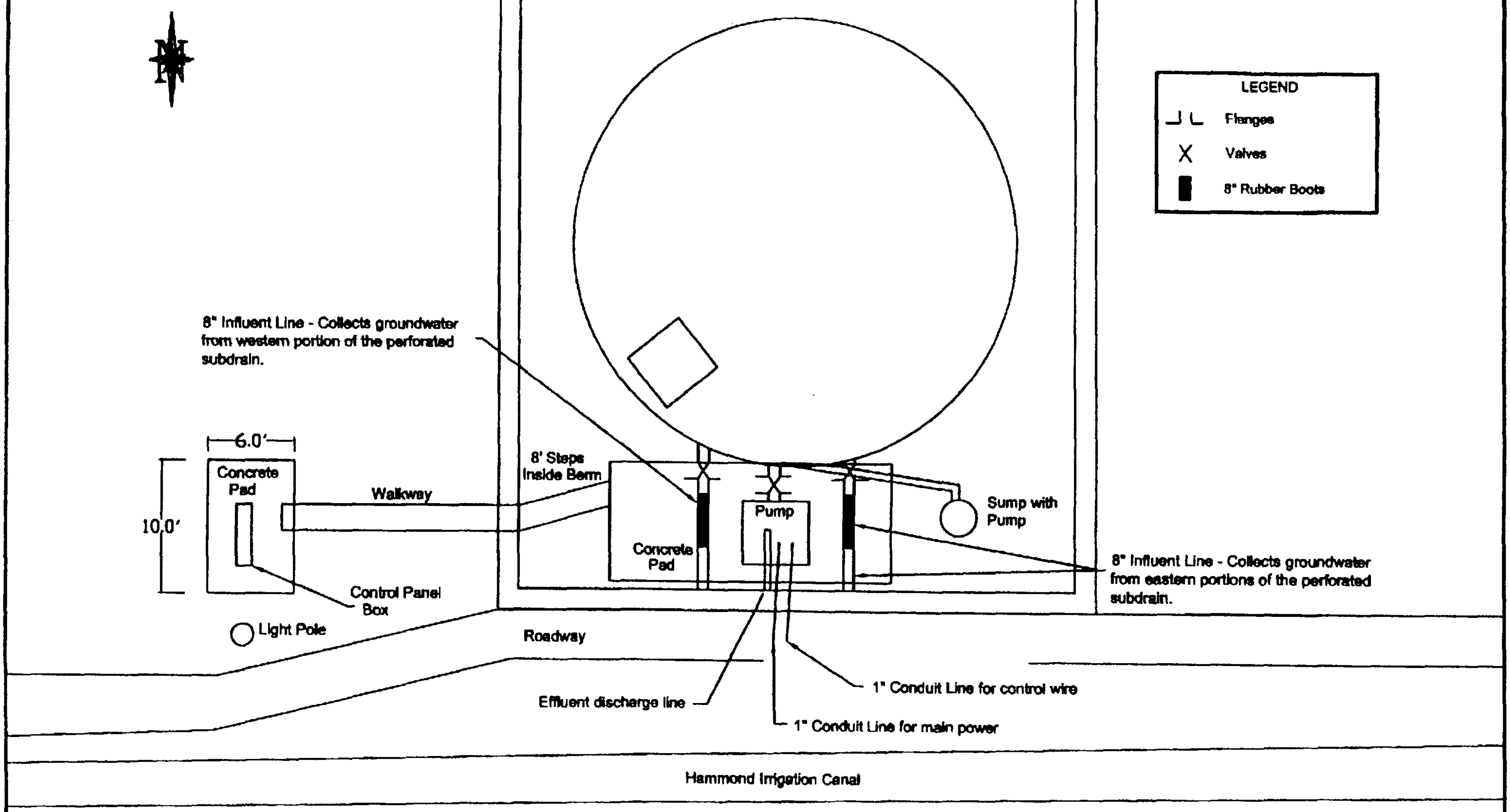
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-517-000001

8519 Jefferson NE
Albuquerque, New Mexico 87113

South Collection System Tank

Figure No. 3

Date Drawn: 8 July 2002
Drawn By: RJT
Checked By: LW



The tank collects groundwater from the two 8" influent lines connected to the perforated sub-drain beneath the irrigation canal. The water is pumped to a 4" welded steel line beneath the road canal, and up the embankment south of the tank.

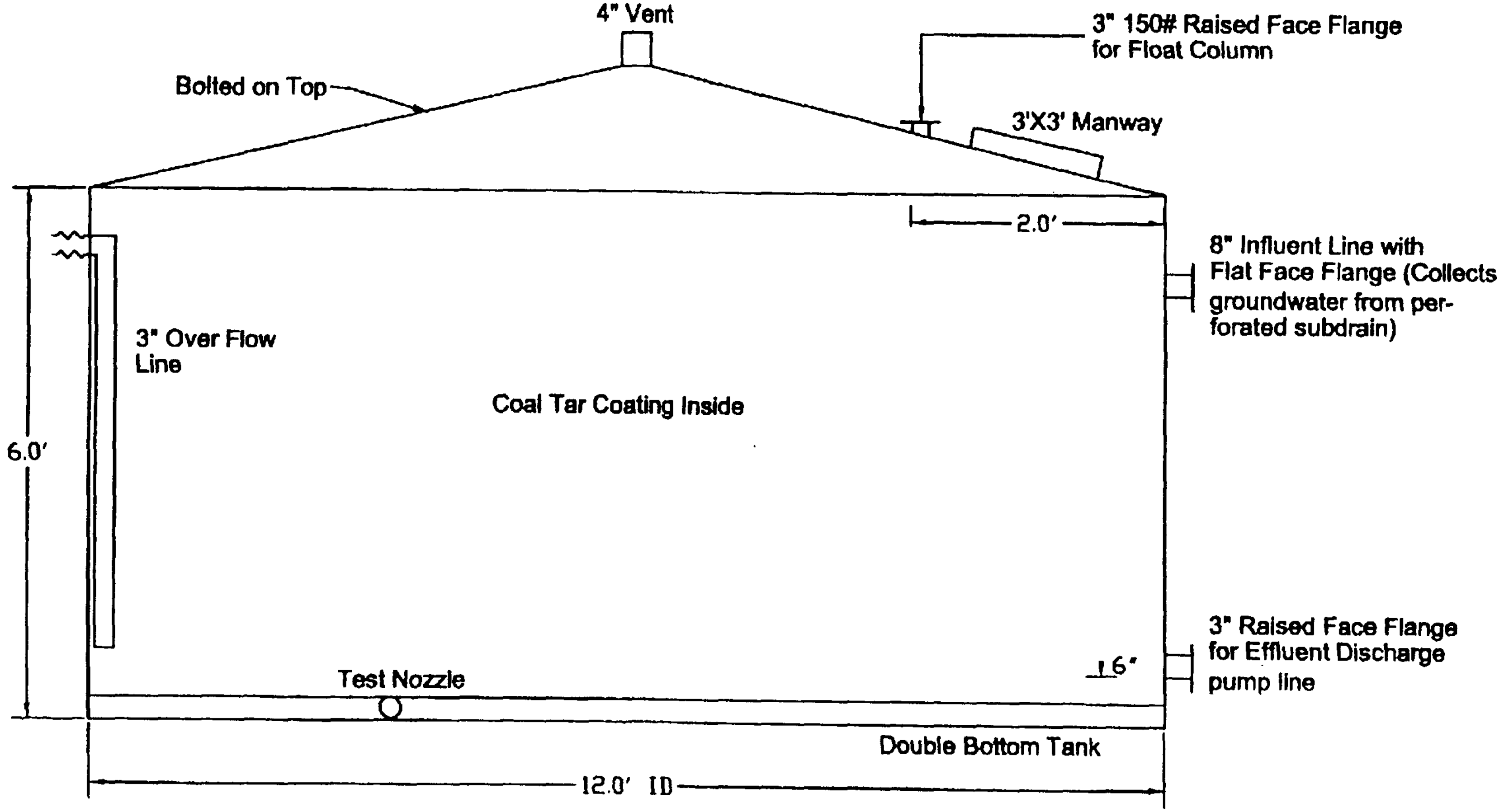
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-517-000001

amec
8519 Jefferson NE
Albuquerque, New Mexico 87113

North Collection System

Figure No. 4

Date Drawn: 9 July 2002
Drawn By: RJT
Checked By: LDW



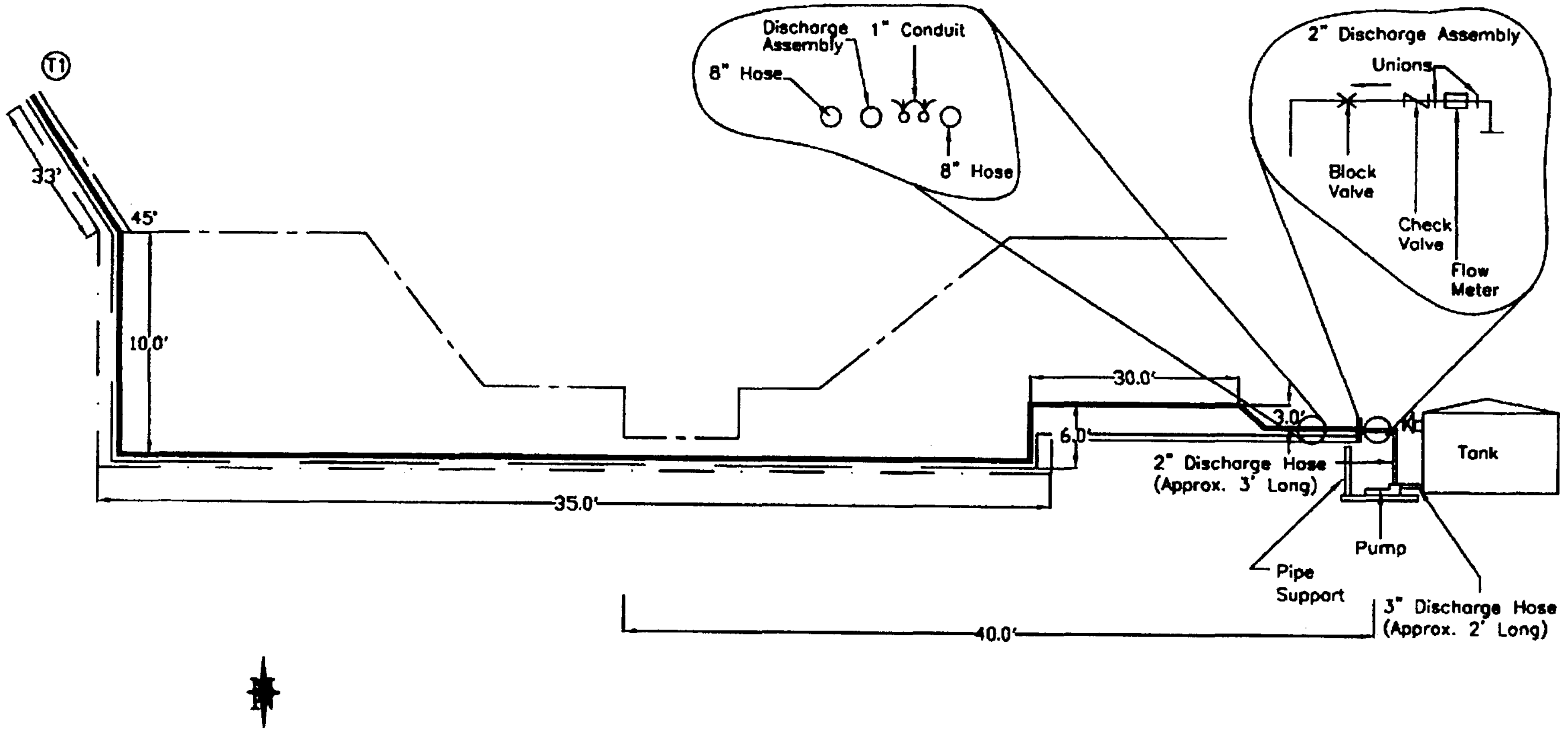
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-517-000001

amec
8519 Jefferson NE
Albuquerque, New Mexico 87113

North Collection System Tank

Figure No. 5

Date Drawn: 8 July 2002 Drawn By: RJT Checked By: LW



LEGEND

- ⋈ 8" Valve
- — — 1" PVC Coated Steel Conduit for control wire
- — · — 1" PVC Coated Steel Conduit for main power
- ——— 4" Schedule 40 Welded Steel Water Line

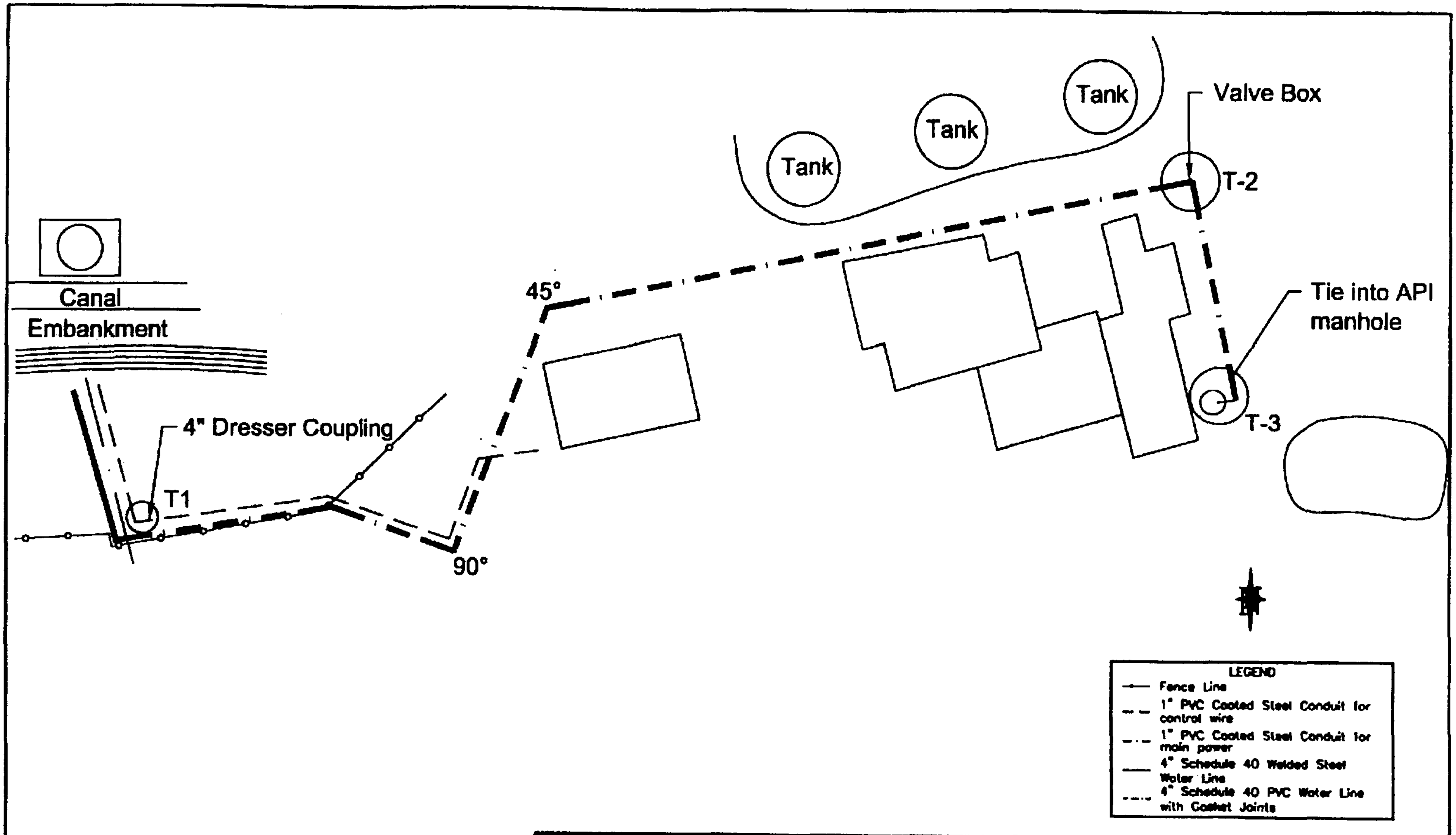
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-617-000001

amec
8519 Jefferson NE
Albuquerque, New Mexico 87113

North Collection System

Figure No. 6

Date Drawn: 9 July 2002 | Drawn By: RJT | Checked By: LDW



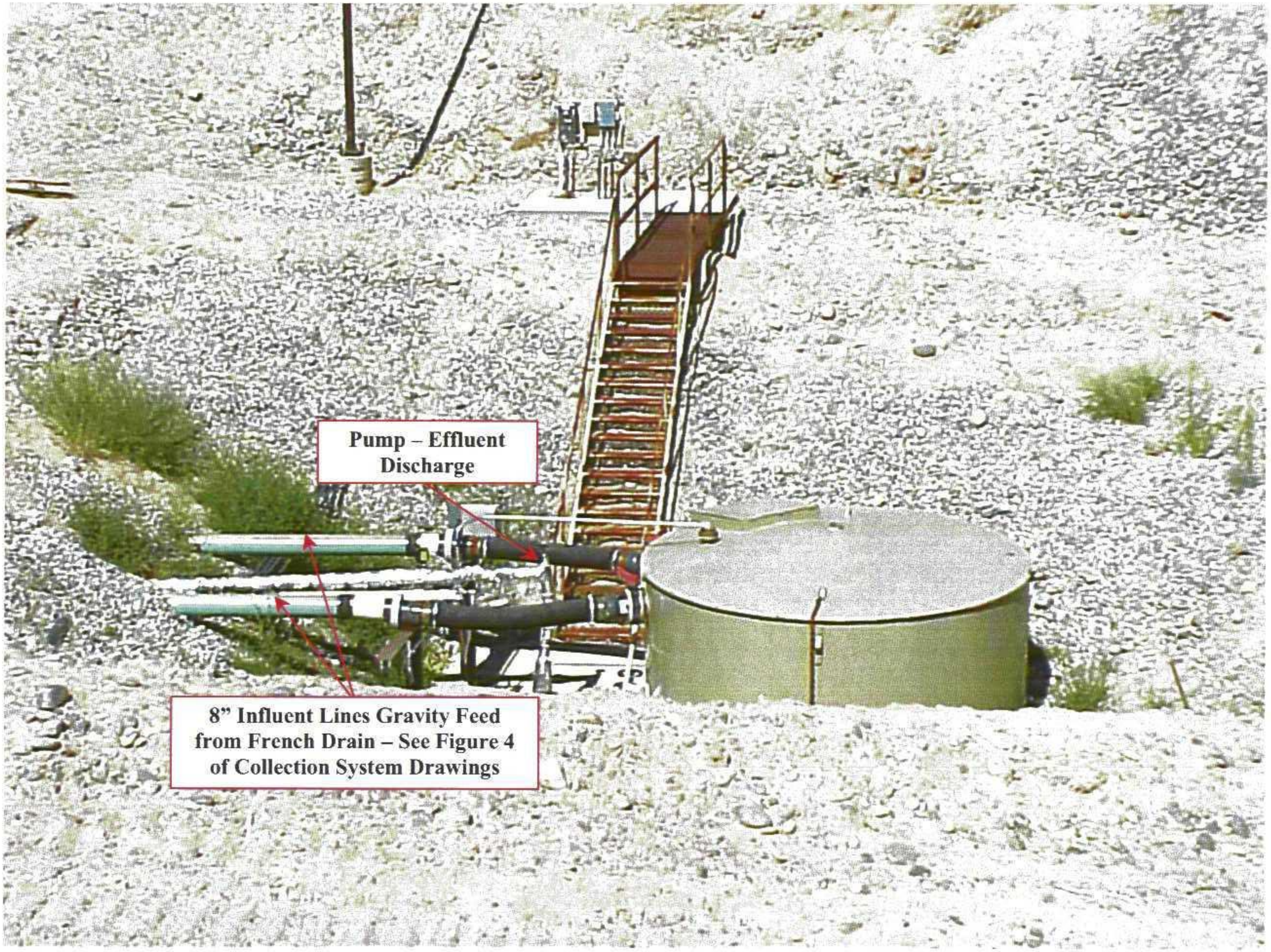
Giant Groundwater
Collection System
Bloomfield, New Mexico
AMEC Project No. 2-517-000001

amec
8519 Jefferson NE
Albuquerque, New Mexico 87113

Site Plan

Figure No. 7

Date Drawn: 9 July 2002 | Drawn By: RJT | Checked By: LW



Recovery Tank 37

3.0

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested site plans presenting monitoring well locations, significant refinery features and water/product level measurements obtained since 2001. NMED also requested that a site plan should be included for each monitoring event.

Response

This attachment includes an 11" by 17" reproduction of the site plan included in Attachment 1 that presents the monitoring well locations and significant refinery features. The monitoring wells, recovery wells, and seeps for which water/product (SPH) level measurements are being provided are highlighted in this site plan.

Water/product level measurements for the monitoring wells, recovery wells, and seeps were taken by refinery personnel throughout 2002. The results of these measurements are presented as part of this attachment in both tabular and graphic form.

An individual site plan has not been included for each monitoring event. However, the tabulated data from all sampling events have been graphed showing the ground water levels across the site.

NOTES

"MW-XX" – Monitoring Wells Locations
"RW-XX" – Recovery Well Locations
"S-XX" – Seep Locations
"P" – Piezometer

REFERENCE DWGS.	NO.	REVISION	JOB No.	DRAWN BY	DRAWN DATE	CHECKED BY	CHECKED DATE	APPROVED BY	APPROVED DATE
	1	Updated As Per Enviromental Dept. Mark Up							

		DATE
SCALE	As Noted	
DRAWN BY	NHB	8/29/02
INITIAL CHK.		
FINAL CHK.		
ENGR.		
APPR. BY		
AFE/WO No.		

Giant Bloomfield Refinery
Area Plot Plan
Recovery Well & Monitoring
Well Locations

GIANT
REFINING CO.

BLOOMFIELD REFINERY
BLOOMFIELD NEW MEXICO

DWG. NO D-000-900-023
REV. 1

MONITOR WELL #4

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
4	2/22/02	N/A	N/A	N/A	N/A
4	2/27/02	26-0	2"	30-5	SMELLS LIGHT
4	3/4/02	25-9	5"	30-5	SMELLS LIKE GASOLINE
4	3/12/02	25-9	6"	30-7	REFORMATE ODOR
4	3/18/02	26-2	6"	30-9	OILY REFORMATE ODOR
4	3/28/02	26-5	6"	30-9	OILY REFORMATE ODOR
4	4/2/02	26-0	7"	30-6	OILY REFORMATE ODOR
4	4/11/02	26-0	12"	30-8	OILY GASOLINE ODOR
4	4/17/02	26-0	12"	30-8	OILY GASOLINE ODOR
4	4/24/02	26-0	12"	30-8	OILY GASOLINE ODOR
4	4/30/02	26-1	12"	30-8	OILY GASOLINE ODOR
4	5/10/02	26-2	10"	30-8	OILY GASOLINE ODOR
4	5/15/02	26-1	12"	30-8	OILY GASOLINE ODOR
4	5/21/02	26-1	14"	30-7	OILY GASOLINE ODOR
4	5/28/02	N/A	N/A	N/A	N/A
4	6/11/02	26-3	12"	30-7	GASOLINE ODOR
4					
4					

MONITOR WELL #11

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
11	2/22/02	N/A	N/A	N/A	N/A
11	2/27/02	11-0'	0	23-0	GOOD
11	3/4/02	10'-8"	0	22-6	GOOD
11	3/12/02	11-0'	0	22-9	GOOD
11	3/18/02	10'-8"	0	22-7	GOOD
11	3/28/02	10'-8"	0	22-7	GOOD
11	4/2/02	11'-1"	0	23-0	GOOD
11	4/11/02	11'-2"	0	22-9	GOOD
11	4/17/02	10'-9"	0	22-9	GOOD
11	4/24/02	11'-2"	0	22-9	GOOD
11	4/30/02	11'-2"	0	22-9	GOOD
11	5/10/02	11'-3"	0	23-0	GOOD
11	5/15/02	11'-3"	0	23-0	GOOD
11	5/15/02	11'-3"	0	23-0	GOOD
11	5/28/02	N/A	N/A	N/A	N/A
11	5/15/02	11'-3"	0	23-0	GOOD
11					
11					

MONITOR WELL #12

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
12	2/22/02	11'-4"	0	15-0	GOOD
12	2/27/02	11'-5"	0	15-0	GOOD
12	3/4/02	11'-5"	0	15-0	GOOD
12	3/12/02	11'-41/2"	0	15-0	GOOD
12	3/18/02	11'-5"	0	15-0	GOOD
12	3/28/02	11'-5"	0	15-0	GOOD
12	4/2/02	11'-6"	0	15-0	GOOD
12	4/11/02	11'-6"	0	15-0	GOOD
12	4/17/02	11'-7"	0	15-0	GOOD
12	4/24/02	11'-6"	0	15-0	GOOD
12	4/30/02	11'-6"	0	15-0	GOOD
12	5/10/02	11'-8"	0	15-0	GOOD
12	5/15/02	11'-8"	0	15-0	GOOD
12	5/21/02	11'-8"	0	15-0	GOOD
12	5/28/02	N/A	N/A	N/A	N/A
12	6/11/02	Dec-00	0	15-0	GOOD
12					
12					

RECOVERY WELL #15

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
15	2/22/02	N/A	N/A	N/A	N/A
15	2/27/02	34-7	0	43-5	B/I & U/P NOT TOO BAD
15	3/4/02	34-6	0	43-4	B/I &U/P NOT TOO BAD
15	3/12/02	34-6	0	43-4	B/I & U/P SLIGHT HYDROCARBON ODOR
15	3/18/02	34-7	0	43-5	B/I & U/P SLIGHT ODOR
15	3/28/02	34-7	0	43-5	B/I & U/P SLIGHT ODOR
15	4/2/02	34-3	0	43-4	B/I & U/P SLIGHT ODOR
15	4/11/02	34-7	0	43-6	B/I & U/P GASOLINE ODOR
15	4/17/02	34-8	0	43-6	B/I & U/P GASOLINE ODOR
15	4/24/02	34-8	0	43-6	B/I & U/P GASOLINE ODOR
15	4/30/02	34-9	0	43-6	IN SERVICE LIGHT ODOR
15	5/10/02	35-0	0	43-6	IN SERVICE LIGHT ODOR
15	5/15/02	34-8	0	43-6	IN SERVICE LIGHT ODOR
15	5/21/02	34-9	0	43-6	IN SERVICE LIGHT ODOR
15	5/28/02	N/A	N/A	N/A	N/A
15	6/11/02	35-0	0	43-5	IN SERVICE LIGHT ODOR
15					
15					
15					
15					
15					

RECOVERY WELL #17

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
17	2/22/02	N/A	N/A	N/A	N/A
17	2/27/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	3/4/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	3/12/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	3/18/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	3/28/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	4/2/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	4/11/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	4/17/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	4/24/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	4/30/02	N/A	N/A	N/A	B/I & U/P PUMP IS STUCK IN WELL
17	5/10/02	32-2	16"	41-9	PULLED OUT PUMP W.O. #55164
17	5/15/02	36-5	0	41-9	IN SERVICE SOME ODOR
17	5/21/02	36-3	1/2"	41-9	IN SERVICE SOME ODOR
17	5/28/02	N/A	N/A	N/A	N/A
17	6/11/02	36-8	0	36-9	IN SERVICE SOME ODOR
17					
17					
17					
17					
17					
17					

RECOVERY WELL #18

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
18	2/22/02	N/A	N/A	N/A	N/A
18	2/27/02	30-0	6"	37-7	B/I & U/P SMELLY
18	3/4/02	30-0	6"	37-7	B/I & U/P DSL SMELL
18	3/12/02	30-2	6"	37-7	B/I & U/P DSL SMELL
18	3/18/02	30-1	6.5"	38-1	B/I & U/P DSL SMELL
18	3/28/02	30-2	6"	38-1	B/I & U/P DSL SMELL
18	4/2/02	30-3	5.5"	37-8	B/I & U/P DSL SMELL
18	4/11/02	30-1	7"	37-9	B/I & U/P LIGHT ODOR
18	4/17/02	30-2	7"	37-9	B/I & U/P LIGHT ODOR
18	4/24/02	30-4	6"	37-9	B/I & U/P LIGHT ODOR
18	4/30/02	30-3	4"	37-8	IN SERVICE LIGHT ODOR
18	5/10/02	31-4	0	37-8	IN SERVICE LIGHT ODOR
18	5/15/02	32-6	1/2"	37-9	IN SERVICE LIGHT ODOR
18	5/21/02	32-8	0	37-8	IN SERVICE LIGHT ODOR
18	5/28/02	32-0	0	38-0	IN SERVICE LIGHT ODOR
18	6/11/02	33-0	0	37-9	IN SERVICE LIGHT ODOR
18					
18					
18					
18					
18					
18					

RECOVERY WELL #19

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
19	2/22/02	N/A	N/A	N/A	N/A
19	2/27/02	28-7	6"	36-7	B/I & U/P SMELLS LIGHT
19	3/4/02	28-9	18-1/2"	36-7	B/I & U/P SMELLS LIGHT
19	3/12/02	28-8	20"	36-6	B/I & U/P OILY
19	3/18/02	28-7	22"	36-7	B/I & U/P OILY
19	3/28/02	28-8	19"	36-7	B/I & U/P OILY
19	4/2/02	29-0	19"	36-6	B/I & U/P OILY
19	4/11/02	29-1	19"	36-6	B/I & U/P GASOLINE ODOR
19	4/17/02	29-2	20"	36-7	B/I & U/P GASOLINE ODOR
19	4/24/02	29-1	18"	36-7	B/I & U/P HEAVY,OILY ODOR
19	4/30/02	29-1	15"	36-7	IN SERVICE OILY
19	5/10/02	29-3	15"	36-7	IN SERVICE OILY
19	5/15/02	29-3	12"	36-7	IN SERVICE OILY
19	5/21/02	29-3	13"	36-7	IN SERVICE OILY
19	5/28/02	N/A	N/A	N/A	N/A
19	6/11/02	28-5	20"	36-4	OILY B /I &U/P WO#55082
19					
19					
19					
19					
19					
19					

MONITOR WELL #21

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
21	2/22/02	N/A	N/A	N/A	N/A
21	2/27/02	21-9	0	32-5	SMELLS LIKE DSL
21	3/4/02	22-0	0	32-5	OK
21	3/12/02	24-0	0	32-5	SLIGHT HYDROCARBON ODOR
21	3/18/02	22-0	0	32-5	SLIGHT HYDROCARBON ODOR
21	3/28/02	22-0	0	32-5	SLIGHT HYDROCARBON ODOR
21	4/2/02	22-1	0	30-5	SLIGHT HYDROCARBON ODOR
21	4/11/02	22-1	0	30-4	SLIGHT HYDROCARBON ODOR
21	4/17/02	22-1	0	30-4	SLIGHT HYDROCARBON ODOR
21	4/24/02	22-2	0	30-4	SLIGHT HYDROCARBON ODOR
21	4/30/02	22-1	0	30-4	SLIGHT HYDROCARBON ODOR
21	5/10/02	22-3	0	30-4	SLIGHT HYDROCARBON ODOR
21	5/15/02	22-2	0	30-4	SLIGHT HYDROCARBON ODOR
21	5/21/02	22-2	0	30-3	SLIGHT HYDROCARBON ODOR
21	5/28/02	N/A	N/A	N/A	N/A
21	6/11/02	22-3	0	30-4	SLIGHT HYDROCARBON ODOR
21					
21					

MONITOR WELL #24

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
24	2/22/02	14-9	0	15-1	SMELLS LIGHT-- API
24	2/27/02	14-9	0	15-1	SMELLS LIGHT-- API
24	3/4/02	15-0	0	15-1	SMELLS LIGHT-- API
24	3/12/02	15-0	0	15-1	SMELLS LIGHT-- API
24	3/18/02	15-0	0	15-1	SMELLS LIGHT-- API
24	3/28/02	15-0	0	15-1	SMELLS LIGHT-- API
24	4/2/02	15-0	0	15-2	SMELLS LIGHT-- API
24	4/11/02	15-0	0	15-1	SMELLS LIGHT-- API
24	4/17/02	15-0	0	15-1	SMELLS LIGHT-- API
24	4/24/02	15-0	0	15-1	SMELLS LIGHT-- API
24	4/30/02	15-0	0	15-1	SMELLS LIGHT-- API
24	5/10/02	15-0	1/2"	15-1	SMELLS LIGHT-- API
24	5/15/02	15-0	1/2"	15-1	SMELLS LIGHT-- API
24	5/21/02	15-0	1/2"	15-1	SMELLS LIGHT-- API
24	5/28/02	N/A	N/A	N/A	N/A
24	6/11/02	15'-1 1/2"	1/2"	15-2	SMELLS LIGHT-- API
24					
24					

MONITOR WELL #28

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
28	2/22/02	27-2	12"	37-0	SMELLS LIKE REFORMATE
28	2/27/02	28-0	9"	37-0	SMELLS LIKE REFORMATE
28	3/4/02	27-9	12"	37-0	SMELLS LIKE REFORMATE
28	3/12/02	28-0	12"	36-9	SMELLS LIKE REFORMATE
28	3/18/02	28- 1/2"	12"	37-0	SMELLS LIKE REFORMATE
28	3/28/02	28-0"	12"	37-0	SMELLS LIKE REFORMATE
28	4/2/02	28-4	11"	37-1	SMELLS LIKE REFORMATE
28	4/11/02	28-3	12"	37-1	SMELLS LIKE REFORMATE
28	4/17/02	28-4	10"	37-1	SMELLS LIKE REFORMATE
28	4/24/02	28-4	10"	37-1	SMELLS LIKE REFORMATE
28	4/30/02	28-5	10"	37-1	SMELLS LIKE REFORMATE
28	5/10/02	28-6	10"	37-0	SMELLS LIKE REFORMATE
28	5/15/02	28-6	10"	37-0	SMELLS LIKE REFORMATE
28	5/21/02	28-6	10"	37-0	SMELLS LIKE REFORMATE
28	5/28/02	N/A	N/A	N/A	N/A
28	6/11/02	28-7	11"	37-0	SMELLS LIKE REFORMATE
28					
28					
28					

MONITOR WELL #29

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
29	2/22/02	N/A	N/A	N/A	N/A
29	2/27/02	23-0	0	28-6	SMELLS LIKE GASOLINE
29	3/4/02	23-1	0	28-6	OK
29	3/12/02	23-2	0	28-6	SLIGHT HYDROCARBON ODOR
29	3/18/02	23-2	0	28-6	SLIGHT HYDROCARBON ODOR
29	3/28/02	23-2	0	28-6	SLIGHT HYDROCARBON ODOR
29	4/2/02	23-2	0	28-6	SLIGHT HYDROCARBON ODOR
29	4/11/02	23-2	0	28-6	GOOD
29	4/17/02	23-3	0	28-7	GOOD
29	4/24/02	23-3	0	28-7	SLIGHT HYDROCARBON ODOR
29	4/30/02	23-3	0	28-7	SLIGHT HYDROCARBON ODOR
29	5/10/02	23-3	0	28-7	SLIGHT HYDROCARBON ODOR
29	5/15/02	23-2	0	28-7	SLIGHT HYDROCARBON ODOR
29	5/21/02	23-3	0	28-8	SLIGHT HYDROCARBON ODOR
29	5/28/02	N/A	N/A	N/A	N/A
29	6/11/02	23-3	0	22-8	SLIGHT HYDROCARBON ODOR
29					
29					

RECOVERY WELL #42

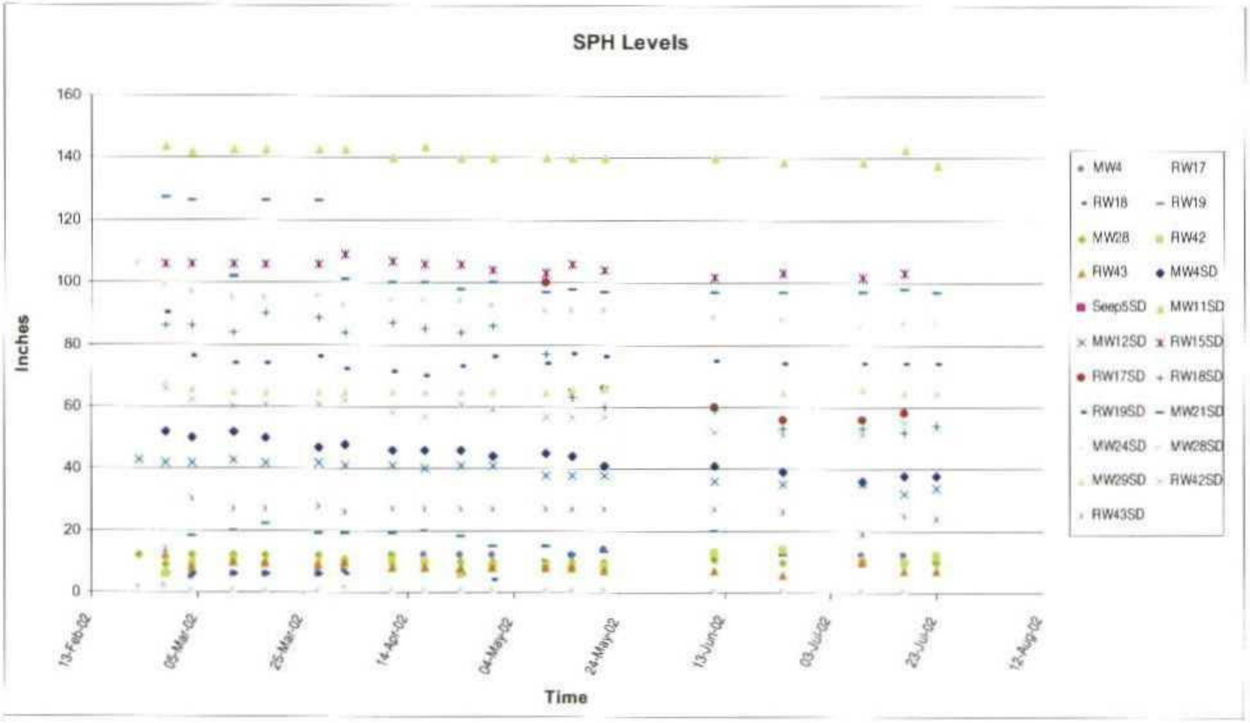
R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
42	2/22/02	N/A	N/A	N/A	N/A
42	2/27/02	26-0	6"	32-0	B/I &U/P, HEAVY ODOR SLIMEY MUD
42	3/4/02	26-1	9-1/2"	32-0	B/I &U/P SMELLS HEAVY
42	3/12/02	26-2	10"	32-0	B/I &U/P OILY
42	3/18/02	26-2	9"	32-0	B/I &U/P OILY
42	3/28/02	26-2	9-1/2"	32-0	B/I &U/P OILY
42	4/2/02	26-2	9"	32-1	B/I &U/P OILY
42	4/11/02	26-4	10"	32-1	B/I &U/P OILY
42	4/17/02	26-5	10"	32-1	B/I &U/P OILY
42	4/24/02	26-5	6"	32-1	B/I &U/P OILY
42	4/30/02	26-4	8"	32-0	IN SERVICE OILY
42	5/10/02	26-6	8"	32-0	IN SERVICE OILY
42	5/15/02	26-6	8"	32-0	IN SERVICE OILY
42	5/21/02	26-6	8"	32-0	IN SERVICE OILY
42	5/28/02	N/A	N/A	N/A	N/A
42	6/11/02	26-6	13"	32-0	IN SERVICE OILY
42					
42					
42					
42					

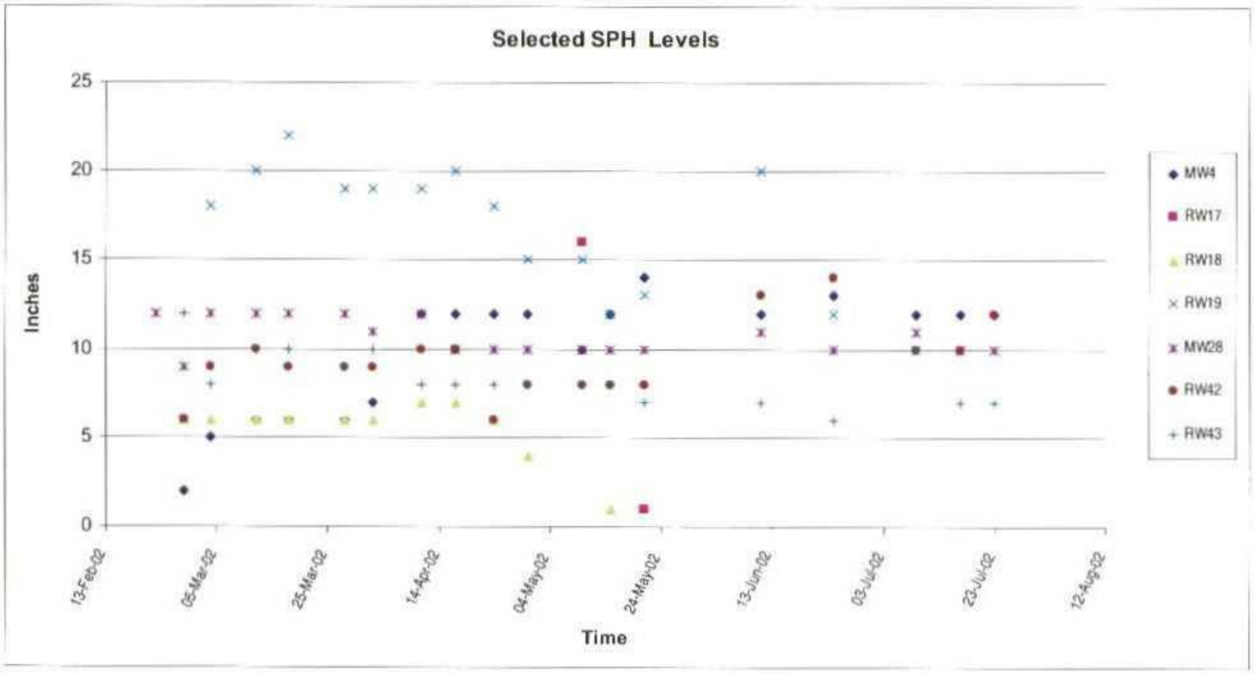
RECOVERY WELL #43

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
43	2/22/02	N/A	N/A	N/A	N/A
43	2/27/02	21-7	12"	23-9	B/I & U/P SMELLY & BLACK SLIME
43	3/4/02	20-8	8-1/2"	24-0	B/I & U/P SMELLS LIGHT---API
43	3/12/02	20-9	10"	24-0	B/I & U/P SMELLS LIGHT---API
43	3/18/02	20-9	10"	24-0	B/I & U/P SMELLS LIGHT---API
43	3/28/02	20-9	9-1/2"	24-0	B/I & U/P SMELLS LIGHT---API
43	4/2/02	21-0	10"	24-0	B/I & U/P SMELLS LIGHT---API
43	4/11/02	21-1	8"	24-0	B/I & U/P SMELLS LIGHT---API
43	4/17/02	21-1	8"	24-0	B/I & U/P SMELLS LIGHT---API
43	4/24/02	21-1	8"	24-0	B/I & U/P SMELLS LIGHT---API
43	4/30/02	21-1	8"	24-0	IN SERVICE LIGHT ODOR
43	5/10/02	21-1	8"	24-0	IN SERVICE LIGHT ODOR
43	5/15/02	21-1	8"	24-0	IN SERVICE LIGHT ODOR
43	5/21/02	21-2	7"	24-0	IN SERVICE LIGHT ODOR
43	5/28/02	21-2	7"	24-0	IN SERVICE LIGHT ODOR
43	6/11/02	21-2	7"	24-0	IN SERVICE LIGHT ODOR
43					

SEEP #5

R.W. #	DATE	DEPTH TO LIQUID (feet)	SPH	WELL DEPTH	LIQUID DESCRIPTION
S-5	2/22/02	4'-5"	0	5'-2"	GOOD
S-5	2/27/02	4'-5"	0	5'-2"	GOOD
S-5	3/4/02	4'-5"	0	5'-2"	GOOD
S-5	3/12/02	4'-6"	0	5'-2"	GOOD
S-5	3/18/02	4'-6 1/2"	0	5'-2"	GOOD
S-5	3/28/02	4'-6"	0	5'-2"	GOOD
S-5	4/2/02	4'-8"	0	5'-2"	GOOD
S-5	4/11/02	4'-8"	0	5'-2"	GOOD
S-5	4/17/02	4'-8"	0	5'-2"	GOOD
S-5	4/24/02	4'-9"	0	5'-2"	GOOD
S-5	4/30/02	4'-9"	0	5'-2"	GOOD
S-5	5/10/02	4'-9"	0	5'-2"	GOOD
S-5	5/15/02	4'-9"	0	5'-2"	GOOD
S-5	5/21/02	5'-1"	0	5'-2"	GOOD
S-5	5/28/02	N/A	N/A	N/A	N/A
S-5	6/11/02	May-00	0	2-May	GOOD
S-5					
S-5					
S-5					


SPH Levels
Inches
160
140
120
100
80
60
40
20
0
13-Feb-02
05-Mar-02
25-Mar-02
14-Apr-02
04-May-02
24-May-02
13-Jun-02
03-Jul-02
23-Jul-02
12-Aug-02
Time
MW4
RW17
RW18
RW19
MW28
RW42
RW43
MW4SD
Seep5SD
MW11SD
MW12SD
RW15SD
RW17SD
RW18SD
RW19SD
MW21SD
MW24SD
MW28SD
MW29SD
RW42SD
RW43SD


Selected SPH Levels
Inches
25
20
15
10
5
0
13-Feb-02
05-Mar-02
25-Mar-02
14-Apr-02
04-May-02
24-May-02
13-Jun-02
03-Jul-02
23-Jul-02
12-Aug-02
Time
MW4
RW17
RW18
RW19
MW28
RW42
RW43

S_Date	MW 4	RW 17	RW 18	RW 19	MW 28	RW 42	RW 43	MW 4SD	Seep 5SD	MW 11SD	MW 12SD	RW 15SD	RW 17SD	RW 18SD	RW 19SD	MW 21SD	MW 24SD	MW 28SD	MW 29SD	RW 42SD	RW 43SD
22-Feb-02					12						43						2	106			
27-Feb-02	2		6	6	9	6	12	52		144	42	106		86	90	127	2	99	67	66	14
04-Mar-02	5		6	18	12	9	8	50		142	42	106		86	76	126	1	97	66	62	30
12-Mar-02	6		6	20	12	10	10	52		143	43	106		84	74	102	1	95	65	60	27
18-Mar-02	6		6	22	12	9	10	50		143	42	106		90	74	126	1	95	65	61	27
28-Mar-02	6		6	19	12	9	9	47		143	42	106		89	76	126	1	96	65	61	28
02-Apr-02	7		6	19	11	9	10	48		143	41	109		84	72	101	2	93	65	62	26
11-Apr-02	12		7	19	12	10	8	46		140	41	107		87	71	100	1	94	65	58	27
17-Apr-02	12		7	20	10	10	8	46		144	40	106		85	70	100	1	94	65	57	27
24-Apr-02	12		6	18	10	6	8	46		140	41	106		84	73	98	1	94	65	61	27
30-Apr-02	12		4	15	10	8	8	44		140	41	104		86	76	100	1	93	65	59	27
10-May-02	10	16		15	10	8	8	45		140	38	103	100	77	74	97	1	91	65	57	27
15-May-02	12		1	12	10	8	8	44		140	38	106	65	63	77	98	1	91	66	57	27
21-May-02	14	1		13	10	8	7	41		140	38	104	66	60	76	97	1	91	66	57	27
11-Jun-02	12			20	11	13	7	41		140	36	102	60	59	75	97	1	89	-6	52	27
24-Jun-02	13			12	10	14	6	39		139	35	103	56	53	74	97	1	88	65	51	26
09-Jul-02	12			10	11	10	10	36		139	35	102	56	53	74	97	1	86	66	51	19
17-Jul-02	12			10	10	10	7	38		143	32	103	58	52	74	98	1	87	65	55	25
23-Jul-02	12			10	10	12	7	38		138	34			54	74	97		87	65	53	24
Total	177	17	61	278	204	169	151	803	0	2541	744	1785	461	1332	1350	1884	21	1766	1105	1040	462

4.0

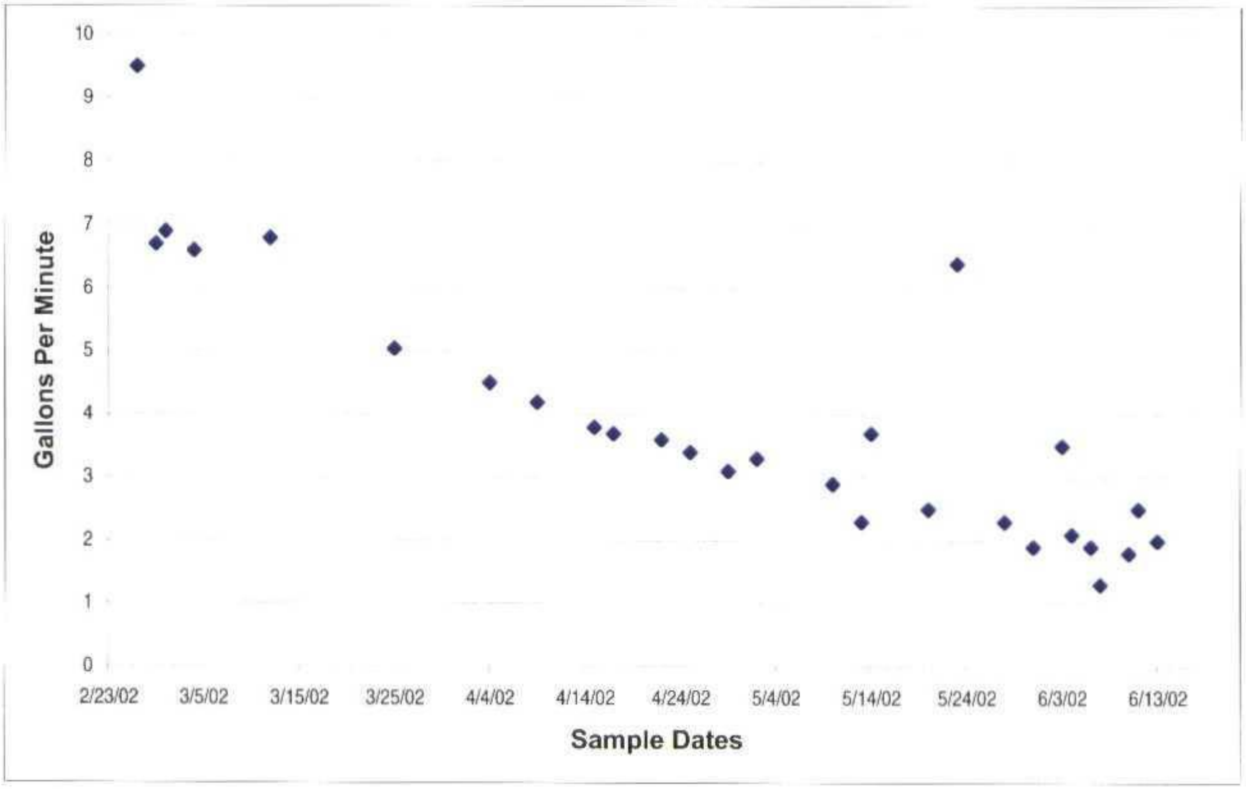
In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested the results of all groundwater recovery and treatment system monitoring and sampling. NMED stated that the results must include treatment system influent and effluent sampling analytical results, remediation system flow rates and volume estimates, product recovery volume estimates, all groundwater quality field measurements and laboratory chemical analytical results.

Response

This attachment contains a table of the flow rates based on data from the flow meter of the Hammond Ditch French Drain groundwater collection system at Tank 37. The flow meter is detailed in the copy of the photograph of Tank 37 at the end of this section. A graph of the flow rate data is also included. Groundwater quality field observations are included in the Water/Product Level Tables in Attachment 3 and laboratory chemical analysis results are provided in Attachment 3.2.2.

BRC does not measure the volume and/or flow rate of water removed from the recovery wells. This water and the water recovered from the Hammond Ditch French Drain join process water in the API Separator; therefore, there is no method to provide product recovery rates from these sources individually.

Recovery Rates from Hammond Ditch French Drain into Tank 37



Date	GPM	Meter Reading	Volume
2/26/02	9.5	20900	
2/28/02	6.7	30500	9600
3/1/02	6.9	40200	9700
3/4/02	6.6	69100	29900
3/12/02	6.8	150700	81600
3/25/02	5.05		
4/4/02	4.5		
4/9/02	4.2		
4/15/02	3.8		
4/17/02	3.7		
4/22/02	3.6		
4/25/02	3.4		
4/29/02	3.1		
5/2/02	3.3		
5/10/02	2.9		
5/13/02	2.3		
5/14/02	3.7		
5/20/02	2.5		
5/23/02	6.4		
5/28/02	2.3		
5/31/02	1.9		
6/3/02	3.5		
6/4/02	2.1		
6/6/02	1.9		
6/7/02	1.3		
6/10/02	1.8		
6/11/02	2.5		
6/13/02	2		

Recovery Tank 37

5.0

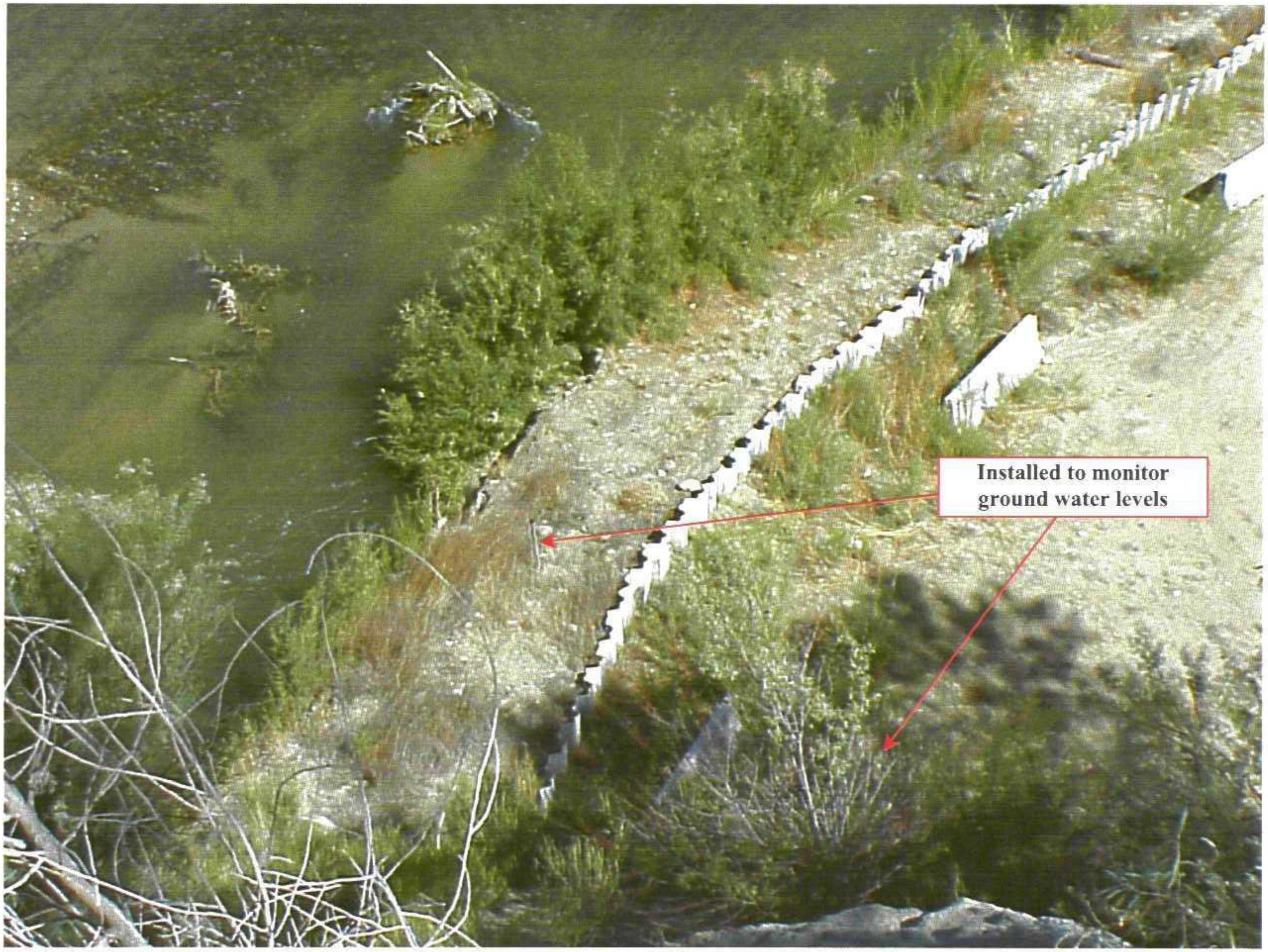
In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested a site plan presenting the location of proposed monitoring wells to be placed downgradiant of the Hammond Ditch to monitor the effectiveness of the groundwater recovery and treatment system.

Response

This attachment includes copies of photographs of monitoring points located downgradiant of Hammond Ditch. The first photo locates Monitoring Well (MW) 24 just to the north of the Hammond Ditch. The second photo is of the San Juan River sheet piling and the wells installed to monitor ground water levels. The third photo is a close up of one of the monitoring wells adjacent to the sheet pilings.

One new monitoring well is proposed downgradiant of the Hammond Ditch to monitor the effectiveness of the Hammond Ditch French Drain. BRC will also continue to monitor the downgradient seeps along the bluff, MW24, and the points at the sheet piling. Attachment 3 includes water level information on the seeps and monitoring wells downgraidient of Hammond Ditch.

Monitoring Well 24 and Hammond Ditch (Lined)



San Juan River Sheet Piling and Slurry Wall with Monitoring Points

Close-up of Monitoring Point Adjacent to Sheet Piling

6.0

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested an updated groundwater monitoring and sampling plan that includes facility-wide groundwater monitoring and incorporates monitoring of the newly installed groundwater recovery and treatment system .

Response

This attachment contains the updated facility-wide groundwater monitoring and sampling work plan. This plan was written as a stand alone work plan and includes the plan for sampling both upgradient and downgradient of the Hammond Ditch. This plan differs from the plan outlined in the CMS because after the CMS was published Hammond Ditch was lined and a French Drain with a liquid recovery system was installed beneath the ditch. Changes have also been made to the recovery wells (RW) and monitoring wells (MW) that will be used to do this work. RW-1 has been removed from the list of wells to be used for monitoring SPH thickness because RW-1 has been decommissioned. MW-26 has been removed as a well used for total fluids pumping as this well is no longer necessary due to the installation of the Hammond Ditch French drain.

This plan includes a sampling plan for ground water levels, SPH thickness, dissolved-phase contaminates, and natural attenuation, as well as testing for dissolved oxygen, nitrates, and conductivity. The plan outlines designs for SPH reduction, removal, and containment, and dissolved-phase contaminate reduction using total fluids pumping and natural attenuation. This plan also incorporates monitoring the flow meter on the newly installed groundwater recovery and treatment system (the Hammond Ditch French Drain).

Bloomfield Refinery
Monitoring and Sampling Work Plan

September 2002

1 BACKGROUND INFORMATION

1.1 SITE LOCATION

The Bloomfield Refinery (the Refinery) is located south of Bloomfield, New Mexico, in San Juan County, latitude N36° 41' 87", longitude W107° 58' 70". The Refinery is owned by the San Juan Refinery Company (SJRC). The Refinery Site (the site) consists of the Refinery processing areas, storage tanks, and waste management areas, as well as adjacent areas that exhibit subsurface petroleum hydrocarbons. Previously installed monitor wells define an area south of the Refinery where petroleum hydrocarbons are present in the subsurface, and the San Juan River defines the northern boundary of the site.

The Refinery is located on a bluff 120 feet above the south side of the San Juan River. The top of the bluff is relatively flat and is at an elevation of 5,540 feet above sea level. The geologic units that comprise the site include, in order of increasing depth, San Juan River Alluvium, Quaternary apron deposits, Aeolian sand and silt, Jackson Lake Terrace, and the Tertiary Nacimiento Formation. An unnamed arroyo flows toward the San Juan River on the southern and western edges of the site. East of the site, a well-defined arroyo cuts a small canyon from the bluff to the San Juan River. Hammond Ditch, a newly concrete-lined irrigation ditch underlain by a French Drain with a liquid recovery system, lies on the bluff between the limit of the Jackson Lake Terrace (also called the Nacimiento Cliff in this document) and the Refinery.

1.2 SITE DESCRIPTION AND HISTORY

Refinery offices are on the western end of the facility, along with warehouse space, maintenance areas, raw water ponds for temporary storage of fresh water from the San Juan River, and a storage yard containing used material (e.g., pipe, valves). Petroleum processing units, located in the northwest portion of the Refinery, include the crude unit, fluidized catalytic cracking unit, catalytic polymerization unit, and hydrodesulfurization unit. Several product storage tanks are present east of the petroleum processing area. The API separator is located in the northwestern portion of the site. The aeration lagoons, formerly known as the north oily water pond (NOWP), the south oily water pond (SOWP), are located in the north central section of the refinery.

In the central portion of the site, aboveground storage tanks (ASTs) occupy a large percentage of Refinery property. South of the Refinery and across Sullivan Road are terminals for loading product and off-loading crude, as well as gas storage and hazardous waste storage.

The eastern portion of the site contains closed and operational wastewater treatment facilities. Until the end of 1994, two clay-lined evaporation ponds and a spray irrigation area were used to treat and dispose of process wastewater. Since that time, two double-lined 5-acre evaporation ponds and a Class 1 underground injection well have been used to manage all Refinery process wastewater. In late 1998, the former evaporation ponds were converted into new raw water ponds. The spray irrigation area was decommissioned in 1994 with the start up of the Class 1 injection well. The spray irrigation area has been overlaid by a parking lot and office complex. The fire training area and the landfill are also located at the eastern end of the facility.

Wells south of the Refinery fence line and west of the crude unloading and product loading area define an area where petroleum hydrocarbons are present in the groundwater. The U.S. Bureau of Land Management (BLM) controls this area. Subsurface hydrocarbons, including both dissolved-phase and separate-phase hydrocarbons, are present in the groundwater north and west of the processing area, between the San Juan River and the cliff that defines the limit of the Jackson Lake Terrace deposits. This area is owned by SJRC.

The historical and current activities conducted at the Refinery include:

- Petroleum processing
- Crude and product storage
- Crude unloading and product loading
- Waste management (closed units and existing facilities)
- Offices and non-petroleum material storage

A detailed history of the Refinery, including improvements, expansions, spills, and investigations, is provided in the September 2001 *Discharge Plan Application, Site Investigation and Abatement Plan, Corrective Measures Study (CMS), Volume 1.*

Local entrepreneur Kimball Campbell originally constructed the facility as a crude topping unit in the late 1950s. O.L. Garretson bought the facility in the early 1960s, renamed it Plateau, Inc., and sold it in 1964 to Suburban Propane of New Jersey. As a protective filing, Plateau applied for a RCRA Part A Permit as a generator of hazardous waste and as a treatment, storage, and disposal (TSD) facility in November 1980. In 1982, Plateau petitioned for reclassification under a generator-only status. Bloomfield Refining Company (BRC) acquired the facility from Suburban Propane (Plateau) on October 31, 1984. Facility ownership was transferred to SJRC on October 4, 1995.

2 SAMPLING PLAN

2.1 SCOPE OF WORK

The scope of this Work Plan is to provide a monitoring plan for the SJRC to determine the efficacy of the Hammond Ditch French Drain and the status of the hydrocarbon plume. This work plan has been updated since the publication of the CMS to reflect changes to the refinery due to lining of Hammond Ditch and the installation of a French Drain with a liquid recovery system beneath the ditch.

2.2 HEALTH AND SAFETY

SJRC has developed a site-specific Health and Safety Plan during initial work on this site that includes the following:

- Drilling and monitor well installation activities
- Water level measurement activities
- Groundwater sampling activities
- Field Procedures

The Health and Safety plan covers the activities that will take place under this work plan and will be updated as necessary.

2.3 GROUNDWATER SAMPLING

The following presents a summary of the monitoring program proposed for the four components of the mitigation system. The four components are separated-phase hydrocarbons, dissolved phase hydrocarbons, additional sampling requirements, and groundwater monitoring.

2.3.1 Separated-Phase Hydrocarbons (SPH)

For SPH recovery, refinery personnel will measure water levels and SPH thickness in the 15 wells listed in Table 1, semiannually for two years, beginning January 2002. This measurement program will monitor the effectiveness of the system in removing SPH.

Table 1
Wells for Monitoring SPH Thickness and Groundwater Levels

MW-9	RW-3	MW-41	MW-21	RW-19	MW-43	MW-28	MW-39
MW-40	MW-20	RW-18	MW-42	MW-24	RW-22	RW-2	

For SPH containment, the effectiveness of the hydraulic barrier between the San Juan River and the alluvial sediments will be monitored with two permanent piezometers installed in drive-point wells. Semiannually refinery personnel will measure water levels and SPH thickness in each of the two piezometers. If contaminants are observed in the piezometers on the San Juan River side of the barrier, refinery personnel will collect San Juan River samples around the perimeter of the barrier for total benzene, toluene, ethyl benzene, xylene, (BTEX) and naphthalene. Additionally, at regular intervals, inspections will be conducted by refinery personnel on Seeps 2 and 3 for product.

2.3.2 Dissolved Phase Hydrocarbons

Refinery personnel will sample the wells listed in Table 2 for BTEX, chromium, lead, total petroleum hydrocarbons (TPH), and total dissolved solids semiannually, beginning after the construction of the new monitoring well, for two years. Seeps 2 and 3 will also be sampled semiannually for two years. A new well, included in the above well count and listed below, will be installed. The new well will be installed at a location between the Hammond Ditch and the San Juan River. This well will also be sampled semiannually for the above constituents for two years.

Table 2
Dissolved Phase Hydrocarbon Sampling Wells

MW-1	MW-4	MW-9	MW-12	MW-27	MW-35	New Well	RW-15
MW-3	MW-8	MW-11	MW-17	MW-34	MW-36	MW-24	

2.3.3 *Additional Requirements*

Refinery personnel will collect field measurements of dissolved oxygen, nitrate, and conductivity from each of the wells in Table 2. This will be done semiannually.

To compliment the field measurements of dissolved oxygen and nitrate, Refinery personnel will sample the wells in Table 3 for sulfate and iron on a semiannual basis.

Table 3
Sulfate and Iron

MW-8	MW-11	MW-34	MW-35	RW-15

Every five years, prior to discharge plan renewal, Refinery personnel will sample the 15 wells identified in Table 2 for the parameters listed in the modified skinner lists, based on EPA Region 6 Human Health Medium-Specific Screening Levels and NM WQCC Regulations. In addition, samples will be analyzed for pH, conductivity, total dissolved solids (TDS), chloride, sulfate, and nitrate.

2.3.4 *Background Wells*

BRC is proposing a background well upgradient of the site to establish background concentrations. The well will be drilled and sampled and results will be used to establish the background concentrations for RCRA metals and OCD groundwater quality parameters. The background well will be sampled annually as per the CMS.

The following section discusses the methods proposed for SPH reduction.

2.4 *SPH REDUCTION*

The following section discusses the methods proposed for SPH reduction.

2.4.1 *SPH Reduction Background*

Source control technologies include SPH removal and containment. This section summarizes the design for each technology to control the source of the SPH recovery.

2.4.1.1 SPH Removal Design

Recent SPH thickness observations indicates SPH in wells RW-17, RW-18, and RW-19. Total fluids pumps will be installed at these three locations for the most efficient SPH recovery. Skimmer pumps are currently operating in RW-18, RW-19, and RW-43 so the design of the proposed system is similar to what is already being implemented.

Historically, skimmer pumps have been used at this site to target the SPH source. Skimmer pumps are triggered into operation by sensors that detect a measurable thickness of the SPH. Because of the success of historical pumping, the remaining SPH thickness may be too small to reliably trigger skimmer pumps into operation. Total fluids pumps operate at a steady 1 to 2 gpm and may be used. Total fluids pumps will result in a shorter time to complete SPH removal with a lower degree of maintenance. As a result, total-operating costs will be reduced. Semiannual monitoring will continue to ensure that the configuration is operating at maximum efficiency.

2.4.1.1 SPH Containment Design

Sheet pilings and a bentonite clay slurry wall have already been installed between the western edge of the gravel bar and the San Juan River. This barrier was constructed after some SPH was observed at the seeps along Jackson Terrace. The base of the slurry wall was placed within the low permeability Nacimiento Formation that underlies the more permeable sand and gravel. The sheet pilings are located just behind the slurry wall, only 5 to 10 feet from the river's edge, and extend to the water make-up ponds. Both barriers will be left in place so they will continue to prevent any seepage of SPH into the San Juan River.

2.4.2 Dissolved-Phase Contaminant Mass Reduction

The following section discusses dissolved-phase contaminant reduction using a combination of total fluids pumping and natural attenuation.

2.4.2.1 Total Fluids Pumping and Natural Attenuation Design

A two-fold method is proposed for reducing the dissolved-phase contaminant distribution. A series of additional total fluids pumps will operate in tandem with natural attenuation to mitigate the contamination. The wells proposed for targeting the dissolved-phase plume with total fluids pumps are RW-2, RW-23, MW-41, MW-28, and MW-20. These wells form an arc around and are approximately 300 to 400 feet down gradient of the three wells proposed for SPH removal.

Using both total fluids pumping and natural attenuation will reduce the dissolved-phase contaminant faster and more effectively than using a single method. A reduced benzene distribution and naphthalene reduction over just the past couple of years is a testament to the efficacy of total fluids pumping alone. Augmenting this recovery with biodegradation of compounds will reduce the time of cleanup and, therefore, the total cost of remediation and monitoring. Studies have shown that site conditions are favorable for natural attenuation.

2.4.2.2 Natural Attenuation Activity Quantification

SJRC will verify natural attenuation activity along the primary groundwater flow path from MW-4 southwest to MW-37. This evaluation will require sampling each of the wells identified in Table 4, one time, for all of the Geochemical Parameters identified in Table 5. The results will be compiled and evaluated to demonstrate that natural attenuation is occurring. The sampling will occur every five years.

Table 4
Natural Attenuation Activity Sampling

RW-2	P-3	MW27	MW-37
P-2	MW-7	MW-34	MW-33
MW-4	MW-11	MW-35	

Table 5
Geotechnical Parameters for Assessing Natural Attenuation At Petroleum Contaminated Sites

Analyte	Use	Change with Biological Activity
Oxygen (02) Dissolved	Terminal electron acceptor. At most sites <1ppm indicates anaerobic conditions	↓
Nitrate (NO_3)	Terminal electron acceptor when O_2 depleted	↓
Manganese (MN^{+2})	Metabolic byproduct of MN^{+4} reduction	↑
Ferrous Iron (Fe^{+2})	Metabolic byproduct of Fe^{+3} reduction	↑
Sulfate (SO_4)	Terminal electron acceptor	↓
Methane (CH_4)	Metabolic byproduct of methanogenesis	↑
Alkalinity	Measures buffering capacity of groundwater. Affected by CO_2 production from biodegradation	↑
Redox Potential (ORP)	Important control on biological activities in subsurface	↓
PH	Biological activities are pH sensitive	→ or ↓
Temperature	Helps determine representative groundwater when purging a well	→
Conductivity	Helps determine representative groundwater when purging a well	→

2.5 HAMMOND DITCH FRENCH DRAIN MONITORING

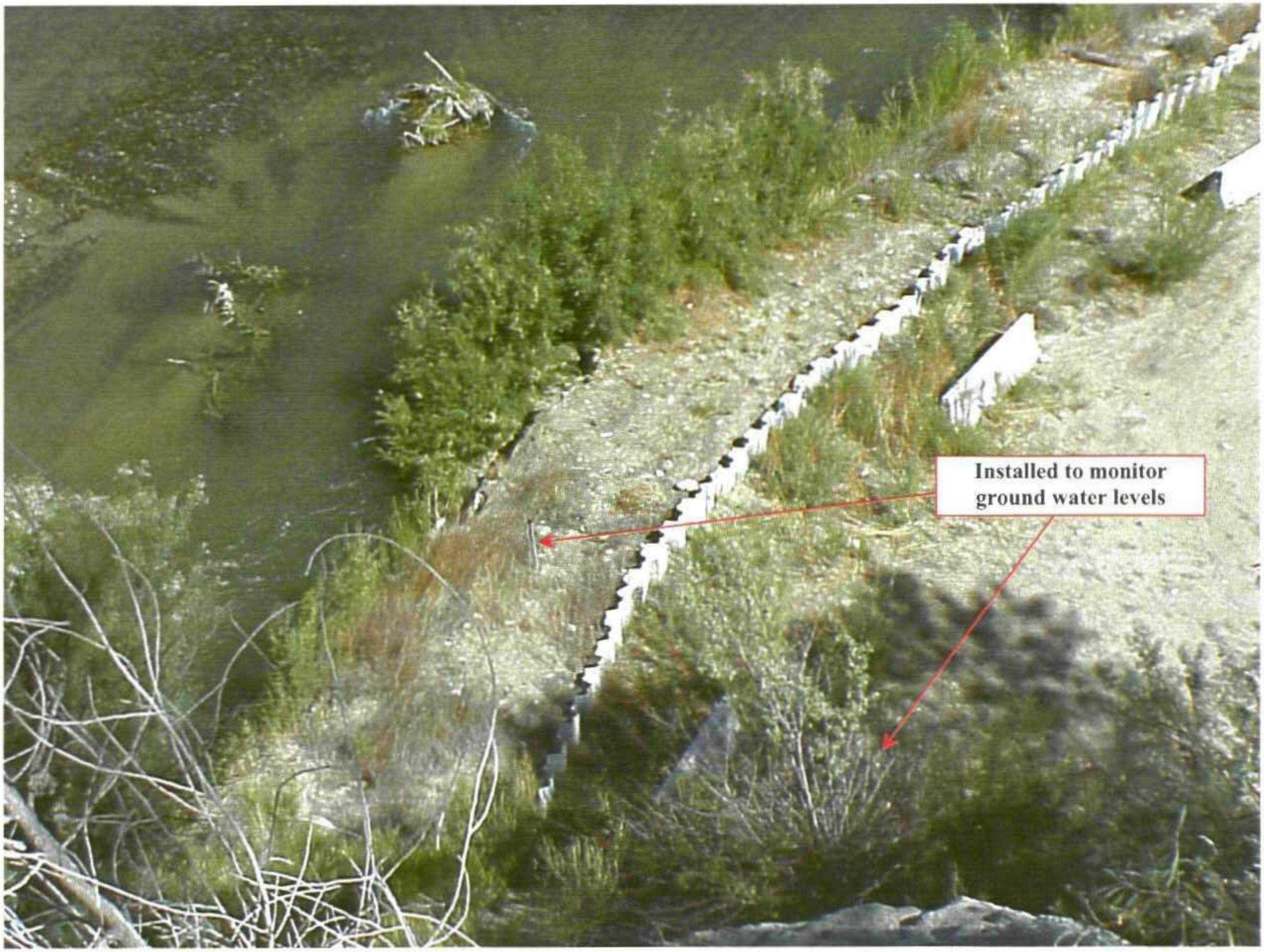
Liquid from the Hammond Ditch French Drain is routed to Recovery Tank 37. From Recovery Tank 37, the liquid flows to the API separator. Recovery Tank 37 is fitted with a flow meter to measure liquid flow. Readings from the flow meter will continue to be recorded under this plan.

7.0

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested a site plan that includes the location(s) or proposed locations of monitoring wells in the vicinity of the barrier at the San Juan River to monitor BETX, TPH as GRO and DRO, and OCD general chemistry parameters (major cations and anions).

Response

This attachment includes two 8 ½" by 11" copies of photographs of the monitoring points at the San Juan River sheet piling and an 11" by 17" copy of a site plan with these points highlighted. These monitoring points are also mapped in the site plan provided in Attachment 1. The Monitoring and Sampling Work Plan (Attachment 6) identifies the plan for the requested sampling at these points.



Installed to monitor ground water levels

San Juan River Sheet Piling and Slurry Wall with Monitoring Points

Close-up of Monitoring Point Adjacent to Sheet Piling

Insert Facility Site Map/ Site Plan

8 ½ x 11

NOTES

"MW-XX" – Monitoring Wells Locations
"RW-XX" – Recovery Well Locations
"S-XX" – Seep Locations
"P" – Piezometer

REFERENCE DWGS	NO.	REVISION	JOB No.	BY	DATE	BY	DATE	BY	DATE
	1	Updated As Per Enviromental Dept. Mark Up							
				DRAWN		CHECKED		APPROVED	

		DATE
SCALE	As Noted	
DRAWN BY	NHB	8/29/02
INITIAL CHK.		
FINAL CHK.		
ENGR.		
APPR. BY		
AFE/WO No.		

Giant Bloomfield Refinery
Area Plot Plan
Recovery Well & Monitoring
Well Locations

GIANT
REFINING CO.

BLOOMFIELD REFINERY
BLOOMFIELD NEW MEXICO

DWG NO. D-000-900-023
REV. 1

3.1.1

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested a map showing Hammond Ditch sediment sample locations and the locations of San Juan River and Hammond Ditch water sample collection points.

<u>Response</u>

This attachment contains the *1999 Hammond Ditch Investigation Report* which contains a site plan that shows all of the borings in the ditch (Figure 1).

1999 Hammond Ditch Investigation Report

80 Road 2400
Aztec, NM 87410
T/F: 505.334.4974

November 6, 1999

CORDILLERAN

Mr. Tyson L. Shelton
Giant Refining Company
111 Road 4990
Bloomfield, NM 87413

RE: Hammond Ditch Investigation
Giant Refining Company
Bloomfield, New Mexico

Dear Mr. Shelton:

As per your recent request of November 5, 1999, Cordilleran Compliance Services, Inc. (Cordilleran) is pleased to provide Giant Refining Company (Giant) with this letter report. This report provides the Scope of Work and subsequent results of the Hammond Ditch Investigation conducted at the above-referenced property on November 6, 1999.

SCOPE OF WORK

Cordilleran conducted an Investigation of the Hammond Ditch on November 6, 1999. Prior to conducting the Investigation, Cordilleran conducted a site reconnaissance with Mr. Lynn Shelton, Giant "Environmental Manager" on November 5, 1999.

The Hammond Ditch (ditch) has a perennial stream flow southwesterly across the northern and western fenced area of Giant's Bloomfield oil refinery (please refer to Figure 1, Site Map). The Investigation consisted of assessing the length of the ditch (from 500 feet east of the flare to County Road 4990; approximately 2,112 feet) for the presence/absence of petroleum hydrocarbons. A hand auger was utilized to assess soil conditions from approximately 0-2 feet below ground surface (bgs). Samples were collected from the south side of the ditch approximately every 200 feet where petroleum hydrocarbons were observed and approximately every 400 feet where they were absent. In addition, two samples were collected from the north side of the ditch at the flare and 1,000 feet down gradient from the flare (please refer to Figure 1, Site Map, attached). Cordilleran was careful to get as close to the flowing stream as possible and attempted to angle the borings toward the stream channel. Cordilleran's local Senior Geologist kept detailed records of the findings. The type of soil based on the Unified Soil Classification System (USCS) was logged, the presence/absence of petroleum hydrocarbons was noted, and heated headspace levels were reported using a *Toxi RAE Model #PGM-30* photoionization detector (PID). Heated Headspace analysis was conducted on each soil sample collected that exhibited physical evidence of petroleum hydrocarbons.

The following New Mexico Oil Conservation Division (OCD) soil sampling procedures for heated headspace analysis were closely adhered to for each sample collected.

- A 1-quart zip lock bag was filled ½ full with sample leaving the remainder of the bag filled with air.
- The sample was heated to between 59-77 degrees Fahrenheit.
- Aromatic hydrocarbon vapors were allowed to develop for 5-10 minutes while the bag was gently massaged to break up soil clods.
- Then one end of the bag was carefully opened while the probe of the PID was inserted. The bag was then resealed around the probe to prevent vapors from escaping. The peak measurement was then recorded. The PID was calibrated to assume a benzene response factor and read in parts per million (ppm).

RESULTS

TABLE 1. INSPECTION RESULTS

SAMPLE#	LOCATION	USCS DESCRIPTION	PID READING
1	South side, 100 feet from east gate/bridge	SW-Gravelly sand, tan, wet, no hydrocarbon stain/odor (auger refusal at 1 foot)	N/A
2	South side, 400 feet west of sample 1	OL-Sandy silt, organic silt and organic silty clay, black from 2 inches to 2 feet, wet, slight hydrocarbon odor, possible old spill	0.0
3	South side, 400 feet west of sample 2	OL-Sandy silt, organic silt and organic silty clay, tan, gray, green, black, wet, no hydrocarbon stain/odor	N/A
4	South side, 400 feet west of sample 3	SP-Poorly graded sand, gravelly sand, tan to black, wet, slight to moderate hydrocarbon odor	**490**
5	South side, 200 feet west of sample 4	OL-Sandy silt, organic silt and organic silty clay, tan to black, wet, no hydrocarbon stain/odor	N/A
6	South side, 400 feet west of sample 5	SM-Silty sand, sand-silt mixture, tan, wet, moderate to strong hydrocarbon (gas) odor	**509**
7	South side, 200 feet west of sample 6	SM-Silty sand, sand-silt mixture, tan, gray, wet, slight hydrocarbon odor	0.0
8	North side, at flare	OL-Sandy silt, organic silt and organic silty clay, black, wet, no hydrocarbon stain/odor to SW-Gravelly sand (auger refusal at 1 foot)	0.0
9	North side, 1000 feet west of sample 8	OL-Sandy silt, organic silt and organic silty clay, tan to black, wet, no hydrocarbon stain/odor	0.0

CONCLUSIONS/RECOMMENDATIONS

Cordilleran concludes that subsurface soil types within the area of investigation ranged from sandy silt, organic silt and organic silty clay to gravelly sand. The ditch appeared to have been impacted by 2 or 3 separate spill events. The area of Sample 2 was perhaps impacted at one time by a petroleum hydrocarbon release, but did not exhibit any recordable heated headspace readings. The areas of samples 4 and 5 exhibited slight to strong petroleum hydrocarbon odors and heated headspace readings near to slightly above 500 ppm. Delineating the precise extent of these two impacted areas was beyond the scope of this limited investigation. However, it should be noted that the southern most area impacted (Sample 5) appeared to be confined to the refinery property.

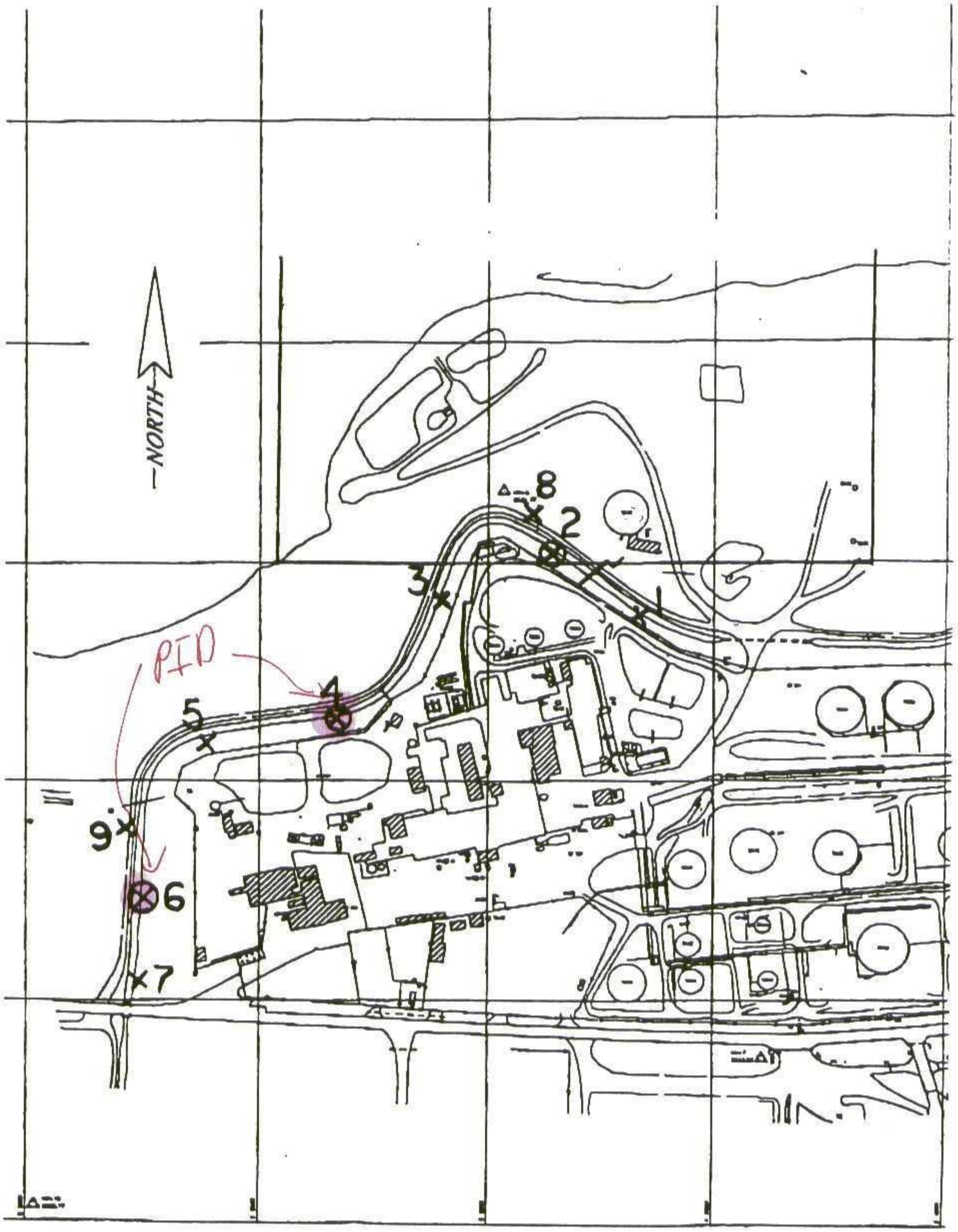
The purpose of this limited Investigation was to assess the presence/absence of petroleum hydrocarbons over a large area. Based on this objective, the Investigation was a success. The Investigation was limited by a number of factors including difficult access conditions, an abundance of black organic silt (resembling petroleum hydrocarbons in color), wet conditions in the ditch which hampered heated headspace readings, and gravel which prevented the auger from being advanced at two sample locations. Cordilleran recommends that a more detailed investigation be conducted in order to better delineate the extent of impact at the two identified areas. Sampling should be conducted from the access road on the north side of the ditch using a backhoe.

This concludes Cordilleran's services for this project. Please call the undersigned at (505) 334-4974, if you have any questions/comments or if we can be of further assistance.

Sincerely,
Cordilleran Compliance Services, Inc.

David R. Cesark
Senior Geologist

CC: File



LEGEND

X = SAMPLE LOCATION

⊗ = 500 PPM. (APPROX.) PID READING

FIGURE 1

SITE PLAN

HAMMOND DITCH

GIANT REFINING COMPANY

BLOOMFIELD, NM

FIGURE	BY	DATE
DRAWN	DP	11/8/99
APPROVED	DRC	11/8/99

CCS JOB NO. EF9972

SCALE: 1"=333'

CORDILLERAN

3.1.2

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED stated "Eight borings were drilled in the vicinity of the river in 1997...but soil samples were obtained for laboratory analysis from only two of the borings...." NMED requested that BRC identify whether additional chemical analyses were conducted on the two soil samples or on samples obtained from the other borings and the results of the additional analyses, is available. Provide the title and date of the investigation report that summaries the results of the investigation. Provide a copy of the investigation report if one was not previously submitted.

Response

This attachment contains the *1997 River Bank Investigation Report*. Information in this report includes results of borings above and below the bluff and laboratory analysis of soil samples. Also included are analytical results from the sampling event.

RIVER BANK INVESTIGATION

GIANT REFINING COMPANY

BLOOMFIELD REFINERY

PREPARED FOR

NEW MEXICO OIL CONSERVATION DIVISION
SANTA FE, NEW MEXICO

PREPARED BY

LYNN SHELTON
ENVIRONMENTAL MANAGER
GIANT REFINING COMPANY - BLOOMFIELD

June 12, 1997

RIVER BANK INVESTIGATION

GIANT REFINING COMPANY - BLOOMFIELD

MAY, 1997

GENERAL:

The Bloomfield refinery was originally built in the late 1950s and has been operated by Kimball Campbell, O. L. Garretson (Plateau), Suburban Propane, Inc. (Plateau), Bloomfield Refining Company and Giant Refining Company.

The facility is located approximately one mile south of Bloomfield, New Mexico on a precipice (bluff) overlooking the San Juan River. Several geological features come into play at the facility which will be discussed in another section.

Giant Refining Company (GRC) continues remediation activities at the refinery which were required of previous operators by a 3008 (h) Administrative Order on Consent that consists of interim measures of hydrocarbon recovery from the Jackson Lake Terrace and is now proceeding with the modification and submittal of a Corrective Measures Study.

On November 26, 1996, over three weeks into the low flow test of the San Juan River (≤250 cfs), maintenance personnel discovered a sheen of what appeared to be hydrocarbon in an eddy on the San Juan River (see site drawing, Figure 1). GRC immediately placed a floating boom around the sheen and placed absorbent pillows within the boomed area. All appropriate regulatory agencies were notified, including the National Response Center, the New Mexico Oil Conservation Division and the New Mexico Environment Department.

Mitigation activities were started immediately, including excavation to determine the source of the hydrocarbon, soil sampling, installation of a collection gallery to recover Separate Phase Hydrocarbon (SPH), laboratory analysis of the recovered product to determine the origin of the product and a geological assessment of the river bank (also referred to as the sand bar) and the precipice (bluff).

Recovery activities continue and a site assessment to determine the horizontal and vertical extent of the contamination on the river bank has been performed. The site assessment has included historical research of the geomorphology and hydrogeology of the prevalent geological features as well as drilling activity to determine the tops of pertinent formations. GRC has used Precision Engineering, Inc. of Las Cruces to develop a surface and subsurface model of the facility, portions of which are attached.

Through the aforementioned activities, GRC has determined the horizontal and vertical extent of the contamination below the river bank.

GEOLOGY:

The GRC facility is located on the Jackson Lake Terrace of the San Juan River (Pastuzak, 1968) about 120 feet above the present river level and about 500 feet from the river. The terrace was formed during the Pleistocene by downcutting of a former valley floor which had been aggraded with the cobble and gravel deposits during the last glacial advance. At the time, the San Juan River was swollen with meltwater and carried great quantities of glaciofluvial outwash.

During the last glacial retreat, wind blown sand and silt from the floodplains settled over the coarse clastics to form structureless loess deposits.

The Jackson Lake Terrace deposits on which the facility is situated are comprised of about 15 feet of cobbles and gravels overlying the Nacimiento Formation of Tertiary Age. The cobble bed is overlain by about 10-15 feet of fine-grained, windblown sand and silt. South of the facility, the cobble bed wedges out leaving only loess in overlying contact with the Nacimiento Formation. A substantial number of soil borings have demonstrated that the Pleistocene cobble bed occurs everywhere beneath the facility.

The Nacimiento Formation is described in the literature as a massively bedded, unctuous clay. The clay at the outcrop is a tight unfractured rock unit. As measured in nearby oil wells, the Nacimiento Formation is about 500 feet thick. At least 100 feet of this rock is exposed in the precipice (bluff) face north of the facility and adjacent to the San Juan River.

The morphology of the contact between the Quaternary cobble and silt of the Jackson Lake Terrace in the vicinity of the facility and the underlying Nacimiento Formation is important in that it influences control over the direction of groundwater flow. This morphology was evaluated in a Groundwater Discharge Plan renewal and submitted to the New Mexico Oil Conservation Division.

Recent drilling activities indicates a dip in the surface of the Nacimiento southward trending from the precipice at a rate of 2 to 4 vertical feet per 500 horizontal feet. This would explain the direct impact of water mounding and bank storage from the Hammond Ditch on the groundwater beneath the facility. The three dimensional model for the facility, will provide a visual representation of the depressions and characteristics of the formation beneath the facility. The three dimensional model will be available later in 1997.

The geology of the river bank area is composed of fluvials consisting of sand, silt, gravel and cobbles, generally 15 to 20 feet thick overlying and in direct contact with the Nacimiento Formation. As shown in the three dimensional drawings of the top of the

Nacimiento Formation in the river bank area (Figures 2 - 4) the surface of the Nacimiento, from the precipice to the river area, shows several depressions and some river channel scarring. In the area of the most prominent Jackson Lake Terrace seep, which is located north of the flare along the interface of the Jackson Lake Terrace cobble bed and the Nacimiento formation, there appears to be an erosional feature in the vertical face of the precipice that tends to channel groundwater seepage down to the river bank and then westward, within the bank, into a depression on the Nacimiento Formation. The western most, as well as northern most, boundary of the contamination that has flowed into this depression is the San Juan River, which acts as a hydraulic barrier during times of normal flow (500 + cfs).

Additional drawings (Figures 5-11) are included with this report to further illustrate the Nacimiento Formation and how the three dimensional drawings were created.

DRILLING ACTIVITY:

Since the discovery of the sheen on the river, numerous borings have been made to document the geology in the area of the seep and the river bank. Three soil borings were made near the outcrop of the precipice on December 10-13, 1996 (Figure 1) using a CME 75D drilling rig with 8.25 inch OD continuous hollow stem augers and a NWD4 core barrel system. Those borings were drilled to the river level to determine the integrity of the Nacimiento Formation. The Nacimiento Formation was continuously cored. No fracturing or faulting that could act as a hydraulic conduit was observed. This indicated that the SPH and water that had seeped down onto the river bank had migrated from the interface between the Jackson Lake Terrace and the Nacimiento Formation downward along the face of the precipice. Lithologic logs of those borings are included as Attachment 1.

Eight soil borings were made on March 13-20, 1997, again using the CME 75D drilling rig and 8.25 inch OD continuous hollow stem auger with a custom bit. Two of those borings were adjacent to or on the talus slope adjacent to the Nacimiento Formation outcrop and six borings were made on the river bank. The eight soil borings were made to characterize the vertical and horizontal extent of the contamination in the river terrace area as well as to document the surface of the Nacimiento Formation in the river area for the modeling activities that are ongoing. Lithologic logs of the seven borings are included as Attachment 2.

All drilling and logging activities were performed by Precision Engineering, Inc. of Las Cruces, NM. A copy of Mr. Bill Kingsley's report is included as Attachment 3. Sufficient information was obtained to define the extent of the contamination at the river bank.

EXTENT OF CONTAMINATION:

The horizontal and vertical extent of the contamination on the river bank was determined by using a combination of methods including visual observation, Photo-Ionization Detector (PID), soil sampling in conjunction with the characteristics of the Nacimiento Formation.

The vertical extent of the contamination under the river bank is to the top of the Nacimiento Formation. Historical data indicates that the Nacimiento Formation is an impermeable aquitard and observations made while drilling into the formation corroborated this. In every boring the Nacimiento Formation was found to be dry, with liquid infiltration limited generally to four to six inches, with a minimum of two inches and a maximum of 23 inches.

Horizontal extent of the contamination was found to be from north of the primary seep out to the south edge of the water intake lagoon, then westerly to the west edge of the water intake lagoon and then northerly to the river bank, around the bank south southwest to the outcrop of the Nacimiento Formation along the precipice then easterly along the plane of the Nacimiento Formation beneath the talus slope back to the area of the seep. A line marking the extent of the contamination is included in Figures 2-4.

No SPH was observed during drilling of the borings. A sheen was thought to be observed in soil boring SB7-397, but PID readings were 0 and there was no hydrocarbon smell. PID readings generally indicated the presence of hydrocarbon, within the contaminated area, at the interface of the fluvials and the top of the Nacimiento Formation. Soil samples were taken at that interval and analyzed for BTEX constituents (EPA Method 8020) and Total Petroleum Hydrocarbons (EPA Method 418.1). Some additional sampling was performed, at depths other than the interface mentioned above, to determine concentrations when PID readings indicated the presence of hydrocarbons.

The absence of SPH in the soil borings within the contaminated area, when considered with the three dimensional drawings of the area, suggest that the SPH observed at the point where the original sheen was observed, that is, the point at which the San Juan River flows south-southwest into the exposed Nacimiento Formation at the bluff, is probably confined to a depression in the Nacimiento Formation at that point and is limited in volume.

SUMMARY:

GRC has performed substantial investigation of the contamination of the river bank and is performing ongoing mitigation activities to prevent additional releases into the San Juan River.

The sheen is felt to be directly attributable to the low flow test of the river. During the low flow test, the flow rate was at or below 250 cfs for a period of four months. After three weeks of low flow, the hydraulic barrier formed by the San Juan River had diminished sufficiently to allow SPH that was trapped in the depression in the Nacimiento Formation (as bank storage) to migrate westward.

Additional data has been collected regarding the geology of the site and the vertical and horizontal delineation of the contamination has been made.

GRC determined when the sheen was discovered that the SPH appeared to be in the Naphtha - Kerosene range. Analysis for organic chlorides and olefins confirmed that the SPH was refined product. Interviews with various long term employees at the facility indicated that two leaded gasoline tanks (Tanks #6 & 7) were overfilled occasionally, allowing gasoline to enter the soil. GRC submits that this is, in all likelihood, the source of the SPH plume in the Jackson Lake Terrace formation beneath the facility and, subsequently, the river bank area.

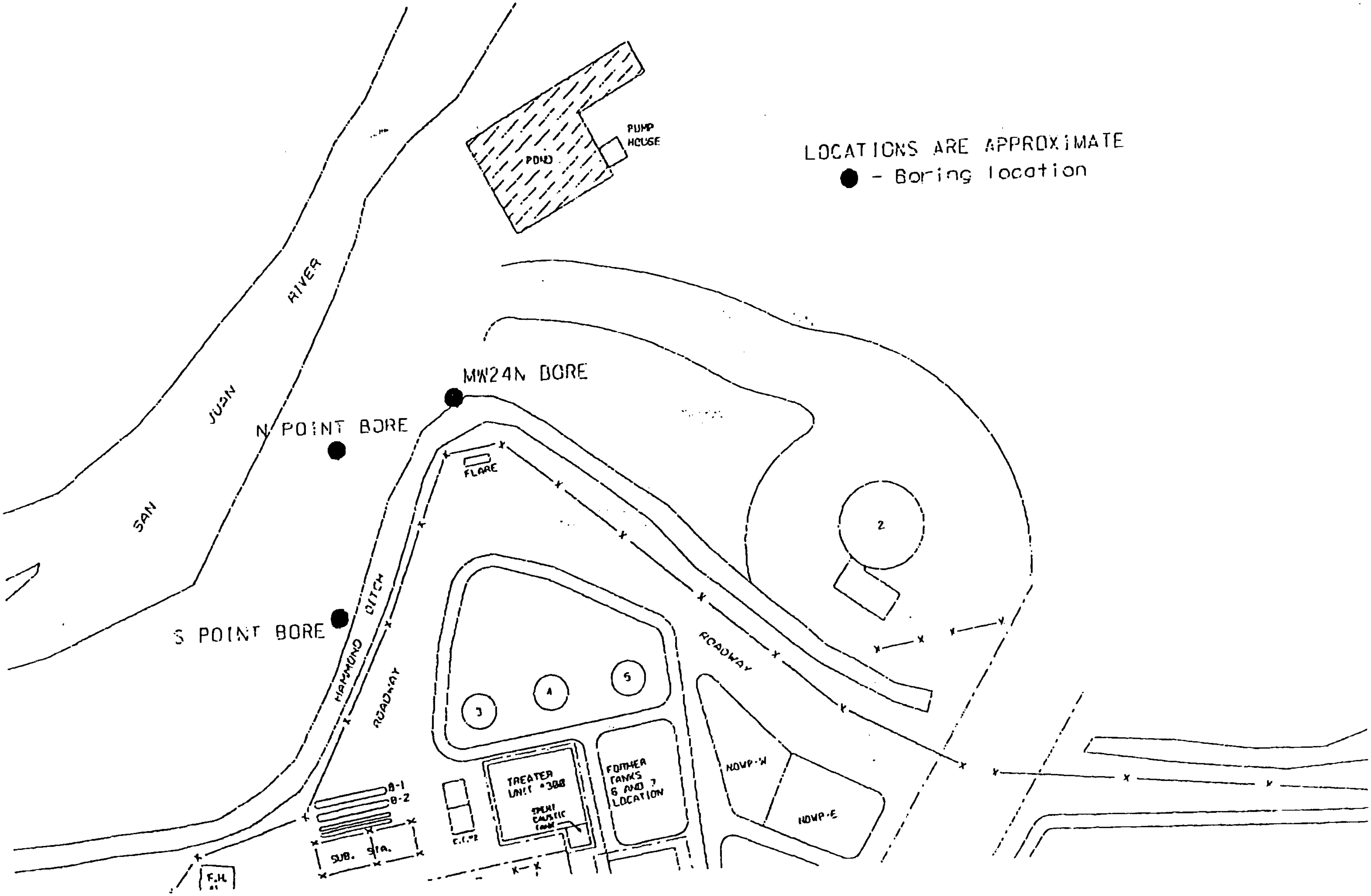
GRC believes that SPH is not presently migrating from the facility to the river bank. Water samples taken from the seep at the interface of the Jackson Lake Terrace cobble bed and the Nacimiento Formation indicate that only a small quantity of dissolved BTEX is contained in the seep. GRC believes that the ongoing interim measures, in the form of product recovery from the Jackson Lake Terrace formation and maintaining a water level in the Hammond Ditch, are preventing migration of the SPH plume from beneath the facility to the northwest and down onto the river bank. GRC also believes that the removal of tanks 6 and 7 in 1987 removed the source of the hydrocarbon that is contained in the SPH plume.

GIANT REFINING COMPANY (as operator)

By: Lynn Shelton

Lynn Shelton
Environmental Manager

Date: 6/13/97


LOCATIONS ARE APPROXIMATE
● - Boring location
MW24N BORE
N POINT BORE
S POINT BORE
SAN JUAN RIVER
POND
PUMP HOUSE
FLARE
HAMMOND DITCH
ROADWAY
ROADWAY
2
3
4
5
TREATER UNIT #308
SPENT CAUSTIC TANK
FORMER TANKS 6 AND 7 LOCATION
NOVP-W
NOVP-E
B-1
B-2
SUB. STA.
F.H.

PRECISION ENGINEERING, INC.

PROJECT: Bloomfield Refinery
uff Investigation

LOG OF TEST BORINGS

FILE #: 96-181
ELEVATION:
TOTAL DEPTH: 85'
LOGGED BY: Kingsley
DATE: 12/10/1996
STATIC WATER: 10.2'
BORING ID: MW24N Bore
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0-10.2	00o000o00		▼	Cobbles, gravelly, sandy, very dense, rounded and disked, composed of chrystalline	
	o00oc00oo		▼	intrusives and high density metamorphic rocks, dry to 10.2 feet where the soil	
	00o000o00			becomes water bearing. Generally light colored rocks and light brown fine grained	
	o00oo00oo		▼	soils.	
10.2-12.5	00o000o00			As above but water bearing. Materials coated black and have hydrocarbon odor.	
12.5	o00oo00oo		▼	Odor is of older tetted hydrocarbon. Sheen on water, no free hydrocarbon observed.	
12.5-39.0	*********		▼	Sandstone, fine, poorly cemented, argillaceous, hand sample crumbles, grey blue,	
	*********		▼	wet but not water bearing, weak hydrocarbon odor, mod. dense, massive (no jointing)	
	*********		▼	Yellow brown color at 13.0', no hydrocarbon odor, slightly less moisture.	
	*********	20	▼	Blue grey at 15.0', no hydrocarbon odor. Sandstone dries white to light grey.	
	*********		▼	Sample recovery 100%. Cores are high quality. Core rate using carbide NWD4 bit	
	*********		▼	approx. 1'/min	
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼	Thin (<1cm) carbonaceous shale seams, appears coaly, random orientation but	
	*********		▼	typically near flat lying. No free water, samples moist.	
9.0	*********		▼		
.0-42.0	---------	40	▼	Shale, damp to moist, no water at interface of sandstone above and shale, blue grey	
42.0	---------		▼	to steel grey, crumbles easily in hand samples but dense in situ. Core rate 3"/min	
42.0-85.0	*********		▼	No jointing observed in cores. Recovery 100%. Occasional sandstone stringer	
	*********		▼	6" or less in thickness (rare). Cores are high quality. Some carbonaceous zones.	
	*********		▼	Sandstone, fine, weakly cemented, argillaceous, sample crumbles with difficulty,	
	*********		▼	grey to light brown, some calcite filling along flat lying bedding planes, moist	
	*********		▼	dense, more cemented than sandstone above. Core rate 7"/min.	
	*********		▼	Some shale in very thin lenses >60'.	
	*********		▼		
	*********		▼		
	*********	60	▼		
	*********		▼		
	*********		▼		
	*********		▼		
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	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼		
	*********	80	▼		
	*********		▼		
85.0	*********		▼		
TD					

LOGGED BY: Kingsley

SIZE AND TYPE OF BORING: 8-5/8 od HSA to 12.5'. NWD4 core to 85'

PRECISION ENGINEERING, INC.

PROJECT: Bloomfield Refinery
luff Investigation

LOG OF TEST BORINGS

FILE #: 96-181
ELEVATION:
TOTAL DEPTH: 80
LOGGED BY: Kingsley
DATE: 12/11-12/1996
STATIC WATER: 11.7
BORING ID: N Point Bore
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE CONDITION, COLOR GRAINSIZE, ETC.)	PID (ppm)
0-11.7	00o000oo0		▼	Cobbles. gravelly. sandy. very dense. rounded and disked. composed of chrystalline	
	o00uu00oo			intrusives and high density metamorphic rocks. dry to 11.7 feet where the soil	
	00o000oo0			becomes water bearing. Generally light colored rocks and light brown fine grained	
	o00oo000o		▼	soils.	
11.7-12.0	00o000oo0			As above but water bearing. Materials coated black and have hydrocarbon odor.	
12.0	o00oo00oo		▼	Odor is of older fetted hydrocarbon. No sheen observed. no free hydrocarbon.	
12.0-34.7	*********		▼	Sandstone. fine. poorly cemented. argillaceous. hand sample crumbles. grey blue.	
	*********			wet but not water bearing. weak hydrocarbon odor to 13.0. >13.0 no odor. mod. dense	
	*********			Yellow brown color at 13.0'. no hydrocarbon odor. slightly less moisture.	
	*********	20	▼	Auger drill to 20.0'. Rotary drill using NWD4 core with carbide bit to TD.	
	*********		▼	21'-23' carbonaceous shale laminae in the sandstone <5mm. >25' sandstone is	
	*********		▼	yellow streaked (limonitic banding).	
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼		
34.7	*********		▼		
34.7-52.0	---------		▼	Shale. damp to moist. no water at interface of sandstone above and shale. blue grey	
	---------		▼	to steel grey. crumbles easily in hand samples but dense in situ. Core rate 2"/min	
	---------	40	▼	No jointing observed in cores. Recovery 100%. Cores are high quality.	
	---------		▼		
	---------		▼		
	---------		▼		
	---------		▼		
	---------		▼		
52.0	---------		▼		
52.0-80.0	*********		▼	Sandstone. fine. moderately cemented. argillaceous. sample difficult to crumble.	
	*********		▼	grey to light brown. some calcite filling along flat lying bedding planes. moist	
	*********		▼	dense. more cemented than sandstone above. Core rate 5"/min.	
	*********	60	▼		
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼	mud volume virtually unchanged during the coring.	
	*********		▼	significantly more dense at 73'. Core rate 3"/min.	
	*********		▼		
	*********		▼		
	*********		▼		
80.0	*********	80	▼		
TD					

LOGGED BY: Kingsley

SIZE AND TYPE OF BORING: 8-5/8 od HSA to 20', NWD4 core to 80'

PRECISION ENGINEERING, INC.

PROJECT: Bloomfield Refinery
Off [illegible]estigation

LOG OF TEST BORINGS

FILE #: 96-101
ELEVATION:
TOTAL DEPTH: 85
LOGGED BY: Kingsley
DATE: 12/13/1996
STATIC WATER: 19.5
BORING ID: 5 Point Bore
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE CONDITION COLOR GRAINSIZE ETC.)	PID (ppm)
0-19.5	00o000o000		▼	Cobbles, gravelly, sandy, very dense, rounded and disked, composed of chrystalline	
	o00oo000oo			intrusives and high density metamorphic rocks, dry to 19.5 feet where the soil	
	00oo00oo0			becomes water bearing. Generally light colored rocks and light brown fine grained	
	o00oo000oo		▼	soils.	
	00oo00oo0				
	o00oo000oo		▼		
	00oo00oo0		▼		
	o00oo000oo				
19.5-22.0	00oo000oo0			As above but water bearing. Materials coated black and have hydrocarbon odor.	
	o00oo000oo	20	▼	Odor is of older fetted hydrocarbon. Slight sheen observed, no free hydrocarbon.	
22.0	00oo00oo0		▼		
22.0-36.0	*********		▼	Sandstone, fine, poorly cemented, argillaceous, hand sample crumbles, grey blue,	
	*********		▼	wet but not water bearing, weak hydrocarbon odor to 22.6, >22.6 no odor, mod. dense	
	*********		▼		
	*********		▼	Auger drill to 25.0'. Rotary drill using NWD4 core with carbide bit to TD.	
	*********		▼		
	*********		▼	Some limonitic banding >30'.	
36.0	*********		▼		
36.0-50.5	---------		▼	Shale, damp to moist, no water at interface of sandstone above and shale, blue grey	
	---------	40	▼	to steel grey, crumbles easily in hand samples but dense in situ. Core rate 2"/min	
	---------		▼	No jointing observed in cores. Recovery 100%. Cores are high quality.	
	---------		▼		
	---------		▼		
	---------		▼		
50.5	---------		▼		
50.5-85.0	*********		▼	Sandstone, fine, moderately cemented, argillaceous, sample difficult to crumble,	
	*********		▼	grey to light brown, some calcite filling along flat lying bedding planes, moist	
	*********		▼	dense, more cemented than sandstone above. Core rate 4.5"/min.	
	*********		▼		
	*********	60	▼		
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼		
	*********		▼	mud volume virtually unchanged during the coring.	
	*********		▼	more dense at 75'. Core rate 3.5"/min.	
	*********		▼		
	*********		▼		
	*********		▼		
	*********	80	▼		
	*********		▼		
85.0	*********		▼		
TD					

LOGGED BY: Kingsley

SIZE AND TYPE OF BORING: 8-5/8 od HSA to 25.0'. NWD-1 core to 85'

PRECISION ENGINEERING, INC.

LOCATION:

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5464.8
TOTAL DEPTH: 31.5'
LOGGED BY: WHK
DATE: 3-13-97
STATIC WATER: 6.0'/16 HRS
BORING ID: SB1-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0.0-6.1	***000***		C	SAND, GRAVELLY, SOME GREY SANDSTONE, LOOSE, (SLOPE TALUS)	0.0-10.0
	000		C		0
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000	5.0	C		
	000		C		
6.1	***000***		C		
6.1-30.3	===**====		C	SHALE, SLIGHTLY SANDY, DARK GREY, WET (NOT WATER BEARING), DENSE	
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====	10	C		
	===**====		C	OLD HYDROCARBON ODOR (DEGRADED)	302
	===**====		C	SLIGHTLY MORE FISSLE AT 12 FEET, DRY GREATER THAN 11 FEET	11.0-31.5
	===**====		C		0
	===**====		C	12.0-13.0 FEET-BROWNER AND SANDY, DRY	
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====	15	C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====	20	C	SHALE, DARK GREY, HARD, DRY FISSLE, SLIGHTLY SANDY	
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION:

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5464.80
TOTAL DEPTH: 31.5'
LOGGED BY: WHK
DATE: 3-13-97
STATIC WATER: 6.0'/16 HRS
BORING ID: SB1-397
PAGE: 2

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
	===**====		C		23.0-31.5
	===**====		C		0
	===**====		C		
	===**====		C		
	===**====	25	C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====		C		
	===**====	30	C	SHALE-HARD FISSLE. SOME SANDY STRINGERS APPROXIMATELY 3 FOOT THICK AT 22'-25'	
30.3	===**====		C		
30.3-31.5	SSSSSSSSS		C	SANDSTONE, WHITE, DENSE, DRY, FINE	
T DEPTH			C	SOME CUTTINGS OBSERVED AT 20'-25' THAT WERE SATURATED, THEN DRIES OUT.	
			C	SAME OBSERVED WHEN DRILLING 25'-30'.	
			C	SUSPECT WATER AT 10.5'-11.0' RUNNING DOWN BORE HOLE. ANNULUS IS SATURATING	
			C	CUTTINGS.	
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		
			C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING. INC.

LOCATION:

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5446.64
TOTAL DEPTH: 37.0'
LOGGED BY: WHK
DATE: 3-13-97
STATIC WATER: 28.0'/16 HRS
BORING ID: SB2-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE.CONDITION.COLOR.GRAINSIZE.ETC.)	PID (ppm)
0.0-6.0	***000***		C	NOTE: SEEP AT SURFACE OF PAD	0.0-2.0
	000		C	SAND. GRAVELLY. WET/MOIST. LOOSE. BROWN. BLACK IN ZONES. HAS (POOR) HYDROCARBON	0
	000		C	ODOR-OLD SMELL	
	000		C		2.0-5.0
	000		C		5
	000		C		
	000		C		
	000		C		
	000		C		
	000	5.0	C		
	000		C		
6.0	***000***		C		
6.0-17.0	***000***		C	SAND. FINE. GRAVELLY. FLUID BEARING. JET BLACK. STRONG HYDROCARBON ODOR-OLD FETTED.	
	000		C	LOOSE	
	000		C	NOT WATER BEARING GREATER THAN 15.0'	
	000		C	MORE CLAY GREATER THAN 15.0'	
	000		C		
	000		C		
	000		C		
	000	10	C		
	000		C		537
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000	15	C		
	000		C		975
	000		C		
	000		C		
17.0	***000***		C		
17.0-23.5	SSSSSSSSS		C	SANDSTONE. LIGHT GREY/WHITE. HARD. WET. LAMINATED. SHOWS SOME ANGULAR DISCONTINUITY	
	SSSSSSSSS		C	(NOT WATER BEARING)	
	SSSSSSSSS		C		
	SSSSSSSSS		C		
	SSSSSSSSS		C		
	SSSSSSSSS	20	C		
	=S=S=S=S=		C	SHALE AND SANDSTONE IN RANDOM DISCONTINUOUS LAYERS AND DIPS-SUSPECT TOPPLED BLOCK	
	=S=S=S=S=		C	FROM ADJACENT CLIFF FACE	1331
	=S=S=S=S=		C		
	=S=S=S=S=		C		
	=S=S=S=S=		C		67
	=S=S=S=S=		C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION:

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5446.64
TOTAL DEPTH: 37.0'
LOGGED BY: WHK
DATE: 3-13-97
STATIC WATER: 28.0'/16 HRS
BORING ID: SB2-397
PAGE: 2

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
23.5	=S=S=S=S=		C		
23.5-29.0	*********		C	SAND, MEDIUM, WET, LOOSE, DARK GREY, OLD HYDROCARBON ODOR FETTED, NOT WATER BEARING	
	*********		C		
	*********	25	C		
	*********		C		571
	*********		C		
	*********		C		1037
	*********		C		
	*********		C		
	*********		C		
	*********		C	WATER BEARING AT 28.0', BLACK, HYDROCARBON ODOR (OLD)	449
29.0	*********		C		
29.0-32.5	SSSSSSSSS		C	NACIMIENTO FORMATION	773
	SSSSSSSSS	30	C	SANDSTONE, HARD, MOIST, ARGILLACEOUS, LIGHT BROWN	
	SSSSSSSSS		C		155
	SSSSSSSSS		C		40
	SSSSSSSSS		C		48
	SSSSSSSSS		C		
32.5	SSSSSSSSS		C		22
32.5-37.0	=========		C	SHALE, GREY-GREEN, HARD, DRY/DAMP, FISSLE	32.0-37.0
	=========		C		0
	=========		C		
	=========		C		
	=========	35	C		
	=========		C		
	=========		C		
	=========		C		
37.0	=========		C		
TOTAL DEPTH				WATER AT 28.0' IN AUGER AFTER 16 HOURS	

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING. INC.

LOCATION:

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5419.09
TOTAL DEPTH: 10.0'
LOGGED BY: WHK
DATE: 3-14-97
STATIC WATER: 4.0'
BORING ID: SB3-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE.CONDITION.COLOR.GRAINSIZE.ETC.)	PID (ppm)
0.0-1.0	****0****		C	SAND. LOOSE. BROWM, MOIST, (FILL) GRAVELLY	
1.0	****0****		C		
1.0-2.2	///**-///		C	CLAY. SANDY. SILT. BLACK-GREY. OLD HYDROCARBON ODOR. WET. NEARLY WATER BEARING	109
2.2	///**-///		C		
2.2-6.0	*********		C	SAND. FINE-MEDIUM. WELL SORTED. BLACK. WET. WATER BEARING GREATER THAN 4.0 FEET	
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********	5.0	C		
	*********		C		1068
6.0	*********		C		
6.0-10.0	SSSSSSSSS		C	NACIMIENTO FORMATION	16.5
	SSSSSSSSS		C	SANDSTONE. ARGILLACEOUS. FINE. DENSE. GREENGREY. WET. NO ODOR	
	SSSSSSSSS		C		
	SSSSSSSSS		C		0
	SSSSSSSSS		C		
	SSSSSSSSS		C		
	SSSSSSSSS		C		
	SSSSSSSSS	10	C	MOIST AT 10.0 FEET	0
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING. INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5428.88
TOTAL DEPTH: 20.0'
LOGGED BY: WHK
DATE: 3-14-97
STATIC WATER: 11.5'
BORING ID: SB4-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE.CONDITION.COLOR.GRAINSIZE.ETC.)	PID (ppm)
0.0-6.0	///--*0//		C	CLAY. SILTY. SANDY. SOME LARGE COBBLES. BOULDER INFILL	0.0-20.0
	///--*0//		C	LARGE COBBLE (BOULDER) 4.5-6.0. BROWN	0
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//	5.0	C		
	///--*0//		C		
6.0	///--*0//		C		
6.0-9.5	*********		C	SAND. FINE. LIGHT BROWN. LOOSE. MOIST	
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
9.5	*********		C		
[illegible].5-17.0	***000***	10	S	SAND. GRAVELLY. DENSE. BROWN. MOIST. WATER BEARING AT 11.5 FEET	
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000	15	S		
	000		S		
	000		S	GLASS FRAGMENT. HIGHLY WEATHERED FOUND AT 16.0 FEET	
	000		S		
17.0	***000***		S		
17.0-20.0	=========		S	NACIMIENTO FORMATION	
	=========		S	SHALE. BLACK/GREY. MOIST. HARD. FISSLE. LITTLE TO NO SAND	
	=========		S		
	=========		S		
	=========		S		
	=========	20	S		
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5423.26
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 4.0'
BORING ID: SB5-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
0.0-11.5	*********		C	SAND, FINE, LOOSE, MOIST, BROWN	
	*********		C		
	*********		C		
	*********		C		
	*********		C		60
	*********		C		
	*********		C		
	*********		C	BLACK, WATER BEARING AT 4.0'	
	*********		C		603
	*********	5.0	C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********	10	C		
	*********		C	SOME SHEEN	1056
	*********		C		
11.5	*********		C		
11.5-13.5	***00****		C	SAND, MEDIUM GRAINED, SOME COBBLES, DENSE, FLOWS, BLACK	
	00*		C		
	00*		C		231
13.5	***00****		C		
13.5-15.0	***00****		C	SAND, MEDIUM, GRAVELLY, GREY (DARK), NO ODOR, LOOSE	
	00*		C		
15.0	***00****	15	C		0
15.0-17.5	=========		C	SHALE, GREY, HARD, DAMP, FISSLE, (APPEARS DRY), LITTLE SAND	
	=========		C		
	=========		C		
	=========		C		0
17.5	=========		C		
TOTAL DEPTH				NO SHEEN-ANY DEPTH	

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5422.69
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 4.67'
BORING ID: SB6-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
0.0-14.5	*********		C	SAND, FINE, DAMP, BROWN, MODERATELY DENSE, BLACK, FINE AND COARSE GRAVEL	
	*********		C		
	*********		C		0
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C	BLACK AT 4.0 FEET	
	*********	5.0	C	WATER BEARING AT 4.67 FEET-NO SHEEN (NO SEPARATE PHASE)	
	*********		C	GRAVELLY AT 5.0 FEET, GRAVEL UP TO 2 INCHES IN SIZE	981
	*********		C	LITTLE TO NO SILT	
	*********		C		
	*********		C		
	*********		C		
	*********		C		511
	*********		C		
	*********		C		970
	*********		C		
	*********	10	C		
	*********		C		13
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		50
	*********		C		
	*********		C		
14.5	*********		C		
14.5-17.5	SSSSSSSSS	15	C	NACIMIENTO FORMATION	
	SSSSSSSSS		C	SANDSTONE, FINE, GREY-BLUE, DENSE, MOIST-WET, NOT WATER BEARING, FRESH SAMPLE LOOKS	3
	SSSSSSSSS		C	DRY	
	SSSSSSSSS		C		
	SSSSSSSSS		C		0
17.5	SSSSSSSSS		C		
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING. INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5423.17
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 5.0'
BORING ID: SB7-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE.CONDITION.COLOR.GRAINSIZE.ETC.)	PID (ppm)
0.0-1.0	///000///		C	CLAY. GRAVELLY. DRY-DAMP. SOFT. BROWN. NO ODOR	0.0-17.5
1.0	///000///		C		0
1.0-5.0	*********		C	SAND. FINE. LOOSE. MOIST. BROWN. NO ODOR	
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
5.0	*********	5.0	C		
5.0-16.3	***000***		C	SLIGHTLY GRAVELLY GREATER THAN 4.0'	
	000		C	SAND. FINE-MEDIUM. WATER BEARING. GRAVELLY. LOOSE. BROWN. NO ODOR	
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000	10	C		
	000		C		
	000		C		
	000		C		
	000		C	BOULDER AT 11.5'-12.9'	
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000	15	C		
	000		C		
	000		C		
16.3	***000***		C		
16.3-17.5	=========		C	SHALE. GREY-BLUE. HARD. FISSLE. MOIST. APPEARS DRY	
17.5	=========		C		
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5421.52
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 4.0'
BORING ID: SB8-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0.0-4.5	**0000***		C	SAND, FINE, LOOSE, BROWN, VERY COBBLEY, MOIST	0.0-17.5
	0000*		C		0
	0000*		C		
	0000*		C		
	0000*		C		
	0000*		C		
	0000*		C		
	0000*		C		
4.5	**0000***		C		
4.5-9.0	***///***	5.0	C	SAND, CLAYEY, WATER BEARING, LIGHT GREY, VERY LOOSE, NO ODOR	
	///		C	WATER BEARING GREATER THAN 4.0 FEET	
	///		C		
	///		C		
	///		C		
	///		C		
	///		C		
	///		C		
9.0	***///***		C		
-13.5	***000***		C	SAND, COBBLEY, WATER BEARING, NO ODOR, MODERATELY DENSE, GREY-BROWN	
	000	10	C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
13.5	***000***		C		
13.5-16.5	***00****		C	SAND, FINE, SLIGHTLY GRAVELLY, WATER BEARING, GREY, NO ODOR	
	00*		C		
	00*	15	C		
	00*		C		
	00*		C		
16.5	***00****		C		
16.5-17.5	=========		C	NACIMIENTO FORMATION	
17.5	=========		C	SHALE, BLACK, FISSLE, DENSE, MOIST, NOT WATER BEARING	
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

ATTACHMENT 3

PRECISION ENGINEERING, INC.
P.O. BOX 422 • LAS CRUCES, NM 88004
Ph: (505) 523-7674
FAX: (505) 523-7248 • E-mail: werpei@aol.com

May 23, 1997

Mr. Lynn Shelton, CET
Environmental Manager
Giant Refining Company
Bloomfield Refinery
#50 County Road 4990
P.O. Box 159
Bloomfield, New Mexico 87413-0159

Re: Geologic Conditions at the Sandbar Site, Bloomfield Refinery

Dear Lynn,

Attached is our report on findings at the "Sandbar" site. The report contains our subsurface information and interpretation of the data obtained during the investigation. The information outlines the vertical and horizontal extent of the contamination identified at the Sandbar site.

As you are aware the interpretation of the extent of the impacted area is based on borings performed at the site, an evaluation of the surface geologic features, as well as previous drilling information provided by Giant Refining Company. If you have any questions concerning the information provided please contact our office.

Sincerely,
Precision Engineering, Inc.

William H. Kingsley

William H. Kingsley, P.E.

SUBSURFACE MODELING
GEOTECHNICAL INVESTIGATIONS
MATERIALS TESTING LABORATORY
ENVIRONMENTAL MONITORING SYSTEMS

Bloomfield Refinery Sandbar Area
File # 97-031

Introduction

In late November of 1996 an apparent hydrocarbon release was noted in an area of the refinery property locally termed as the "Sandbar". The hyrdocarbon was noted as a sheen on the San Juan River surface at a point where the river bends and flows adjacent to a bluff approximately eighty (80) to ninety (90) feet in height. The release was noted at the beginning of a low flow period for the river which was intended to assist in the propagation of certain fish species native to the river. Recovery operations were initiated and quickly controlled the release. It is the intent of this report to discuss the horizontal and vertical extent of the impacted area as it relates to the river area.

Site Geology

Generally, the refinery site is located on a bluff that has been developed as a result of the incision of the San Juan River into the Nacimiento Formation. There are three distinct stratigraphic units that underlay the refinery site. From oldest to youngest these units are: the Nacimiento Formation, the Jackson Lake Terrace, and an unnamed structureless loess unit composed of silts and fine sand that have been deposited as the result of eolian deposition during the last glacial retreat.

The uppermost loess deposit is essentially absent from the river terrace area above the sandbar site. Deflation caused by wind and precipitation erosion has all but eliminated the layer within approximately one hundred (100) feet of the bluff crest. Only a thin veneer of the deposit remains at isolated protected locations along the bluff crest.

The Jackson Lake Terrace is composed of well rounded cobble and boulder sized rocks placed as the result of high energy deposition during melting of the last glacial advance. The rock is often disk shaped as a result of grinding and polishing of slabby rock debris. The rock is predominantly comprised of metamorphic and intrusive volcanic fragments imported by the swollen San Juan River system. Because of the disk shaped nature of the materials, when confined the rock is very dense. The smooth, well rounded surfaces, however, cause the material to be relatively unstable when exposed and unconfined. As a result, most of the material eroded out of an exposed section of Jackson Lake Terrace accumulates at the toe of sloping faces. Substantial amounts of the rocky material litters the base of the eroded slopes of cuts through the Jackson Lake Terrace material. The terrace material caps the bluff throughout the sandbar area.

The Nacimiento Formation directly underlies the Jackson Lake Terrace material and is composed of a highly argillaceous, very fine, soft, sand or siltstone with interbeds of dense black shale. The clay-sandstone is massively bedded at the sandbar site and in the continuous cores and in outcrops shows little evidence of vertical jointing. Some outcrops show blocks separating from the main unit to form toppling blocks, however, continuous deep seated jointing is not observed.

The material that composes the sand bar area itself consists of relatively loose sands and cobbles deposited by the San Juan River. The lower two to three feet of this debris where near the face of the bluff is fine sand. The sand is placed in laminar layers and likely represents older flood plain deposits of the river. This sand represents the bulk of the affected material along the south edge of the sandbar.

In the past the river channel flowed along the bluff face at the sand bar location but was aggraded when the river was forced to the north by naturally occurring upstream channel changes. These changes pushed the point of contact between the river and the Nacimiento Formation to the west, forming the sandbar area.

All but twenty (20) to thirty (30) feet of the Nacimiento bluff is covered by talus debris. The talus consists mainly of sandy clays deposited as a result of the erosion of the cliff face. Some large blocks of the formation have toppled onto the talus slope and have been subsequently buried by additional soil. Occasional cobbles or boulders are encountered in the talus debris, but, because the slope is steep and the rock of the Jackson Lake Terrace is well rounded these materials tend to collect at the base of the talus pile.

Free water was encountered at all drilling locations, however, it varied in thickness substantially. The water encountered at the sandbar is essentially at the same elevation as the river. Observations in stand pipes placed in the sandbar area indicate fluctuation of the river level directly affects the depth of the groundwater in the sandbar area.

Free water on the bluff directly over looking the sandbar appears to be generated by the Hammond ditch and flows along the top of the Nacimiento Formation surface. Drilling along the bluff crest indicated that no free water was encountered below the Nacimiento Formation surface. The findings support earlier studies that indicate the Nacimiento is an aquitard.

The impacted area consists of a portion of the site extending from the Hammond ditch on the south to the San Juan River on the north. Ponds in the sandbar area used to provide water to the refinery facility also appear to be a northern boundary. Drilling north of the pond outline showed no affected material. The east extent of the affected area at the sand bar is a point approximately parallel to the east edge of the pump station. The west edge is essentially defined by the river edge as it sweeps southward and contacts the Nacimiento Formation outcrop at the bluff face. Hand excavations and hand augering showed no evidence of the impacted material west of the westerly most edge of the sand bar along the bluff face.

The thickness of the affected material varies from approximately three feet at the westerly edge of the sand bar to approximately nine feet of material in the central portion of the sandbar area. The upper surface of the affected material is typically within five feet of the existing ground surface at any location within the affected area. The lower boundary can be is defined by the top of the Nacimiento Formation. In the sandbar area the Nacimiento Formation is typically a black, dense, fissle shale. Hydrocarbon within the shale drops to nondetectable levels as measured using photoionization techniques within one to two feet of the shale surface. Samples of the shale show decreasing moisture content with depth and are nonwater bearing.

During the drilling no free product was identified during the drilling in the sandbar area.

Evaluation of the drill logs indicate that there is an incised area that cuts into the Nacimiento surface at the sand bar location. Water flowing over the top of the Nacimiento surface follows the dished out zone and migrates onto the flatter Nacimiento surface below, which represents the present day bed level of the river. The river apparently looped through what is now the raised sandbar surface cutting out the Nacimiento surface. The Nacimiento surface below the sandbar is slightly lower toward the south central portion of the sandbar than at the edges suggesting that the river scoured the Nacimiento surface somewhat as it flowed adjacent to the bluff at that location. This may account for some "pooling" of contaminants and hydraulic trapping during high flow periods.

Logs of the drilling, boring location diagrams, and cross sections used for the evaluation of the site are included as attachments. Information used for the interpretation of the site conditions was derived from our observations of drilling, previous drill logs, an evaluation of site outcrops, and a review of previous studies performed near the plant site.

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

Giant Refining Company

Case Narrative

On March 14, 1997, five soil samples were submitted to Inter-Mountain Laboratories - Farmington for analysis. The samples were received intact. Analysis for Benzene-Toluene-Ethylbenzene-Xylenes (BTEX); Total Petroleum Hydrocarbons (TPH) was performed on the samples as per the accompanying Chain of Custody # 43940.

BTEX analysis on the samples were performed by EPA Method 5030, Purge and Trap, and EPA Method 8020, Aromatic Volatile Hydrocarbons, using an OI Analytical 4560 Purge and Trap and a Hewlett-Packard 5890 Gas Chromatograph, equipped with a photoionization detector. Detectable levels of BTEX analytes were found in the samples as indicated in the enclosed reports.

TPH samples were extracted by Method 3550, "Ultrasonic Extraction of Non-Volatile and Semi-Volatile Organic Compounds from Solids", with 1,1,2-tricloro 1,2,2-trifluoroethane (Freon) as the extraction solvent. Analysis was by Method 418.1, "Total Recoverable Petroleum Hydrocarbons", using a Buck Scientific Infrared Spectrophotometer. Petroleum Hydrocarbons were detected in the samples as indicated in the enclosed reports.

It is the policy of this laboratory to employ, whenever possible, preparatory and analytical methods which have been approved by regulatory agencies. The methods used in the analyses of the samples reported herein are found in Test Methods for Evaluation of Solid Waste, SW-846, USEPA, 1986 and Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, USEPA, 1983.

Quality control reports appear at the end of the analytical package and may be identified by title. If there are questions regarding the information presented in this package, please feel free to contact me at your convenience.

Sincerely,
Sharon Williams

Sharon Williams/Organics Analyst

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

TOTAL PETROLEUM HYDROCARBONS
EPA METHOD 418.1

Client:	**Giant Refining Company**	Date Reported:	03/19/97
Project:	Bloomfield Refinery	Date Sampled:	03/11/97
Matrix:	soil	Date Received:	03/14/97
Condition:	Intact/Cool	Date Extracted:	03/19/97
		Date Analyzed:	03/19/97

Sample ID	Lab ID	Result mg/kg	Detection Limit mg/kg
MW-41	0397G00373	1,900	20.0
SB1-397-10.5	0397G00374	317	20.0
SB2-397-6.0	0397G00375	1,400	19.8
SB2-397-10.0	0397G00376	2,520	19.8
SB2-397-25.0	0397G00377	1,390	19.8

ND - Analyte not detected at stated detection level.

Method 418.1: Petroleum Hydrocarbons, Total Recoverable, USEPA Chemical Analysis of Water and Waste, 1978.

Method 3550: Ultrasonic Extraction of Non-Volatile and Semi-Volatile Organic Compounds from Solids, USEPA SW-846, Rev. 1, July 1992.

Analyst:

Reviewed:

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS

Giant Refining Company

Project ID:	Bloomfield Refinery	Report Date:	03/19/97
Sample ID:	MW-41	Date Sampled:	03/11/97
Lab ID:	0397G00373	Date Received:	03/14/97
Sample Matrix:	soil	Date Extracted:	NA
Condition:	Cool/Intact	Date Analyzed:	03/18/97

Target Analyte	Concentration (ppb)	Detection Limit (ppm)
Benzene	875	1.0
Toluene	13,000	1.0
Ethylbenzene	11,100	1.0
m,p-Xylenes	40,600	1.0
o-Xylene	20,200	1.0

ND - Analyte not detected at the stated detection limit.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	166%	70%-130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments:

alyst

Review

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS

Giant Refining Company

Project ID:	Bloomfield Refinery	Report Date:	03/19/97
Sample ID:	SB1-397-10.5	Date Sampled:	03/13/97
Lab ID:	0397G00374	Date Received:	03/14/97
Sample Matrix:	soil	Date Extracted:	NA
Condition:	Cool/Intact	Date Analyzed:	03/18/97

Target Analyte	Concentration (ppb)	Detection Limit (ppb)
Benzene	ND	19.9
Toluene	72.0	19.9
Ethylbenzene	83.7	19.9
m,p-Xylenes	139	19.9
o-Xylene	324	19.9

ND - Analyte not detected at the stated detection limit.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	188%	70%-130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments:

lyst

Review

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS

Giant Refining Company

Project ID:	Bloomfield Refinery	Report Date:	03/19/97
Sample ID:	SB2-397-6.0	Date Sampled:	03/13/97
Lab ID:	0397G00375	Date Received:	03/14/97
Sample Matrix:	soil	Date Extracted:	NA
Condition:	Cool/Intact	Date Analyzed:	03/18/97

Target Analyte	Concentration (ppb)	Detection Limit (ppb)
Benzene	ND	199.4
Toluene	392	199.4
Ethylbenzene	3,090	199.4
m,p-Xylenes	10,400	199.4
o-Xylene	948	199.4

ND - Analyte not detected at the stated detection limit.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	143%*	70%-130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments: *Surrogate did not recover due to matrix interferences.

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Review

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS

Giant Refining Company

Project ID:	Bloomfield Refinery	Report Date:	03/19/97
Sample ID:	SB2-397-10.0	Date Sampled:	03/13/97
Lab ID:	0397G00376	Date Received:	03/14/97
Sample Matrix:	soil	Date Extracted:	NA
Condition:	Cool/Intact	Date Analyzed:	03/18/97

Target Analyte	Concentration (ppb)	Detection Limit (ppm)
Benzene	270	1.0
Toluene	2,050	1.0
Ethylbenzene	17,900	1.0
m,p-Xylenes	103,500	1.0
o-Xylene	2,140	1.0

ND - Analyte not detected at the stated detection limit.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	144%*	70%-130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments: *Surrogate did not recover due to matrix interferences.

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Review

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS

Giant Refining Company

Project ID:	Bloomfield Refinery	Report Date:	03/19/97
Sample ID:	SB2-397-25.0	Date Sampled:	03/13/97
Lab ID:	0397G00377	Date Received:	03/14/97
Sample Matrix:	soil	Date Extracted:	NA
Condition:	Cool/Intact	Date Analyzed:	03/18/97

Target Analyte	Concentration (ppb)	Detection Limit (ppb)
Benzene	777	199.6
Toluene	3,610	199.6
Ethylbenzene	ND	199.6
m,p-Xylenes	37,200	199.6
o-Xylene	5,900	199.6

ND - Analyte not detected at the stated detection limit.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	135%*	70%-130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments: *Surrogate did not recover due to matrix interferences.

alyst

Review

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS
QUALITY CONTROL REPORT

Duplicate Analysis

Lab ID: 0397G00373
Sample Matrix: soil
Condition: Cool/Intact

Report Date: 03/19/97
Date Analyzed: 03/18/97

Target Analyte	Duplicate Concentration (ppb)	Original Concentration (ppb)	% Difference
Benzene	792	875	10.0
Toluene	13,600	13,000	4.5
Ethylbenzene	10,500	11,100	5.6
m,p-Xylenes	38,800	40,600	4.5
o-Xylene	21,200	20,200	4.8

ND - Analyte not detected at the stated detection limit.
NA - Not applicable or not calculated.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	154%*	70 -130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments: *Surrogate did not recover due to matrix interferences.

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Review

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS
QUALITY CONTROL REPORT

Matrix Spike Analysis

Lab ID: 0397G00373
Sample Matrix: soil
Condition: Cool/Intact

Report Date: 03/19/97
Date Analyzed: 03/18/97

Target Analyte	Spiked Sample Result in ng	Sample result in ng	Spike Added (ng)	% Recovery	Acceptance Limits (%)
Benzene	19.43	0.31	20.0	96%	70-130
Toluene	19.29	0.09	20.0	96%	70-130
Ethylbenzene	20.37	0.07	20.0	102%	70-130
m,p-Xylenes	39.37	0.31	40.0	98%	70-130
o-Xylene	19.60	0.00	20.0	98%	70-130

ND - Analyte not detected at the stated detection limit.
NA - Not applicable or not calculated.

Quality Control:

Surrogate	Percent Recovery	Acceptance Limits
Bromofluorobenzene	122%	70 -130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments:

alyst

Review

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

VOLATILE AROMATIC HYDROCARBONS
QUALITY CONTROL REPORT

Method Blank Analysis

Sample Matrix:	Extract	Report Date:	03/19/97
Lab ID:	MB	Date Analyzed:	03/18/97

Target Analyte	Concentration (ppb)	Detection Limit (ppb)
Benzene	ND	10.0
Toluene	ND	10.0
Ethylbenzene	ND	10.0
m,p-Xylenes	ND	10.0
o-Xylene	ND	10.0

ND - Analyte not detected at the stated detection limit.

Quality Control:	Surrogate	Percent Recovery	Acceptance Limits
	Bromofluorobenzene	88%	70-130%

Reference: Method 5030, Purge and Trap; Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments:

nalyst

Review

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

Quality Control / Quality Assurance

Known Analysis

BTEX

Client:	**Giant Refining Company**	Date Reported:	03/19/97
Project:	Bloomfield Refinery	Date Analyzed:	03/18/97

Known Analysis

Parameter	Found Concentration (ppb)	Known Concentration (ppb)	Percent Recovery	Acceptance Limits
Benzene	4.9	4.0	123%	70-130%
Toluene	4.3	4.0	107%	70-130%
Ethylbenzene	4.4	4.0	110%	70-130%
m+p-Xylene	9.5	8.0	119%	70-130%
o-Xylene	4.5	4.0	111%	70-130%

Quality Control:

Surrogate	Percent Recovery	Acceptance Limits
Bromofluorobenzene	88%	75-125%

Reference: Method 5030, Purge and Trap: Method 8020, Aromatic Volatile Organics; Test Methods for Evaluating Solid Wastes, SW-846, United States Environmental Protection Agency, September 1986.

Comments:

Analyst

Reviewed by

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

TOTAL PETROLEUM HYDROCARBONS
Quality Assurance/Quality Control

Client:	**Giant Refining Company**	Date Reported:	03/19/97
Project:	Bloomfield Refinery	Date Sampled:	03/11/97
Matrix:	soil	Date Received:	03/14/97
Condition:	Intact/Cool	Date Extracted:	03/19/97
		Date Analyzed:	03/19/97

Duplicate Analysis

Lab ID	Sample Result	Duplicate Result	Units	% Difference
0397G00373	1895	1846	mg/Kg	2.6%

Method Blank Analysis

Lab ID	Result	Units	Detection Limit
Method Blank	ND	mg/Kg	20

Spike Analysis

Lab ID	Found Conc.	Sample Conc.	Spike Amount	Percent Recovery	Acceptance Limits
MB	1,071	ND	1,050	102%	70-130%

Known Analysis

Lab ID	Found Conc. mg/Kg	Known Conc. mg/Kg	Percent Recovery	Acceptance Limits
QC	24.7	25.2	98%	70-130%

Method 418.1: Petroleum Hydrocarbons, Total Recoverable, USEPA Chemical Analysis of Water and Waste, 1978.

Method 3550: Ultrasonic Extraction of Non-Volatile and Semi-Volatile Organic Compounds from Solids, USEPA SW-846, Rev. 1, July 1992.

Analyst: __________

Reviewed: __________

Soil Sample Analytical Results - 3/11/97 (Precision Engineering)

Parameter	Units	MW-41	SB1-397-10.5	SB2-397-6.0	SB2-397-10.0	SB2-397-25
Benzene	ppb	875	ND	ND	270	777
Toluene	ppb	13000	72	392	2050	3610
Ethylbenzene	ppb	11100	83.7	3090	17900	ND
m,p-Xylenes	ppb	40600	139	10400	103500	97200
o-Xylene	ppb	20200	324	948	2140	5900
TPH	mg/kg	1900	317	1400	2520	1390

Soil Samples - 8/28/98 (Hicks-Hand Auger)

Parameter	Units	HA1 4FT (SHB 1)	HA2 7FT (SHB 4)	HA2 4FT (SHB-4)
Benzene	mg/kg	0.074	0.052	
Ethylbenzene	mg/kg	0.089	0.2	59
m,p-Xylene	mg/kg	0.26	0.68	410
o-Xylene	mg/kg	0.15	0.24	150
Toluene	mg/kg	0.16	0.17	18

Soil Samples - 9/98 (Hicks-Soil Borings)

Parameter	Units	SHB2 5' (MW-43)	SHB2 13' (MW-43)	SHB1 12.8	SHB1 5	SHB1 9
Benzene	mg/kg	0.71		0.5		
Ethylbenzene	mg/kg	1.9		3.3	38	3.4
m,p-Xylene	mg/kg	9.2	0.011	14	200	16
o-Xylene	mg/kg	3		3.8	42	3.9
Toluene	mg/kg	1.8		2.4	21	2.1

Parameter	Units	SHB4 18'	SHB3 7.5	SHB3 11	SHB3 20
Benzene	mg/kg	27	0.5	0.22	0.09
Ethylbenzene	mg/kg	27			0.051
m,p-Xylene	mg/kg				
o-Xylene	mg/kg				
Toluene	mg/kg	29	0.28	0.18	0.1

3.1.3

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED stated: Soil samples obtained from beneath the aeration lagoon liners in 1985 were likely composite samples therefore a lack of significant volatile organic compound (VOC) detections is not unexpected. TPH and VOCs were detected during drilling investigations conducted within the process areas; however, no site plan is provided showing the boring locations relative to facility features including the aeration lagoons. Provide a site plan presenting facility features and boring locations. In addition, Boring SHB-2 is not shown on Plate 10 (boring locations). Please add Boring SHB-2 to Plate 10.

Response

This attachment includes a section of a report that gives the locations of the borings below the North and South API ponds (referred to as the "aeration lagoon" above) from the 1985 BRC Part B Application. The CMS section that refers to the sampling event is included as well. A map of boring locations and table presenting related information is attached at the end of this section. In addition, this information has been transferred to the site plan provided in Attachment 1, which includes the ponds and the boring locations in the ponds.

From 1985 Part B

handle such material as hazardous waste. BRC shall also comply with 40 CFR 262.11 and the equivalent New Mexico regulations at HWMR-2, and other requirements when and where applicable.

API Wastewater Ponds

Although all visible contaminated soil was removed from the API wastewater ponds when the pond liners were installed, EPA and NMEID expressed concern that some residual contamination remained. Therefore, the subsurface soils beneath the pond liners were tested for residual contamination during the week of October 14, 1985, after the removal of all hazardous waste from the ponds. Appendix A includes a closure certification by the sampler, a registered professional engineer. These materials were handled as hazardous wastes.

A total of 12 samples were collected by penetrating the liner at six approximately equally spaced locations in each pond and collecting two samples in each location with a clean split-spoon sampler. Sampling site locations are shown on Figures 2 and 3. The pond liner was penetrated for sampling purposes by cutting a clean hole of sufficient size to admit the split-spoon sampler. Following the collection of samples, the liner was repaired with a high-density polyethylene patch, joined to the existing liner with a hot (approximately 460°F) polyethylene resin weld. The sampling and liner repair was not conducted under wet conditions or inclement weather which could affect the integrity of the analytical results or weld. Each split-spoon sampler was cleaned prior to sampling with a detergent wash, followed by a distilled water rinse, acetone wash, and final distilled water rinse. The two samples in each location were collected at depths of 0-6 inches and 6-12 inches, respectively. Three samples were composited at each depth from pairs of the closest adjacent grab samples. The six total composite samples in each pond (three at each depth) were analyzed for the indicator parameters benzene, toluene, xylene, phenols, total lead, and total chromium. The analytical results for these parameters are included in Appendix B. Although small concentrations of xylenes were detected in a single composite sample in the south API pond, none of these data indicate significant residual BTX or phenolic contamination beneath the pond liners.

FIGURE 2
NORTH API POND

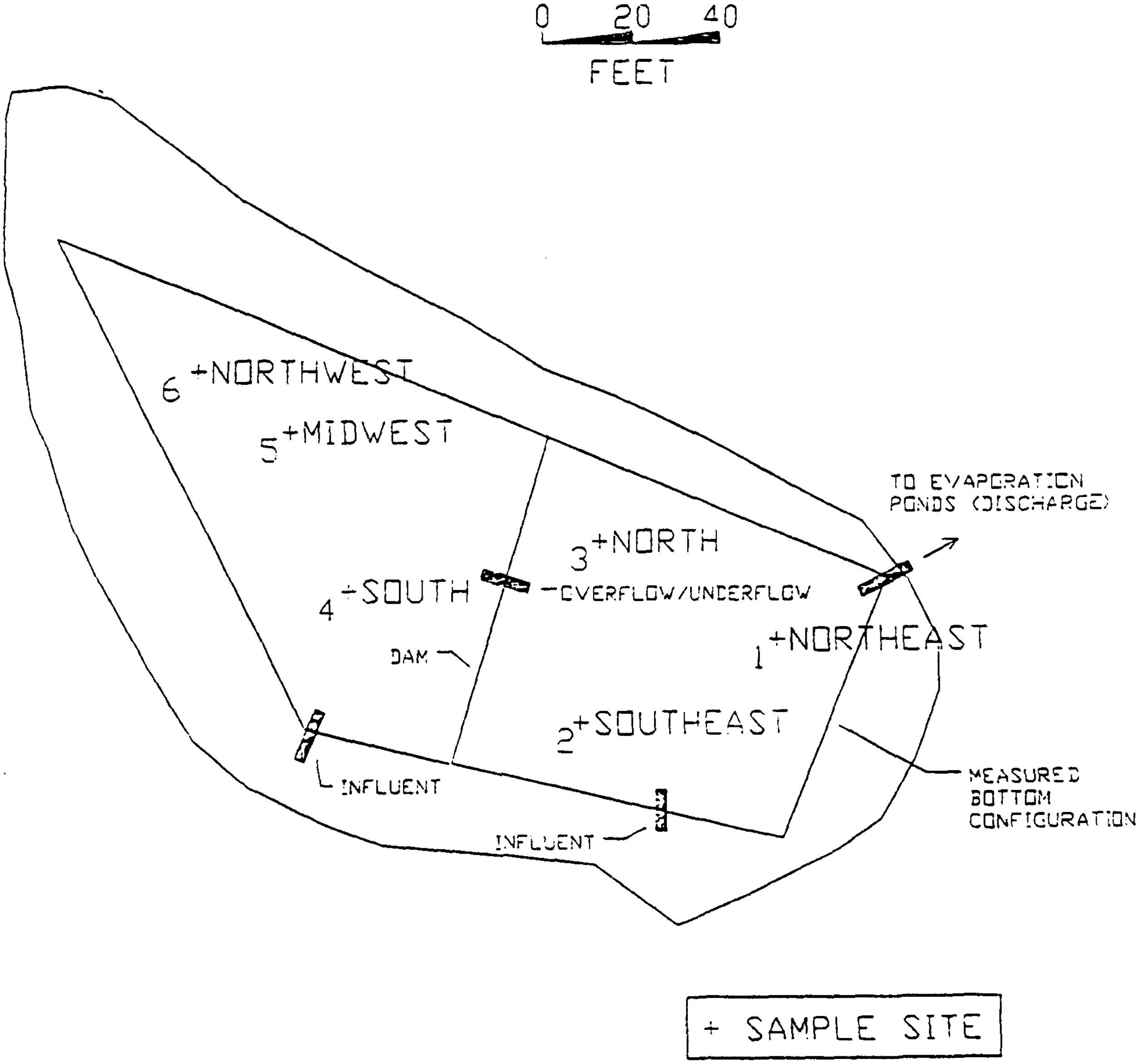
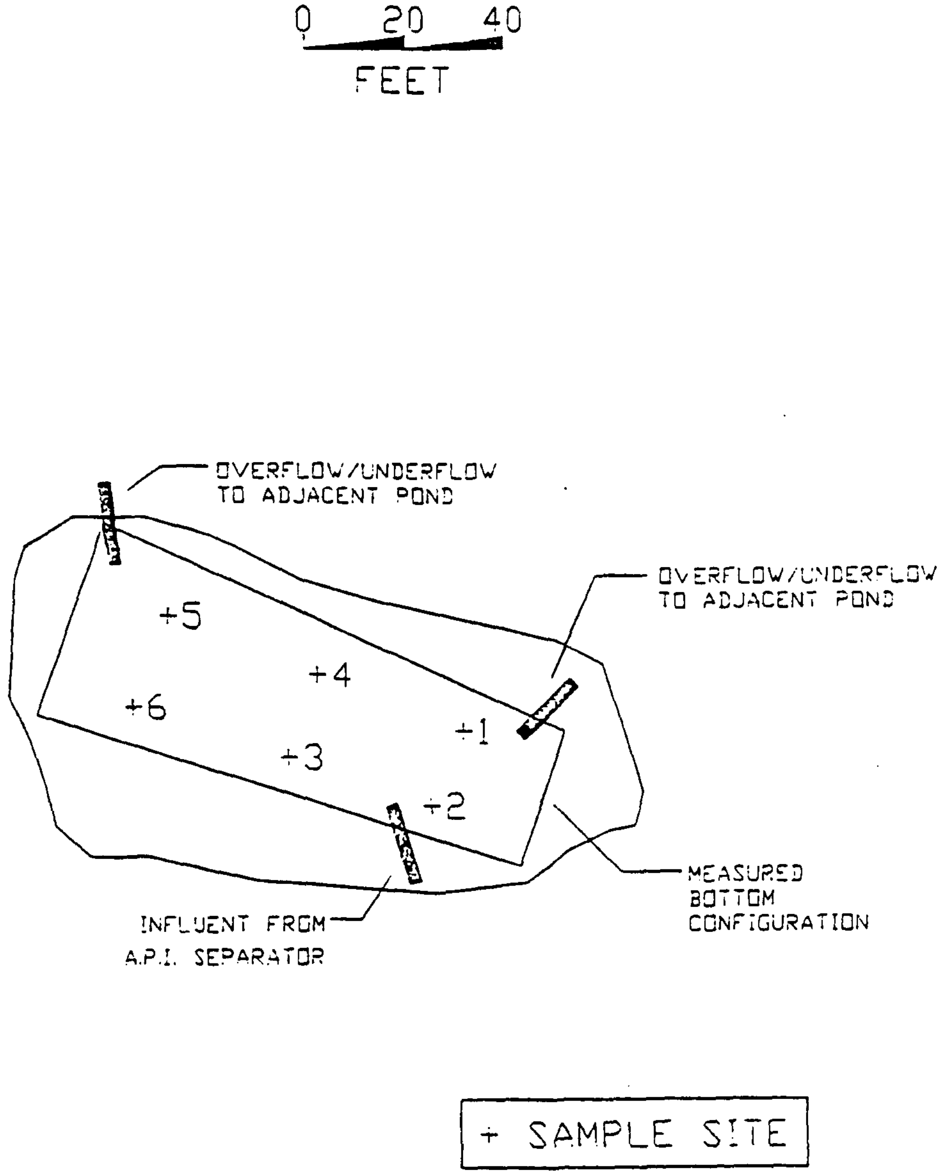


FIGURE 3
SOUTH API POND



In the south API wastewater pond, a single grab sample collected in the top 6 inches near the influent end of the pond was analyzed for the "Skinner List" of compounds expected to be present in petroleum refinery wastes. This list and the analytical methods being used are presented in Table 1. None of the "Skinner List" constituents were present at detectable concentrations in this sample.

The analytical data presented in Appendix B indicates no appreciable residual contamination in the top 12 inches immediately beneath the ponds. Based on this finding, and the removal of material from the ponds as documented in Appendix A, closure of the API wastewater ponds should be deemed complete.

From 1985 BRC Part B

CMS

3.1.3. Samples Near Waste Management Units and Spill Sites

In October 1985, Engineering Science collected 13 soil samples from beneath the synthetic liners of the aeration lagoons (former SOWP and NOWP) (see Table 11). Most of them were composite samples from several locations. Only one of these samples detected VOCs, registering 0.0074 mg/kg of xylene. Chromium and lead analyses from the samples also showed concentrations well below soil screening action level that would classify this material as RCRA hazardous waste.

During the October 1985 field program, Engineering Science also collected soil samples from the landfill (e.g., Quadrant #1 Landfill, Table 11). This material is the visually stained soil that was under the sludge removed from the former NOWP and SOWP prior to conversion to the aeration lagoons. The previous refinery owners removed the sludge from the former NOWP and SOWP and shipped the sludge to a TSD facility for proper disposal.

In 1994, GTI collected 11 samples from 10 borings at or adjacent to potential source areas identified by the EPA during the 1987 inspection and in potential or suspected spill areas. Although neither semivolatile organic compounds (SVOCs) nor TPH were detected, two samples measured total benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations below 0.1 mg/kg, and a third sample detected methylene chloride, a common laboratory contaminant, at 0.11 mg/kg (see Table 10). Results for inorganic parameters, such as lead, showed no pattern with respect to location or concentrations that would classify this material as being a RCRA hazardous waste.

Refinery personnel also collected a soil sample during the installation of MW-41, located due south of the Refinery processing area. It is believed that this sample was obtained within a sand zone at the base of the Jackson Lake Terrace. The sample shows a benzene concentration of 875 parts per billion (ppb) (see Table 10). Other VOCs exceeded 10,000 ppb; TPH was 1,900 mg/kg.

Hicks Consultants collected three soil samples within Refinery boundaries: one adjacent to the southerly aeration lagoon (the former SOWP), one between the flare and Tanks 2 and 3, and one at the location of former Tanks 6 and 7. Because standard soil sampling techniques have not been successful in sampling the Jackson Lake Terrace cobbles, all of the samples were obtained from the aeolian unit that is situated above the Jackson Lake Terrace. Black-stained soil was collected near Tanks 3 and 4 and at the location of former Tanks 6 and 7. Analyses of both soil samples detected p-xylene and m-xylene at concentrations above 200 mg/kg (see Table 10). Neither chromium nor lead was detected.

3.2. Groundwater Chemistry

A table of New Mexico and the EPA groundwater standards are presented in Appendix D.

3.2.1. Separate-Phase Hydrocarbon Distribution

Historical evidence suggests that, during the 1980s, SPH periodically entered Hammond Ditch and also discharged to the seeps along the Nacimiento Formation cliff. Along the cliff, the sand and gravel of the Jackson Lake Terrace is stained with hydrocarbons. This staining provides evidence of historic SPH flow near the cliff.

GCL data from 1988 suggest that SPH was present on the south border of the Refinery; however, this report did not discuss SPH distribution throughout the remainder of the Refinery. This report notes that GCL installed the first three recovery wells in 1988. There are no data related to SPH in monitor wells prior to a 1993 GTI report (*RCRA Facility Investigation, Task 1: Description of Current Conditions*). According to the 1993 GTI report, Refinery staff completed an expansion and upgrade of the hydrocarbon recovery system in 1991. Well logs document the installation of RW-14 through RW-19 in August 1990.

Giant Refining Company
Bloomfield Refinery
Boring Locations

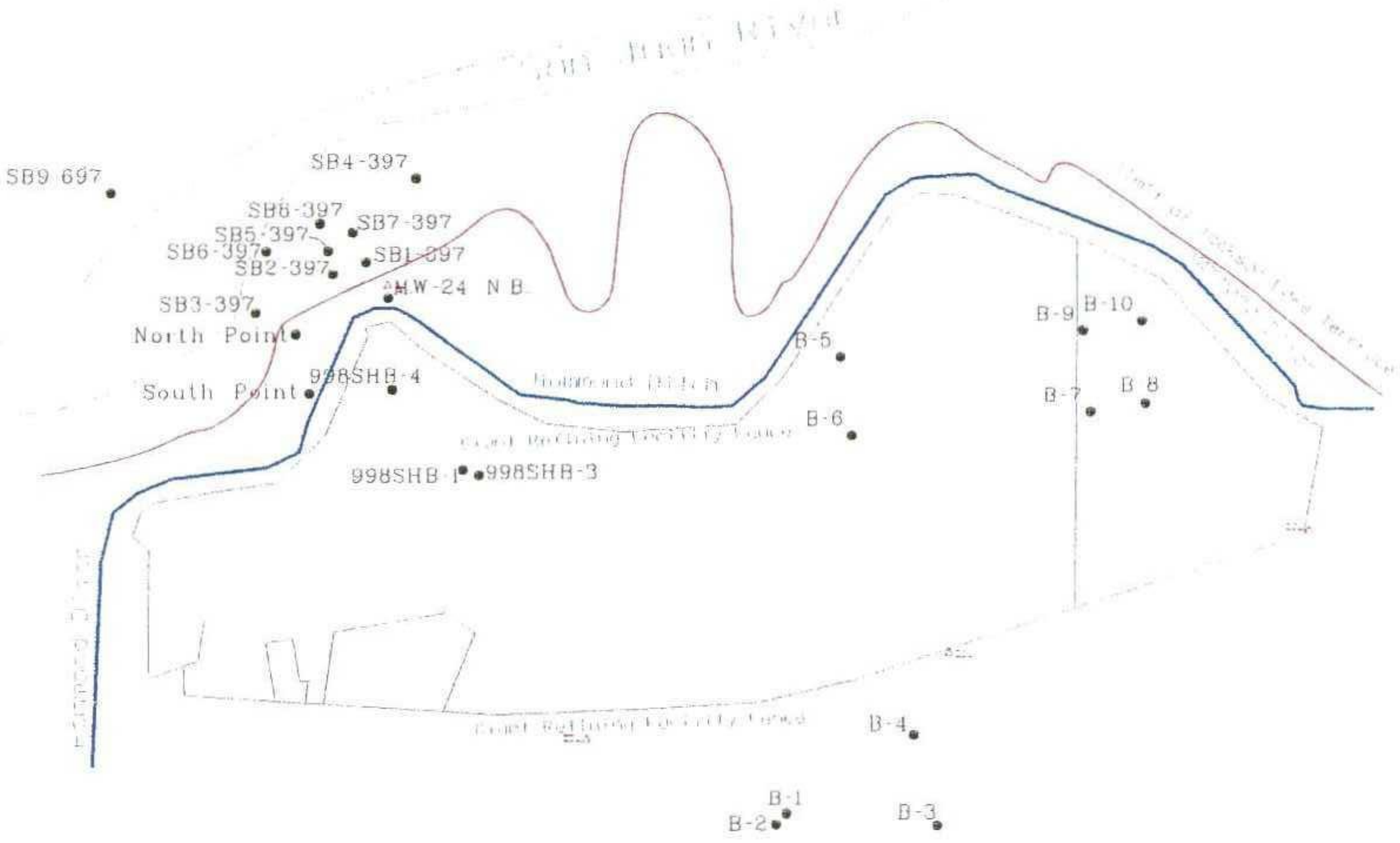


Table 1
Measured Hydraulic Conductivity

Measured K Values		Location	Source	Method
ft/sec	m/sec			
1.65 E-4	5.03 E-5	MW-1	Engineering-Science (1987)	Slug Tests
3.30 E-4	1.00 E-4	MW-2 (near MW-29)		
1.29 E-4	3.84 E-5	MW-4		
2.23 E-4	6.80 E-5	MW-10 (RW-3)	Geoscience Consultants (3/88)	Pumping Test 1
1.95 E-4	5.94 E-5	MW-10 (RW-3)		Pumping Test 2
4.49 E-5	1.36 E-5	MW-10 (RW-3)		Recovery Test 1
6.25 E-5	1.91 E-5	MW-10 (RW-3)		Recovery Test 2`
2.34 E-5	7.13 E-6	MW-11		Recovery
2.04 E-3	6.22 E-4	MP-3 (near RW-19)	Groundwater Technology (7/94)	Pumping Test RW-19
1.83 E-3	5.58 E-4	MP-4 (near RW-19)		Pumping Test RW-19
5.09 E-4	1.55 E-4	RW-22		Pumping Test RW-22

Table 2
Groundwater Sampling Event, September 2000

Method	SW-846 5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	RSK 147	EPA 300.0	EPA 300.0	EPA 4.1.1/ 200.71 CP
Liquid Reporting Limit (μg/L)[a]	**5**	**750**	**700**	**620[b]**	**620[b]**	**30[c]**	**100**	**600,000**	**10,000**	**1,000**
Location	**Benzene**	**Toluene**	**Ethylbenzene**	**o-Xylene**	**mp-Xylenes**	**Napthalene**	**Methane**	**Sulfate**	**Nitrate**	**Iron**
SEEP #1	1600	ND	720	ND	97	360	—	—	—	—
SEEP #4	ND	ND	ND	ND	ND	ND	—	—	—	—
SEEP #5	ND	ND	ND	ND	24	11	—	—	—	—
MW-1	ND	ND	ND	ND	ND	ND	—	130	1.4	—
MW-3	ND	ND	ND	ND	ND	ND	—	980	41	—
MW-4	9100	ND	850	ND	ND	ND	—	ND	ND	—
MW-8	ND	ND	ND	ND	ND	ND	ND	830	12	0.07
MW-9	15000	260	940	340	4400	510	—	13.6	ND	—
MW-11	250	ND	15	ND	160	ND	3.7	46	ND	15.3
MW-12	10	ND	2.3	ND	31	2.0	—	2100	ND	—
MW-26	4600	ND	1000	ND	4300	170	—	1.0	ND	—
MW-27	18	ND	9.9	ND	64	50	—	49	ND	—
MW-34	140	ND	17	ND	85	47	3.9	55	ND	5.72
MW-35	21	ND	4.6	ND	100	9.5	ND	120	ND	2.77
MW-36	7.7	ND	15	ND	150	15	—	90	ND	—
RW-1	180	ND	18	ND	25	38	—	346	ND	—
RW-15	7600	14000	3300	4600	14000	890	0.79	2.26	ND	3.42

a Based on EPA Region 6 Human Health Medium-Specific Screening Levels (2001) and NM WQCC Regulations (1999). Analytical detection limits are required to be lower than reporting limits.

b Regulatory limits for individual isomers combined into a "total" limit for these compounds.

c Total naphthalene plus monomethylnaphthalenes regulatory limit is <30 μg/L for aqueous samples.

Table 3
Groundwater Sample Event, April 1999
Modified Skinner List SW-846 Method 8260, Volatile Organics[b]

Liquid Reporting Limit (µg/L)	1.5	610	5.0	4.3	6.1	5	100	1900	1000	0.16	5	60	5	60	750	39	5	39	750	10,000	10,000	100	0.055	
Location	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone (MEK)	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene [a]	m&p-Xylenes [a]	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
SEEP #1	—	—	—	—	—	—	—	—	—	—	—	—	800.00	—	—	—	—	—	1400.00	—	1100.00	—	—	—
SEEP #4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.00	—	—	—	1.50	—	8.90	—	—	—
SEEP #5	—	—	—	—	—	—	—	—	—	—	—	—	56.00	—	—	—	—	—	10.00	—	330.00	—	—	—
MW-1	—	—	—	—	—	—	—	—	—	—	—	—	2.80	—	—	—	—	—	2.50	—	30.00	—	—	—
MW-3	—	—	—	—	—	—	—	—	—	—	—	—	4.70	—	—	—	—	—	4.70	—	29.00	—	—	—
MW-4	—	—	—	—	—	—	—	—	—	—	160.00	—	8900.00	—	—	—	—	—	600.00	—	330.00	—	—	—
MW-8	—	—	—	—	—	—	—	—	—	—	—	—	1.60	—	—	—	—	—	2.00	—	23.00	—	—	—
MW-9	—	—	—	—	—	—	—	—	—	—	330.00	—	18000.00	—	690.00	—	—	—	1000.00	510.00	6300.00	—	—	—
MW-11	—	—	—	—	—	—	—	—	—	—	—	—	2700.00	—	—	—	—	—	330.00	—	8900.00	—	—	—
MW-12	—	—	—	—	—	—	—	—	—	—	—	—	23.00	—	—	—	—	—	5.00	—	130.00	—	—	—
MW-26	—	—	—	—	—	—	—	—	—	—	77.00	—	4200.00	—	—	—	—	—	800.00	—	7900.00	—	—	—
MW-27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	28.00	—	—	—
MW-34	—	30.00	—	—	—	—	—	—	—	—	—	—	110.00	—	—	—	—	—	6.20	—	80.00	—	—	—
MW-35	—	—	—	—	—	—	—	—	—	—	—	—	5.50	—	—	—	—	—	—	—	59.00	—	—	—
MW-36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	54.00	—	—	—
RW-1	—	—	—	—	—	—	—	—	—	—	21.00	—	1000.00	—	260.00	—	—	—	130.00	87.00	430.00	—	—	—
RW-15	—	—	—	—	—	—	—	—	—	—	—	—	14000.00	—	25000.00	—	—	—	6900.00	9400.00	36000.00	—	—	—

NOTES: [a] Regulatory limits for individual isomers combined into a "total" limit for these compounds.

– Not detected above Reporting Limit

[b] Analytical results for other analytes and sampling locations can be found in Discharge Plan Application. Site Investigation and Abatement Plan - Giant Bloomfield Refinery (R. T. Hicks Consultants, Ltd., 1999)

Reporting Limit varies with sample % moisture.

Reporting Limit for aqueous samples was 1.0 µg/L for all analytes except 1,4 Dioxane (100 µg/L) and Acetone and 2-Butanone (10 µg/L).

3.2.2

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED stated: "The text and Table 6 reference 1999 groundwater sampling" and requested that BRC provide the results of all monitoring and sampling conducted since 1999. Submit copies of all groundwater monitoring reports generated since 1999 to NMED.

Response

This attachment contains copies of lab analysis for years 1999, 2000, 2001, and 2002 to-date. The reports are arranged chronologically from 1999 to 2002.

Groundwater Monitoring Analytical Reports

1999

ASSAIGAI
ANALYTICAL
LABORATORIES, INC.
7300 Jefferson, NE • Albuquerque, New Mexico 87109 • (505) 345-8964 • FAX (505) 345-7259
3332 Wedgewood Dr., Suite N • El Paso, Texas 79925 • (915) 593-6000 • FAX (915) 593-7820
127 Eastgate Drive, 212-C • Los Alamos, New Mexico 87544 • (505) 662-2558

Explanation of codes

B	analyte detected in Method Blank
E	result is estimated
H	analyzed out of hold time
N	tentatively identified compound
S	subcontracted
1-9	see footnote

GIANT REFINING-BLOOMFIELD
attn: **LYNN SHELTON**
PO BOX 159
BLOOMFIELD, NM 87413

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: **GIANT REFINING-BLOOMFIELD**
Project: **9910244** **BLOOMFIELD GIANT REF.**

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Client Sample ID ***MW-26*** Sample Matrix ***GW*** Sample Collected ***10/22/99 09:50:00***

[illegible]roup	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-01A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99352	XG.1999.922-17	71-43-2	Benzene	4000	ug / L	100	1		10/28/99
X99352	XG.1999.922-9	100-41-4	Ethylbenzene	860	ug / L	10	1		10/27/99
X99352	XG.1999.922-9		Naphthalene	200	ug / L	10	5		10/27/99
X99352	XG.1999.922-9	95-47-6	o-Xylene	ND	ug / L	10	1		10/27/99
X99352	XG.1999.922-17		p/m Xylenes	6000	ug / L	100	2		10/28/99
X99352	XG.1999.922-9	108-88-3	Toluene	ND	ug / L	10	1		10/27/99
9910244-01B		**EPA 300.0**							
W99253	MW.1999.1312-28		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

Client Sample ID ***MW-27*** Sample Matrix ***GW*** Sample Collected ***10/22/99 10:30:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-02A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99352	XG.1999.922-10	71-43-2	Benzene	56	ug / L	5	1		10/27/99
X99352	XG.1999.922-10	100-41-4	Ethylbenzene	48	ug / L	5	1		10/27/99
X99352	XG.1999.922-10		Naphthalene	ND	ug / L	5	5		10/27/99
X99352	XG.1999.922-10	95-47-6	o-Xylene	ND	ug / L	5	1		10/27/99
[illegible]2	XG.1999.922-10		p/m Xylenes	440	ug / L	5	2		10/27/99
[illegible]2	XG.1999.922-10	108-88-3	Toluene	ND	ug / L	5	1		10/27/99

Assaigal Analytical Laboratories, Inc.

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ient: **GIANT REFINING-BLOOMFIELD**
roject: **9910244** **BLOOMFIELD GIANT REF.**

9910244-02B		**EPA 300.0**							
W99253	MW.1999.1312-30		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

Client Sample ID ***MW-36*** Sample Matrix ***GW*** Sample Collected ***10/21/9*** ***14:55:0***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-03A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99352	XG.1999.922-8	71-43-2	Benzene	ND	ug / L	1	1		10/27/99
X99352	XG.1999.922-8	100-41-4	Ethylbenzene	4.7	ug / L	1	1		10/27/99
X99352	XG.1999.922-8		Naphthalene	9.1	ug / L	1	5		10/27/99
X99352	XG.1999.922-8	95-47-6	o-Xylene	ND	ug / L	1	1		10/27/99
X99352	XG.1999.922-8		p/m Xylenes	75	ug / L	1	2		10/27/99
X99352	XG.1999.922-8	108-88-3	Toluene	ND	ug / L	1	1		10/27/99
9910244-03B		**EPA 300.0**							
W99253	MW.1999.1312-33		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

it :ple ID ***RW-1*** Sample Matrix ***GW*** Sample Collected ***10/22/99*** ***13:40:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-04A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99352	XG.1999.922-11	71-43-2	Benzene	540	ug / L	5	1		10/27/99
X99352	XG.1999.922-5	100-41-4	Ethylbenzene	71	ug / L	1	1		10/27/99
X99352	XG.1999.922-11		Naphthalene	33	ug / L	5	5		10/27/99
X99352	XG.1999.922-5	95-47-6	o-Xylene	1.1	ug / L	1	1		10/27/99
X99352	XG.1999.922-5		p/m Xylenes	110	ug / L	1	2		10/27/99
X99352	XG.1999.922-5	108-88-3	Toluene	ND	ug / L	1	1		10/27/99
9910244-04B		**EPA 300.0**							
W99253	MW.1999.1312-35		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

Client Sample ID ***RW-15*** Sample Matrix ***GW*** Sample Collected ***10/21/99*** ***12:40:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-05A		**EPA 4.1.3/200.7 ICP**							
M991262	MW.1999.1304-92	7439-89-6	Iron	23.8	mg / L	1	0.05		11/04/99

[illegible]ient: **GIANT REFINING-BLOOMFIELD**
[illegible]roject: **9910244 BLOOMFIELD GIANT REF.**

9910244-05A		SW846 8260A Purgeable VOCs by GC/MS							
X99352	XG.1999.922-12	71-43-2	Benzene	7400	ug / L	50	1		10/27/99
X99352	XG.1999.922-12	100-41-4	Ethylbenzene	2700	ug / L	50	1		10/27/99
X99352	XG.1999.922-12		Naphthalene	590	ug / L	50	5		10/27/99
X99352	XG.1999.922-12	95-47-6	o-Xylene	4100	ug / L	50	1		10/27/99
X99352	XG.1999.922-12		p/m Xylenes	13000	ug / L	50	2		10/27/99
X99352	XG.1999.922-12	108-88-3	Toluene	9200	ug / L	50	1		10/27/99
9910244-05B		EPA 300.0							
W99253	MW.1999.1312-37		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

Client Sample ID ***SEEP #1*** Sample Matrix ***GW*** Sample Collected ***10/22/9 10:50:0***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-06A		SW846 8260A Purgeable VOCs by GC/MS							
X99352	XG.1999.922-13	71-43-2	Benzene	940	ug / L	10	1		10/27/99
X99352	XG.1999.922-13	100-41-4	Ethylbenzene	1200	ug / L	10	1		10/27/99
X99352	XG.1999.922-13		Naphthalene	460	ug / L	10	5		10/27/99
X99352	XG.1999.922-13	95-47-6	o-Xylene	ND	ug / L	10	1		10/27/99
[illegible]52	XG.1999.922-13		p/m Xylenes	390	ug / L	10	2		10/27/99
[illegible]352	XG.1999.922-13	108-88-3	Toluene	ND	ug / L	10	1		10/27/99

Client Sample ID ***MW-1*** Sample Matrix ***GW*** Sample Collected ***10/21/99 11:30:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-07A		SW846 8260A Purgeable VOCs by GC/MS							
X99352	XG.1999.922-7	71-43-2	Benzene	ND	ug / L	1	1		10/27/99
X99352	XG.1999.922-7	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/27/99
X99352	XG.1999.922-7		Naphthalene	ND	ug / L	1	5		10/27/99
X99352	XG.1999.922-7	95-47-6	o-Xylene	ND	ug / L	1	1		10/27/99
X99352	XG.1999.922-7		p/m Xylenes	ND	ug / L	1	2		10/27/99
X99352	XG.1999.922-7	108-88-3	Toluene	ND	ug / L	1	1		10/27/99
9910244-07B		EPA 300.0							
W99253	MW.1999.1312-39		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

nt: **GIANT REFINING-BLOOMFIELD**
oject: **9910244 BLOOMFIELD GIANT REF.**

Client Sample ID ***MW-3*** Sample Matrix ***GW*** Sample Collected ***10/21/99 12:00:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-08A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99352	XG.1999.922-18	71-43-2	Benzene	ND	ug / L	1	1		10/28/99
X99352	XG.1999.922-18	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/28/99
X99352	XG.1999.922-18		Naphthalene	ND	ug / L	1	5		10/28/99
X99352	XG.1999.922-18	95-47-6	o-Xylene	ND	ug / L	1	1		10/28/99
X99352	XG.1999.922-18		p/m Xylenes	ND	ug / L	1	2		10/28/99
X99352	XG.1999.922-18	108-88-3	Toluene	1.1	ug / L	1	1		10/28/99
9910244-08B		**EPA 300.0**							
W99253	MW.1999.1312-41		Nitrate, as N	15.5	mg / L	1	0.1		11/03/99

Client Sample ID ***MW-4*** Sample Matrix ***GW*** Sample Collected ***10/22/99 12:50:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
244-09A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99352	XG.1999.922-19	71-43-2	Benzene	8700	ug / L	50	1		10/28/99
X99352	XG.1999.922-19	100-41-4	Ethylbenzene	760	ug / L	50	1		10/28/99
X99354	XG.1999.926-10		Naphthalene	180	ug / L	10	5		10/29/99
X99354	XG.1999.926-10	95-47-6	o-Xylene	27	ug / L	10	1		10/29/99
X99352	XG.1999.922-19		p/m Xylenes	900	ug / L	50	2		10/28/99
X99354	XG.1999.926-10	108-88-3	Toluene	ND	ug / L	10	1		10/29/99
9910244-09B		**EPA 300.0**							
W99253	MW.1999.1312-43		Nitrate, as N	ND	mg / L	1	0.1		11/03/99

Client Sample ID ***MW-9*** Sample Matrix ***GW*** Sample Collected ***10/22/99 14:30:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-10A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-2	71-43-2	Benzene	16000	ug / L	100	1		10/28/99
X99354	XG.1999.926-2	100-41-4	Ethylbenzene	870	ug / L	100	1		10/28/99
X99354	XG.1999.926-2		Naphthalene	ND	ug / L	100	5		10/28/99
X99354	XG.1999.926-2	95-47-6	o-Xylene	450	ug / L	100	1		10/28/99
X99354	XG.1999.926-2		p/m Xylenes	5000	ug / L	100	2		10/28/99
X9	XG.1999.926-2	108-88-3	Toluene	110	ug / L	100	1		10/28/99

9910244-10B		**EPA 300.0**							
W99261	MW.1999.1352-31		Nitrate, as N	0.7	mg / L	2	0.1		11/10/99

Client Sample ID ***MW-11*** Sample Matrix ***GW*** Sample Collected ***10/21/9*** ***16:30:0***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-11A		**EPA 4.1.3/200.7 ICP**							
M991262	MW.1999.1304-93	7439-89-6	Iron	14.0	mg / L	1	0.05		11/04/99
9910244-11A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-3	71-43-2	Benzene	910	ug / L	50	1		10/28/99
X99354	XG.1999.926-3	100-41-4	Ethylbenzene	87	ug / L	50	1		10/28/99
X99354	XG.1999.926-4		Naphthalene	22	ug / L	1	5		10/28/99
X99354	XG.1999.926-4	95-47-6	o-Xylene	ND	ug / L	1	1		10/28/99
X99354	XG.1999.926-3		p/m Xylenes	1300	ug / L	50	2		10/28/99
X99354	XG.1999.926-4	108-88-3	Toluene	1.5	ug / L	1	1		10/28/99
9910244-11B		**EPA 300.0**							
W99261	MW.1999.1352-33		Nitrate, as N	ND	mg / L	2	0.1		11/10/99

Client Sample ID ***MW-12*** Sample Matrix ***GW*** Sample Collected ***10/22/99*** ***09:00:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-12A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-11	71-43-2	Benzene	23	ug / L	1	1		10/29/99
X99354	XG.1999.926-11	100-41-4	Ethylbenzene	3.8	ug / L	1	1		10/29/99
X99354	XG.1999.926-11		Naphthalene	ND	ug / L	1	5		10/29/99
X99354	XG.1999.926-11	95-47-6	o-Xylene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-11		p/m Xylenes	69	ug / L	1	2		10/29/99
X99354	XG.1999.926-11	108-88-3	Toluene	1.7	ug / L	1	1		10/29/99
9910244-12B		**EPA 300.0**							
W99261	MW.1999.1352-35		Nitrate, as N	ND	mg / L	2	0.1		11/10/99

Client Sample ID ***SEEP #4*** Sample Matrix ***GW*** Sample Collected ***10/22/99*** ***11:50:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
244-13A		**SW846 8260A Purgeable VOCs by GC/MS**							
54	XG.1999.926-12	71-43-2	Benzene	ND	ug / L	1	1		10/29/99

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X99354	XG.1999.926-12	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-12		Naphthalene	ND	ug / L	1	5		10/29/99
X99354	XG.1999.926-12	95-47-6	o-Xylene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-12		p/m Xylenes	ND	ug / L	1	2		10/29/99
X99354	XG.1999.926-12	108-88-3	Toluene	ND	ug / L	1	1		10/29/99

Client Sample ID ***SEEP #5*** Sample Matrix ***GW*** Sample Collected ***10/22/99 12:00:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-14A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-13	71-43-2	Benzene	7.9	ug / L	1	1		10/29/99
X99354	XG.1999.926-13	100-41-4	Ethylbenzene	1.9	ug / L	1	1		10/29/99
X99354	XG.1999.926-13		Naphthalene	12	ug / L	1	5		10/29/99
X99354	XG.1999.926-13	95-47-6	o-Xylene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-13		p/m Xylenes	230	ug / L	1	2		10/29/99
X99354	XG.1999.926-13	108-88-3	Toluene	ND	ug / L	1	1		10/29/99

Cl e ID ***MW-8*** Sample Matrix ***GW*** Sample Collected ***10/21/99 11:00:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-15A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-14	71-43-2	Benzene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-14	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-14		Naphthalene	ND	ug / L	1	5		10/29/99
X99354	XG.1999.926-14	95-47-6	o-Xylene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-14		p/m Xylenes	ND	ug / L	1	2		10/29/99
X99354	XG.1999.926-14	108-88-3	Toluene	1.0	ug / L	1	1		10/29/99
9910244-15B		**EPA 300.0**							
W99261	MW.1999.1352-45		Nitrate, as N	3.1	mg / L	2	0.1		11/11/99
9910244-15C		**EPA 300.0**							
W99261	MW.1999.1352-40		Sulfate	286	mg / L	10	0.5		11/10/99
9910244-15D		**RSKSOP-147**							
MT.1999.2910	MT.1999.2910-1		Methane	ND	mg/L	1	0.0012	S	11/10/99
9910244-15E		**EPA 4.1.1/200.7 ICP**							
M991231	MW.1999.1280-48	7439-89-6	Iron, ferrous	ND	mg / L	1	0.05		10/29/99

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roject: **9910244** **BLOOMFIELD GIANT REF.**

Client Sample ID **MW-34** Sample Matrix **GW** Sample Collected **10/21/9** **15:30:0**

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-16A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-16	71-43-2	Benzene	71	ug / L	1	1		10/29/99
X99354	XG.1999.926-16	100-41-4	Ethylbenzene	7.3	ug / L	1	1		10/29/99
X99354	XG.1999.926-16		Naphthalene	67	ug / L	1	5		10/29/99
X99354	XG.1999.926-16	95-47-6	o-Xylene	2.1	ug / L	1	1		10/29/99
X99354	XG.1999.926-16		p/m Xylenes	120	ug / L	1	2		10/29/99
X99354	XG.1999.926-16	108-88-3	Toluene	ND	ug / L	1	1		10/29/99
9910244-16B		**EPA 300.0**							
W99261	MW.1999.1352-47		Nitrate, as N	ND	mg / L	2	0.1		11/11/99
9910244-16C		**EPA 300.0**							
W99261	MW.1999.1352-41		Sulfate	80.2	mg / L	1	0.5		11/10/99
9910244-16D		**RSKSOP-147**							
MT.1999.2910	MT.1999.2910-2		Methane	6.6	mg/L	1	0.12	S	11/10/99
0244-16E		**EPA 4.1.1/200.7 ICP**							
M991231	MW.1999.1349-16	7439-89-6	Iron, ferrous	0.73	mg / L	1	0.05		11/10/99

Client Sample ID **MW-35** Sample Matrix **GW** Sample Collected **10/21/99** **15:50:00**

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
9910244-17A		**SW846 8260A Purgeable VOCs by GC/MS**							
X99354	XG.1999.926-15	71-43-2	Benzene	1.9	ug / L	1	1		10/29/99
X99354	XG.1999.926-15	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-15		Naphthalene	ND	ug / L	1	5		10/29/99
X99354	XG.1999.926-15	95-47-6	o-Xylene	ND	ug / L	1	1		10/29/99
X99354	XG.1999.926-15		p/m Xylenes	14	ug / L	1	2		10/29/99
X99354	XG.1999.926-15	108-88-3	Toluene	ND	ug / L	1	1		10/29/99
9910244-17B		**EPA 300.0**							
W99261	MW.1999.1352-51		Nitrate, as N	0.8	mg / L	2	0.1		11/11/99
9910244-17C		**EPA 300.0**							
W99261	MW.1999.1352-43		Sulfate	18.0	mg / L	1	0.5		11/10/99
244-17D		**RSKSOP-147**							
99.2910	MT.1999.2910-3		Methane	0.46	mg/L	1	0.012	S	11/10/99

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Project: 9910244 BLOOMFIELD GIANT REF.

9910244-17E **EPA 4.1.1/200.7 ICP**

M991231	MW.1999.1301-16	7439-89-6	Iron, ferrous	0.12	mg / L	1	0.05		11/02/99

**** Sample specific Detection Limit is determined by multiplying the sample Dilution Factor by the listed Reporting Detection Limit. ****

**** ND = Not detected: less than the sample specific Detection Limit. Results relate only to the items tested. ****

ASSAIGAI ANALYTICAL LABORATORIES, INC.
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GIANT REFINING-BLOOMFIELD
attn: **LYNN SHELTON**
PO BOX 159
BLOOMFIELD, NM 87413

* explanation of codes	
B	analyte detected in Method Blank
E	result is estimated
H	analyzed out of hold time
N	tentatively identified compound
S	subcontracted
1-9	see footnote

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Client: **GIANT REFINING-BLOOMFIELD**
Project: **9903176 MONITOR WELLS**

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Client Sample ID **MW-21** | Sample Matrix **W** | Sample Collected **03/18/99 15:10:00**

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID							
9903176-01A	X9995		1,2-Dichlorobenzene	ND	ug / L	10	1		XG.1999.265-8	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	10	1		XG.1999.265-8	
	X9995		1,4-Dichlorobenzene	ND	ug / L	10	1		XG.1999.265-8	
	X9995		Benzene	960	ug / L	10	1		XG.1999.265-8	
	X9995		Chlorobenzene	ND	ug / L	10	1		XG.1999.265-8	
	X9995		Ethylbenzene	280	ug / L	10	1		XG.1999.265-8	
	X9995		O-Xylene	16	ug / L	10	1		XG.1999.265-8	
	X9995		P/M-Xylenes	570	ug / L	10	2		XG.1999.265-8	
	X9995		Toluene	ND	ug / L	10	1		XG.1999.265-8	
			Test: SM 5310C/9060							
9903176-01B	MT.1999.728		Total Organic Carbon, TOC	30	mg/L	1	0.7		MT.1999.728-1	03/29/99
			Test: EPA 5320/9020A							
9903176-01C	MT.1999.726		Total Organic Halides, TOX	410	ug/L	1	5		MT.1999.726-1	04/01/99

Client Sample ID **RW-15** | Sample Matrix **W** | Sample Collected **03/18/99 18:00:00**

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID							
176-02A	X9995		1,2-Dichlorobenzene	ND	ug / L	100	1		XG.1999.286-1	03/29/99

9903176-02A	X9995		1,3-Dichlorobenzene	ND	ug / L	100	1		XG.1999.286-1	03/29/99
	X9995		1,4-Dichlorobenzene	ND	ug / L	100	1		XG.1999.286-1	
	X9995		Benzene	7400	ug / L	100	1		XG.1999.286-1	
	X9995		Chlorobenzene	ND	ug / L	100	1		XG.1999.286-1	
	X9995		Ethylbenzene	1200	ug / L	100	1		XG.1999.286-1	
	X9995		O-Xylene	4200	ug / L	100	1		XG.1999.286-1	
	X9995		P/M-Xylenes	12000	ug / L	100	2		XG.1999.286-1	
	X9995		Toluene	15000	ug / L	100	1	E	XG.1999.286-1	

Test: SM 5310C/9060

9903176-02B	MT.1999.728		Total Organic Carbon, TOC	180	mg/L	10	0.7		MT.1999.728-2	03/29/99

Test: EPA 5320/9020A

9903176-02C	MT.1999.726		Total Organic Halides, TOX	2,700	ug/L	1	5		MT.1999.726-2	04/01/99

Client Sample ID ***RW-18*** Sample Matrix ***W*** Sample Collected ***03/18/99 15:45:00***

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

9903176-03A	X9995		1,2-Dichlorobenzene	ND	ug / L	100	1		XG.1999.265-9	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	100	1		XG.1999.265-9	
	X9995		1,4-Dichlorobenzene	ND	ug / L	100	1		XG.1999.265-9	
	X9995		Benzene	810	ug / L	100	1		XG.1999.265-9	
	X9995		Chlorobenzene	ND	ug / L	100	1		XG.1999.265-9	
	X9995		Ethylbenzene	480	ug / L	100	1		XG.1999.265-9	
	X9995		O-Xylene	ND	ug / L	100	1		XG.1999.265-9	
	X9995		P/M-Xylenes	ND	ug / L	100	2		XG.1999.265-9	
	X9995		Toluene	ND	ug / L	100	1		XG.1999.265-9	

Test: SM 5310C/9060

9903176-03B	MT.1999.728		Total Organic Carbon, TOC	84	mg/L	10	0.7		MT.1999.728-3	03/29/99

Test: EPA 5320/9020A

9903176-03C	MT.1999.726		Total Organic Halides, TOX	670	ug/L	1	5		MT.1999.726-3	04/01/99

Client Sample ID ***MW-20*** Sample Matrix ***W*** Sample Collected ***03/18/99 16:45:00***

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

9903176-04A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-4	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-4	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-4	
	X9995		Benzene	30	ug / L	1	1		XG.1999.265-4	
	X9995		Chlorobenzene	ND	ug / L	1	1		XG.1999.265-4	
	X9995		Ethylbenzene	3.1	ug / L	1	1		XG.1999.265-4	

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
9903176-04A	X9995		O-Xylene	6.3	ug / L	1	1		XG.1999.265-4	03/26/99
	X9995		P/M-Xylenes	5.2	ug / L	1	2		XG.1999.265-4	
	X9995		Toluene	2.6	ug / L	1	1		XG.1999.265-4	
			Test: SM 5310C/9060							
9903176-04B	MT.1999.728		Total Organic Carbon, TOC	23	mg/L	1	0.7		MT.1999.728-4	03/29/99
			Test: EPA 5320/9020A							
9903176-04C	MT.1999.726		Total Organic Halides, TOX	330	ug/L	1	5		MT.1999.726-4	04/01/99

Client Sample ID ***MW-09 FIELD BLNK*** Sample Matrix ***W*** Sample Collected ***03/18/9***
16:00:0

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID							
9903176-05A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-12	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-12	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-12	
	X9995		Benzene	ND	ug / L	1	1		XG.1999.265-12	
	X9995		Chlorobenzene	ND	ug / L	1	1		XG.1999.265-12	
	X9995		Ethylbenzene	ND	ug / L	1	1		XG.1999.265-12	
	X9995		O-Xylene	ND	ug / L	1	1		XG.1999.265-12	
	X9995		P/M-Xylenes	ND	ug / L	1	2		XG.1999.265-12	
	X9995		Toluene	ND	ug / L	1	1		XG.1999.265-12	

Client Sample ID ***MW-09*** Sample Matrix ***W*** Sample Collected ***03/18/99***
16:00:00

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
			Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID							
9903176-06A	X9995		1,2-Dichlorobenzene	ND	ug / L	100	1		XG.1999.286-2	03/29/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	100	1		XG.1999.286-2	
	X9995		1,4-Dichlorobenzene	ND	ug / L	100	1		XG.1999.286-2	
	X9995		Benzene	19000	ug / L	100	1	E	XG.1999.286-2	
	X9995		Chlorobenzene	ND	ug / L	100	1		XG.1999.286-2	
	X9995		Ethylbenzene	830	ug / L	100	1		XG.1999.286-2	
	X9995		O-Xylene	200	ug / L	100	1		XG.1999.286-2	
	X9995		P/M-Xylenes	4000	ug / L	100	2		XG.1999.286-2	
	X9995		Toluene	180	ug / L	100	1		XG.1999.286-2	
			Test: SM 5310C/9060							
9903176-06B	MT.1999.728		Total Organic Carbon, TOC	77	mg/L	1	0.7		MT.1999.728-5	03/29/99
			Test: EPA 5320/9020A							
9903176-06C	MT.1999.726		Total Organic Halides, TOX	330	ug/L	1	5		MT.1999.726-5	04/01/99

Test: EPA 300.0

9903176-06D	W9957		Nitrate, as N	ND	mg / L	5	0.1		MW.1999.345-16	03/24/99

Test: SM 4500-N & NH3B,C

9903176-06D	W9958		Kjeldahl Nitrogen, Total	5.5	mg / L	5	0.2		MW.1999.346-16	03/25/99

Test: SM 4500-NH3B,C

9903176-06D	W9951	7664-41-7	Ammonia, as N	0.4	mg / L	1	0.2		MW.1999.351-5	03/26/99

Client Sample ID ***MW-05 FIELD BLNK***   Sample Matrix ***W***   Sample Collected ***03/19/99 09:10:00***

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
9903176-07A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-13	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-13	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-13	
	X9995		Benzene	ND	ug / L	1	1		XG.1999.265-13	
	X9995		Chlorobenzene	ND	ug / L	1	1		XG.1999.265-13	
	X9995		Ethylbenzene	ND	ug / L	1	1		XG.1999.265-13	
	X9995		O-Xylene	ND	ug / L	1	1		XG.1999.265-13	
	X9995		P/M-Xylenes	ND	ug / L	1	2		XG.1999.265-13	
	X9995		Toluene	ND	ug / L	1	1		XG.1999.265-13	

Client Sample ID ***MW-05***   Sample Matrix ***W***   Sample Collected ***03/19/99 09:10:00***

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
9903176-08A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-14	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-14	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-14	
	X9995		Benzene	ND	ug / L	1	1		XG.1999.265-14	
	X9995		Chlorobenzene	ND	ug / L	1	1		XG.1999.265-14	
	X9995		Ethylbenzene	ND	ug / L	1	1		XG.1999.265-14	
	X9995		O-Xylene	ND	ug / L	1	1		XG.1999.265-14	
	X9995		P/M-Xylenes	ND	ug / L	1	2		XG.1999.265-14	
	X9995		Toluene	ND	ug / L	1	1		XG.1999.265-14	

Test: EPA 300.0

9903176-08B	W9957		Nitrate, as N	27.2	mg / L	5	0.1		MW.1999.345-18	03/24/99

Test: SM 4500-N & NH3B,C

9903176-08B	W9958		Kjeldahl Nitrogen, Total	1.0	mg / L	1	0.2	4	MW.1999.346-17	03/25/99

Test: SM 4500-NH3B,C

[illegible]3-08B	W9951	7664-41-7	Ammonia, as N	0.2	mg / L	1	0.2		MW.1999.351-6	03/26/99

Test: EPA 4.1.1/200.7 ICP

9903176-08C	M99358	7440-38-2	Arsenic, dissolved	ND	mg / L	1	0.06		MW.1999.337-90	03/24/99
	M99358	7440-39-3	Barium, dissolved	ND	mg / L	1	0.01		MW.1999.337-90	
	M99358	7440-42-8	Boron, dissolved	0.48	mg / L	1	0.05		MW.1999.337-90	
	M99358	7440-43-9	Cadmium, dissolved	ND	mg / L	1	0.006		MW.1999.337-90	
	M99358	7440-47-3	Chromium, dissolved	ND	mg / L	1	0.01		MW.1999.337-90	
	M99358	7439-89-6	Iron, dissolved	ND	mg / L	1	0.05		MW.1999.337-90	
	M99358	7439-92-1	Lead, dissolved	ND	mg / L	1	0.06		MW.1999.337-90	
	M99358	7439-96-5	Manganese, dissolved	0.02	mg / L	1	0.01		MW.1999.337-90	

Test: EPA 160.1

9903176-08D	TD995		Total Dissolved Solids	5,780	mg / L	1	10		MT.1999.643-2	03/25/99

Test: EPA 300.0

9903176-08D	W9956		Chloride	2720	mg / L	100	0.5		MW.1999.345-45	03/24/99
	W9952		Sulfate	1070	mg / L	10	0.5		MW.1999.339-20	03/23/99

Test: EPA 420.1 Section 8.3

9903176-08E	W9966		Phenolics, Total	ND	mg / L	1	0.005		MW.1999.385-6	04/05/99

Test: EPA 335.2 / SM 4500 CN-C

9903176-08F	W9937		Cyanide, Total	ND	mg / L	1	0.02		MW.1999.340-3	03/24/99

t
ple ID ***MW-01 FIELD BLNK*** Sample Matrix ***W*** Sample Collected ***03/19/99 11:00:00***

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
9903176-09A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1	2	XG.1999.265-15	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1	2	XG.1999.265-15	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1	2	XG.1999.265-15	
	X9995		Benzene	43	ug / L	1	1	2	XG.1999.265-15	
	X9995		Chlorobenzene	ND	ug / L	1	1	2	XG.1999.265-15	
	X9995		Ethylbenzene	13	ug / L	1	1	2	XG.1999.265-15	
	X9995		O-Xylene	2.7	ug / L	1	1	2	XG.1999.265-15	
	X9995		P/M-Xylenes	62	ug / L	1	2	2	XG.1999.265-15	
	X9995		Toluene	2.1	ug / L	1	1	2	XG.1999.265-15	

Client
Sample ID ***MW-01*** Sample Matrix ***W*** Sample Collected ***03/19/99 11:00:00***

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
9903176-10A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1	2	XG.1999.265-16	03/27/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1	2	XG.1999.265-16	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1	2	XG.1999.265-16	

nt: GIANT REFINING-BLOOMFIELD
oject: 9903176 MONITOR WELLS

9903176-10A	X9995		Benzene	45	ug / L	1	1	2	XG.1999.265-16	03/27/99
	X9995		Chlorobenzene	ND	ug / L	1	1	2	XG.1999.265-16	
	X9995		Ethylbenzene	13	ug / L	1	1	2	XG.1999.265-16	
	X9995		O-Xylene	2.9	ug / L	1	1	2	XG.1999.265-16	
	X9995		P/M-Xylenes	64	ug / L	1	2	2	XG.1999.265-16	
	X9995		Toluene	2.2	ug / L	1	1	2	XG.1999.265-16	

Test: EPA 4.1.1/200.7 ICP

9903176-10B	M99358	7440-38-2	Arsenic, dissolved	ND	mg / L	1	0.06		MW.1999.337-93	03/24/99
	M99358	7440-39-3	Barium, dissolved	ND	mg / L	1	0.01		MW.1999.337-93	
	M99358	7440-42-8	Boron, dissolved	0.05	mg / L	1	0.05		MW.1999.337-93	
	M99358	7440-43-9	Cadmium, dissolved	ND	mg / L	1	0.006		MW.1999.337-93	
	M99358	7440-47-3	Chromium, dissolved	ND	mg / L	1	0.01		MW.1999.337-93	
	M99358	7439-89-6	Iron, dissolved	ND	mg / L	1	0.05		MW.1999.337-93	
	M99358	7439-92-1	Lead, dissolved	ND	mg / L	1	0.06		MW.1999.337-93	
	M99358	7439-96-5	Manganese, dissolved	0.24	mg / L	1	0.01		MW.1999.337-93	

Test: EPA 160.1

9903176-10C	TD995		Total Dissolved Solids	412	mg / L	1	10		MT.1999.643-3	03/25/99

Test: EPA 300.0

9903176-10C	W9952		Chloride	36.1	mg / L	1	0.5		MW.1999.339-21	03/23/99
	W9952		Sulfate	139	mg / L	10	0.5		MW.1999.339-22	

Test: EPA 420.1 Section 8.3

6-10D	W9966		Phenolics, Total	ND	mg / L	1	0.005	3	MW.1999.385-7	04/05/99

Test: EPA 335.2 / SM 4500 CN-C

9903176-10E	W9937		Cyanide, Total	ND	mg / L	1	0.02		MW.1999.340-6	03/24/99

Test: EPA 300.0

9903176-10F	W9957		Nitrate, as N	2.3	mg / L	5	0.1		MW.1999.345-20	03/24/99

Test: SM 4500-N & NH3B,C

9903176-10F	W9958		Kjeldahl Nitrogen, Total	0.8	mg / L	1	0.2		MW.1999.346-18	03/25/99

Test: SM 4500-NH3B,C

9903176-10F	W9951	7664-41-7	Ammonia, as N	0.3	mg / L	1	0.2		MW.1999.351-7	03/26/99

Client Sample ID **TRIP BLANK** Sample Matrix **W** Sample Collected ***03/19/99 11:15:00***

Test: SW846 5030A/8020A Purgeable Aromatics by GC/PID

Fraction	QC Group	CAS #		Result	Units	Dilution Factor	Detection Limit	*	Sequence	Run Date
9903176-11A	X9995		1,2-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-7	03/26/99
	X9995		1,3-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-7	
	X9995		1,4-Dichlorobenzene	ND	ug / L	1	1		XG.1999.265-7	
	X9995		Benzene	ND	ug / L	1	1		XG.1999.265-7	
	X9995		Chlorobenzene	ND	ug / L	1	1		XG.1999.265-7	
	X9995		Ethylbenzene	ND	ug / L	1	1		XG.1999.265-7	
	X9995		O-Xylene	ND	ug / L	1	1		XG.1999.265-7	

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roject: **9903176 MONITOR WELLS**

9903176-11A	X9995		P/M-Xylenes	ND	ug / L	1	2		XG.1999.265-7	03/26/99
	X9995		Toluene	ND	ug / L	1	1		XG.1999.265-7	

**** Sample specific analytical Detection Limit is determined by multiplying the sample Dilution Factor by the listed method Detection Limit. ****

**** Results relate only to the items tested. ****

footnote

[1] The o-xylene result for sample 9903176-04A may be biased high due to matrix interference observed on the chromatogram.

[2] One of two surrogate recoveries for these fraction was outside of QC criteria for the VOC analysis suggesting matrix interference problems. The bias was high. This should be taken into account when reviewing the data.

[3] This sample was utilized for the matrix spike and duplicate. Please note that the recoveries were outside of QC criteria, suggesting matrix interference problems. This should be taken into account when reviewing the data.

[4] This sample had a high concentration of nitrate. When nitrate concentration is higher than 10 mg/L, it can interfere with the analysis for total Kjeldahl nitrogen (TKN). This should be taken into account when reviewing the data.

memo

The "E" qualifiers on the toluene result for sample fraction 9903176-02A and the benzene result for sample fraction 9903176-06A indicate that the response for said compound was above the calibrated range at the dilution reported.

Groundwater Monitoring Analytical Reports

2000

ASSAIGAI ANALYTICAL LABORATORIES, INC.
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Explanation of codes

B	*analyte detected in Method Blank*
E	*result is estimated*
H	*analyzed out of hold time*
N	*tentatively identified compound*
S	*subcontracted*
1-9	*see footnote*

GIANT REFINING-BLOOMFIELD
attn: **BARRY HOLMAN**
PO BOX 159
BLOOMFIELD, NM 87413

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: **GIANT REFINING-BLOOMFIELD**
Project: **0010031 BLOOMFIELD REFINERY SEPT**

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Client Sample ID ***SEEP #5*** Sample Matrix ***GW*** Sample Collected ***09/28/00 10:50:00***

oup	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-01A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1127-12	71-43-2	Benzene	ND	ug / L	5	1	1	10/10/00
X00394	XG.2000.1127-12	100-41-4	Ethylbenzene	ND	ug / L	5	1	1	10/10/00
X00394	XG.2000.1127-12		Naphthalene	11	ug / L	5	2	1	10/10/00
X00394	XG.2000.1127-12	95-47-6	o-Xylene	ND	ug / L	5	1	1	10/10/00
X00394	XG.2000.1127-12	108-38-3/106-42	p/m-Xylenes	24	ug / L	5	2	1	10/10/00
X00394	XG.2000.1127-12	108-88-3	Toluene	ND	ug / L	5	1	1	10/10/00

Client Sample ID ***SEEP #4*** Sample Matrix ***GW*** Sample Collected ***09/28/00 11:30:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-02A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1127-4	71-43-2	Benzene	ND	ug / L	1	1		10/09/00
X00394	XG.2000.1127-4	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/09/00
X00394	XG.2000.1127-4		Naphthalene	ND	ug / L	1	2		10/09/00
X00394	XG.2000.1127-4	95-47-6	o-Xylene	ND	ug / L	1	1		10/09/00
X00394	XG.2000.1127-4	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2		10/09/00
X00394	XG.2000.1127-4	108-88-3	Toluene	ND	ug / L	1	1		10/09/00

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Certificate of Analysis

[illegible]nt: GIANT REFINING-BLOOMFIELD
[illegible]ject: 0010031 BLOOMFIELD REFINERY SEPT

Client Sample ID *SEEP #1* | Sample Matrix *GW* | Sample Collected *09/28/00 11:50:00*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-03A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-2	71-43-2	Benzene	1600	ug / L	50	1		10/11/00
X00394	XG.2000.1127-5	100-41-4	Ethylbenzene	720	ug / L	10	1	1	10/09/00
X00394	XG.2000.1127-5		Naphthalene	360	ug / L	10	2	1	10/09/00
X00394	XG.2000.1127-5	95-47-6	o-Xylene	ND	ug / L	10	1	1	10/09/00
X00394	XG.2000.1127-5	108-38-3/106-42	p/m-Xylenes	97	ug / L	10	2	1	10/09/00
X00394	XG.2000.1127-5	108-88-3	Toluene	ND	ug / L	10	1	1	10/09/00

Client Sample ID *MW-1* | Sample Matrix *GW* | Sample Collected *09/28/00 13:05:00*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-04A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X0[illegible]4	XG.2000.1127-6	71-43-2	Benzene	ND	ug / L	1	1	1	10/09/00
[illegible]	XG.2000.1127-6	100-41-4	Ethylbenzene	ND	ug / L	1	1	1	10/09/00
[illegible]4	XG.2000.1127-6		Naphthalene	ND	ug / L	1	2	1	10/09/00
X00394	XG.2000.1127-6	95-47-6	o-Xylene	ND	ug / L	1	1	1	10/09/00
X00394	XG.2000.1127-6	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2	1	10/09/00
X00394	XG.2000.1127-6	108-88-3	Toluene	ND	ug / L	1	1	1	10/09/00
0010031-04B		**EPA 300.0**							
HE0010030	TT.2000.1053-6		Sulfate	130	mg/L	1	0.5	S	10/11/00
0010031-04C		**EPA 300.0**							
HE0010030	TT.2000.1053-7		Nitrite/Nitrate as Nitrogen	1.4	mg/L	1	0.5	S	10/11/00

Client Sample ID *MW-8* | Sample Matrix *GW* | Sample Collected *09/28/00 13:45:00*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-05A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1127-7	71-43-2	Benzene	ND	ug / L	1	1	1	10/09/00
X00394	XG.2000.1127-7	100-41-4	Ethylbenzene	ND	ug / L	1	1	1	10/09/00
X00394	XG.2000.1127-7		Naphthalene	ND	ug / L	1	2	1	10/09/00
X00394	XG.2000.1127-7	95-47-6	o-Xylene	ND	ug / L	1	1	1	10/09/00
X00[illegible]4	XG.2000.1127-7	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2	1	10/09/00

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t: GIANT REFINING-BLOOMFIELD

ect: 0010031 BLOOMFIELD REFINERY SEPT

X00394	XG.2000.1127-7	108-88-3	Toluene	ND	ug / L	1	1	1	10/09/00
0010031-05B		**EPA 300.0**							
HE0010030	TT.2000.1053-8		Sulfate	830	mg/L	1	0.5	S	10/11/00
0010031-05C		**EPA 300.0**							
HE0010030	TT.2000.1053-9		Nitrite/Nitrate as Nitrogen	12	mg/L	1	0.5	S	10/11/00
0010031-05D		**EPA 4.1.1/200.7 ICP**							
M001116	MW.2000.1489-44	7439-89-6	Iron, ferrous	0.07	mg / L	1	0.05		10/10/00
0010031-05E		**RSK 147**							
SPL00100117	TT.2000.1126-3		Methane	ND	mg/L	1	0.0012	S	10/11/00

Client Sample ID ***MW-3*** Sample Matrix ***GW*** Sample Collected ***09/28/00 14:20:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-06A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1127-13	71-43-2	Benzene	ND	ug / L	1	1		10/10/00
X0	XG.2000.1127-13	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/10/00
	XG.2000.1127-13		Naphthalene	ND	ug / L	1	2		10/10/00
X4	XG.2000.1127-13	95-47-6	o-Xylene	ND	ug / L	1	1		10/10/00
X00394	XG.2000.1127-13	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2		10/10/00
X00394	XG.2000.1127-13	108-88-3	Toluene	ND	ug / L	1	1		10/10/00
0010031-06B		**EPA 300.0**							
HE0010030	TT.2000.1053-10		Sulfate	980	mg/L	1	0.5	S	10/11/00
0010031-06C		**EPA 300.0**							
HE0010030	TT.2000.1053-11		Nitrite/Nitrate as Nitrogen	41	mg/L	1	0.5	S	10/11/00

Client Sample ID ***MW-11*** Sample Matrix ***GW*** Sample Collected ***09/28/00 15:50:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-07A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-7	71-43-2	Benzene	250	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-7	100-41-4	Ethylbenzene	15	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-7		Naphthalene	ND	ug / L	5	2	1	10/11/00
X00394	XG.2000.1138-7	95-47-6	o-Xylene	ND	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-7	108-38-3/106-42	p/m-Xylenes	160	ug / L	5	2	1	10/11/00
X0	XG.2000.1138-7	108-88-3	Toluene	ND	ug / L	5	1	1	10/11/00

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Certificate of Analysis

C[illegible]t: **GIANT REFINING-BLOOMFIELD**
[illegible]ect: **0010031 BLOOMFIELD REFINERY SEPT**

0010031-07B		**EPA 300.0**							
HE0010030	TT.2000.1053-12		Sulfate	46	mg/L	1	0.5	S	10/11/00
0010031-07C		**EPA 300.0**							
HE0010030	TT.2000.1053-13		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00
0010031-07D		**EPA 4.1.1/200.7 ICP**							
M001116	MW.2000.1489-47	7439-89-6	Iron, ferrous	15.3	mg / L	1	0.05		10/10/00
0010031-07E		**RSK 147**							
SPL00100117	TT.2000.1126-4		Methane	3.7	mg/L	75	0.09	S	10/11/00

Client Sample ID **MW-34** Sample Matrix **GW** Sample Collected **09/28/00 16:30:00**

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-08A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-5	71-43-2	Benzene	140	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-5	100-41-4	Ethylbenzene	17	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-5		Naphthalene	47	ug / L	5	2	1	10/11/00
[illegible]	XG.2000.1138-5	95-47-6	o-Xylene	ND	ug / L	5	1	1	10/11/00
[illegible]	XG.2000.1138-5	108-38-3/106-42	p/m-Xylenes	85	ug / L	5	2	1	10/11/00
X00394	XG.2000.1138-5	108-88-3	Toluene	ND	ug / L	5	1	1	10/11/00
0010031-08B		**EPA 300.0**							
HE0010030	TT.2000.1053-14		Sulfate	55	mg/L	1	0.5	S	10/11/00
0010031-08C		**EPA 300.0**							
HE0010030	TT.2000.1053-15		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00
0010031-08D		**EPA 4.1.1/200.7 ICP**							
M001116	MW.2000.1489-48	7439-89-6	Iron, ferrous	5.72	mg / L	1	0.05		10/10/00
0010031-08E		**RSK 147**							
SPL00100117	TT.2000.1126-5		Methane	3.9	mg/L	75	0.09	S	10/11/00

Client Sample ID **MW-35** Sample Matrix **GW** Sample Collected **09/28/00 16:50:00**

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-09A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-13	71-43-2	Benzene	21	ug / L	1	1		10/12/00
X0[illegible]	XG.2000.1127-14	100-41-4	Ethylbenzene	4.6	ug / L	1	1	1	10/10/00

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X00394	XG.2000.1127-14		Naphthalene	9.5	ug / L	1	2	1	10/10/00
X00394	XG.2000.1127-14	95-47-6	o-Xylene	ND	ug / L	1	1	1	10/10/00
X00394	XG.2000.1127-14	108-38-3/106-42	p/m-Xylenes	100	ug / L	1	2	1	10/10/00
X00394	XG.2000.1127-14	108-88-3	Toluene	ND	ug / L	1	1	1	10/10/00
0010031-09B		**EPA 300.0**							
HE0010030	TT.2000.1053-18		Sulfate	120	mg/L	1	0.5	S	10/11/00
0010031-09C		**EPA 300.0**							
HE0010030	TT.2000.1053-19		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00
0010031-09D		**EPA 4.1.1/200.7 ICP**							
M001116	MW.2000.1489-49	7439-89-6	Iron, ferrous	2.77	mg / L	1	0.05		10/10/00
0010031-09E		**RSK 147**							
SPL00100117	TT.2000.1126-6		Methane	ND	mg/L	1	0.0012	S	10/11/00

Client Sample ID ***MW-36*** Sample Matrix ***GW*** Sample Collected ***09/28/00 17:15:00***

QC oup	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
31-10A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-6	71-43-2	Benzene	7.7	ug / L	5	1	1	10/11/00
X00394	XG.2000.1154-2	100-41-4	Ethylbenzene	15	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-6		Naphthalene	15	ug / L	5	2	1	10/11/00
X00394	XG.2000.1138-6	95-47-6	o-Xylene	ND	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-6	108-38-3/106-42	p/m-Xylenes	150	ug / L	5	2	1	10/11/00
X00394	XG.2000.1138-6	108-88-3	Toluene	ND	ug / L	5	1	1	10/11/00
0010031-10B		**EPA 300.0**							
HE0010030	TT.2000.1053-20		Sulfate	90	mg/L	1	0.5	S	10/11/00
0010031-10C		**EPA 300.0**							
HE0010030	TT.2000.1053-21		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00

Client Sample ID ***MW-12*** Sample Matrix ***GW*** Sample Collected ***09/28/00 17:40:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-11A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-3	71-43-2	Benzene	10	ug / L	1	1		10/11/00
X00394	XG.2000.1138-3	100-41-4	Ethylbenzene	2.3	ug / L	1	1		10/11/00
X0	XG.2000.1138-3		Naphthalene	2.0	ug / L	1	2		10/11/00

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ject: **0010031 BLOOMFIELD REFINERY SEPT**

X00394	XG.2000.1138-3	95-47-6	o-Xylene	ND	ug / L	1	1		10/11/00
X00394	XG.2000.1138-3	108-38-3/106-42	p/m-Xylenes	31	ug / L	1	2		10/11/00
X00394	XG.2000.1138-3	108-88-3	Toluene	ND	ug / L	1	1		10/11/00
0010031-11B		**EPA 300.0**							
HE0010030	TT.2000.1053-22		Sulfate	2100	mg/L	1	0.5	S	10/11/00
0010031-11C		**EPA 300.0**							
HE0010030	TT.2000.1053-23		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00

Client Sample ID ***MW-27*** Sample Matrix ***GW*** Sample Collected ***09/28/00 18:00:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-12A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-4	71-43-2	Benzene	18	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-4	100-41-4	Ethylbenzene	9.9	ug / L	5	1	1	10/11/00
X00394	XG.2000.1154-1		Naphthalene	50	ug / L	5	2	1	10/11/00
X00394	XG.2000.1138-4	95-47-6	o-Xylene	ND	ug / L	5	1	1	10/11/00
X00394	XG.2000.1138-4	108-38-3/106-42	p/m-Xylenes	64	ug / L	5	2	1	10/11/00
[illegible]4	XG.2000.1138-4	108-88-3	Toluene	ND	ug / L	5	1	1	10/11/00
0010031-12B		**EPA 300.0**							
HE0010030	TT.2000.1053-24		Sulfate	49	mg/L	1	0.5	S	10/11/00
0010031-12C		**EPA 300.0**							
HE0010030	TT.2000.1053-25		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00

Client Sample ID ***MW-26*** Sample Matrix ***GW*** Sample Collected ***09/28/00 18:30:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-13A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-14	71-43-2	Benzene	4600	ug / L	50	1	1	10/12/00
X00401	XG.2000.1138-14	100-41-4	Ethylbenzene	1000	ug / L	50	1	1	10/12/00
X00401	XG.2000.1138-14		Naphthalene	170	ug / L	50	2	1	10/12/00
X00401	XG.2000.1138-14	95-47-6	o-Xylene	ND	ug / L	50	1	1	10/12/00
X00401	XG.2000.1138-14	108-38-3/106-42	p/m-Xylenes	4300	ug / L	50	2	1	10/12/00
X00401	XG.2000.1138-14	108-88-3	Toluene	ND	ug / L	50	1	1	10/12/00
0010031-13B		**EPA 300.0**							
H[illegible]0030	TT.2000.1053-26		Sulfate	1.0	mg/L	1	0.5	S	10/11/00

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ect: **0010031** **BLOOMFIELD REFINERY SEPT**

0010031-13C **EPA 300.0**

HE0010030	TT.2000.1053-27		Nitrite/Nitrate as Nitrogen	ND	mg/L	1	0.5	S	10/11/00

Client Sample ID *FIELD BLANK* Sample Matrix *GW* Sample Collected *09/28/00 18:45:00*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010031-14A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00394	XG.2000.1138-8	71-43-2	Benzene	ND	ug / L	1	1		10/11/00
X00394	XG.2000.1138-8	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/11/00
X00394	XG.2000.1138-8		Naphthalene	ND	ug / L	1	2		10/11/00
X00394	XG.2000.1138-8	95-47-6	o-Xylene	ND	ug / L	1	1		10/11/00
X00394	XG.2000.1138-8	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2		10/11/00
X00394	XG.2000.1138-8	108-88-3	Toluene	ND	ug / L	1	1		10/11/00

**** Sample specific Detection Limit is determined by multiplying the sample Dilution Factor by the listed Reporting Detection Limit. ****

**** ND = Not detected: less than the sample specific Detection Limit. Results relate only to the items tested. ****

footnote [1] Sample pH was greater than 2 exceeding QA/QC criteria.

ASSAIGAI ANALYTICAL LABORATORIES, INC.
7300 Jefferson, NE • Albuquerque, New Mexico 87109 • (505) 345-8964 • FAX (50) 345-7259
3332 Wedgewood Dr., Suite N • El Paso, Texas 79925 • (915) 593-6000 • FAX (915) 593-7820
127 Eastgate Drive, 212-C • Los Alamos, New Mexico 87544 • (505) 662-255

Explanation of codes

B	*analyte detected in Method Blank*
E	*result is estimated*
H	*analyzed out of hold time*
N	*tentatively identified compound*
S	*subcontracted*
1-9	*see footnote*

GIANT REFINING-BLOOMFIELD
attn: **BARRY HOLMAN**
PO BOX 159
BLOOMFIELD, NM 87413

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: **GIANT REFINING-BLOOMFIELD**
Project: **0010032 BLOOMFIELD REFINERY SEPT**

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Client Sample ID ***MW-9*** Sample Matrix ***GW*** Sample Collected ***09/29/00 11:20:00***

oup	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010032-01A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-17	71-43-2	Benzene	15000	ug / L	250	1		10/12/00
X00401	XG.2000.1138-17	100-41-4	Ethylbenzene	940	ug / L	250	1		10/12/00
X00401	XG.2000.1138-17		Naphthalene	510	ug / L	250	2		10/12/00
X00401	XG.2000.1138-17	95-47-6	o-Xylene	340	ug / L	250	1		10/12/00
X00401	XG.2000.1138-17	108-38-3/106-42	p/m-Xylenes	4400	ug / L	250	2		10/12/00
X00401	XG.2000.1138-17	108-88-3	Toluene	260	ug / L	250	1		10/12/00
0010032-01B		**EPA 300.0**							
W00271	MW.2000.1520-11		Sulfate	13.6	mg / L	100	0.05		10/13/00
0010032-01C		**EPA 300.0**							
W00284	MW.2000.1587-14	14797-65-0	Nitrate, as N	ND	mg / L	10	0.05		10/27/00

Client Sample ID ***RW-15*** Sample Matrix ***GW*** Sample Collected ***09/29/00 12:00:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010032-02A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00	XG.2000.1138-18	71-43-2	Benzene	7600	ug / L	250	1		10/12/00
X0	XG.2000.1138-18	100-41-4	Ethylbenzene	3300	ug / L	250	1		10/12/00

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C[illegible]t: **GIANT REFINING-BLOOMFIELD**

[illegible]ect: **0010032** **BLOOMFIELD REFINERY SEPT**

X00401	XG.2000.1138-18		Naphthalene	890	ug / L	250	2		10/12/00
X00401	XG.2000.1138-18	95-47-6	o-Xylene	4600	ug / L	250	1		10/12/00
X00401	XG.2000.1138-18	108-38-3/106-42	p/m-Xylenes	14000	ug / L	250	2		10/12/00
X00401	XG.2000.1138-18	108-88-3	Toluene	14000	ug / L	250	1		10/12/00
0010032-02B		**EPA 300.0**							
W00272	MW.2000.1539-9		Sulfate	2.26	mg / L	1	0.05		10/16/00
0010032-02C		**EPA 300.0**							
W00284	MW.2000.1587-15	14797-65-0	Nitrate, as N	ND	mg / L	10	0.05		10/27/00
0010032-02D		**EPA 4.1.1/200.7 ICP**							
M001116	MW.2000.1489-50	7439-89-6	Iron, ferrous	3.42	mg / L	1	0.05		10/10/00
0010032-02E		**RSK 147**							
SPL00100117	TT.2000.1126-7		Methane	0.79	mg/L	20	0.024	S	10/11/00

Client Sample ID ***MW-4*** Sample Matrix ***GW*** Sample Collected ***09/29/00 12:30:00***

QC [illegible]oup	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
[illegible]32-03A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-21	71-43-2	Benzene	9100	ug / L	250	1		10/13/00
X00401	XG.2000.1138-21	100-41-4	Ethylbenzene	850	ug / L	250	1		10/13/00
X00401	XG.2000.1138-21		Naphthalene	ND	ug / L	250	2		10/13/00
X00401	XG.2000.1138-21	95-47-6	o-Xylene	ND	ug / L	250	1		10/13/00
X00401	XG.2000.1138-21	108-38-3/106-42	p/m-Xylenes	ND	ug / L	250	2		10/13/00
X00401	XG.2000.1138-21	108-88-3	Toluene	ND	ug / L	250	1		10/13/00
0010032-03B		**EPA 300.0**							
W00272	MW.2000.1539-10		Sulfate	ND	mg / L	1	0.05		10/16/00
0010032-03C		**EPA 300.0**							
W00284	MW.2000.1587-16	14797-65-0	Nitrate, as N	ND	mg / L	10	0.05		10/27/00

Client Sample ID ***RW-1*** Sample Matrix ***GW*** Sample Collected ***09/29/00 13:35:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010032-04A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-19	71-43-2	Benzene	180	ug / L	3	1		10/12/00
X004[illegible]	XG.2000.1138-19	100-41-4	Ethylbenzene	18	ug / L	3	1		10/12/00
X0[illegible]	XG.2000.1138-19		Naphthalene	38	ug / L	3	2		10/12/00

[illegible]nt: **GIANT REFINING-BLOOMFIELD**
[illegible]ject: **0010032 BLOOMFIELD REFINERY SEPT**

X00401	XG.2000.1138-19	95-47-6	o-Xylene	ND	ug / L	3	1		10/12/00
X00401	XG.2000.1138-19	108-38-3/106-42	p/m-Xylenes	25	ug / L	3	2		10/12/00
X00401	XG.2000.1138-19	108-88-3	Toluene	ND	ug / L	3	1		10/12/00
0010032-04B		**EPA 300.0**							
W00271	MW.2000.1520-16		Sulfate	346	mg / L	100	0.05		10/13/00
0010032-04C		**EPA 300.0**							
W00284	MW.2000.1587-17	14797-65-0	Nitrate, as N	ND	mg / L	10	0.05		10/27/00

Client Sample ID ***FIELD BLANK*** Sample Matrix ***GW*** Sample Collected ***09/29/00 14:15:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010032-05A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-15	71-43-2	Benzene	1.6	ug / L	1	1		10/12/00
X00401	XG.2000.1138-15	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/12/00
X00401	XG.2000.1138-15		Naphthalene	ND	ug / L	1	2		10/12/00
X00401	XG.2000.1138-15	95-47-6	o-Xylene	ND	ug / L	1	1		10/12/00
X00401	XG.2000.1138-15	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2		10/12/00
[illegible]	XG.2000.1138-15	108-88-3	Toluene	ND	ug / L	1	1		10/12/00

Client Sample ID ***TRIP BLANK*** Sample Matrix ***GW*** Sample Collected ***09/29/00 14:17:00***

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Run Date
0010032-06A		**SW846 5030A/8021B Purgeable VOCs by GC/PID**							
X00401	XG.2000.1138-16	71-43-2	Benzene	ND	ug / L	1	1		10/12/00
X00401	XG.2000.1138-16	100-41-4	Ethylbenzene	ND	ug / L	1	1		10/12/00
X00401	XG.2000.1138-16		Naphthalene	ND	ug / L	1	2		10/12/00
X00401	XG.2000.1138-16	95-47-6	o-Xylene	ND	ug / L	1	1		10/12/00
X00401	XG.2000.1138-16	108-38-3/106-42	p/m-Xylenes	ND	ug / L	1	2		10/12/00
X00401	XG.2000.1138-16	108-88-3	Toluene	ND	ug / L	1	1		10/12/00

**** Sample specific Detection Limit is determined by multiplying the sample Dilution Factor by the listed Reporting Detection Limit. ****

**** ND = Not detected: less than the sample specific Detection Limit. Results relate only to the items tested. ****

Groundwater Monitoring Analytical Reports

2001

PINNACLE
LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
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Pinnacle Lab ID number **109068**
October 05, 2001

SAN JUAN REFINING CO.
#50 ROAD 4990
BLOOMFIELD, NM 87413

Project Name MONITOR WELLS
Project Number 91801

Attention: CINDY HURTADO

On 09/19/01 Pinnacle Laboratories, Inc., (ADHS License No. AZ0592 pending), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: jt

Enclosure

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

PINNACLE ID : 109068
DATE RECEIVED : 09/19/01
REPORT DATE : 10/05/01

PINNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
109068 - 01	MW-12-91801	AQUEOUS	09/18/01
109068 - 02	MW-36-91801	AQUEOUS	09/18/01
109068 - 03	MW-26-91801	AQUEOUS	09/18/01
109068 - 04	MW-27-91801	AQUEOUS	09/18/01
109068 - 05	SEEP-5-91801	AQUEOUS	09/18/01
109068 - 06	MW-4-91801	AQUEOUS	09/18/01
109068 - 07	MW-3-91801	AQUEOUS	09/18/01
109068 - 08	MW-1-91801	AQUEOUS	09/18/01
109068 - 09	MW-9-91801	AQUEOUS	09/18/01
09068 - 10	MW-11-91801	AQUEOUS	09/17/01
109[illegible] 11	MW-35-91801	AQUEOUS	09/17/01
109[illegible]- 12	MW-34-91801	AQUEOUS	09/17/01
109068 - 13	MW-8-91801	AQUEOUS	09/17/01
09068 - 14	RW-15-91801	AQUEOUS	09/17/01

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-01	MW-12-91801	AQUEOUS	09/18/01	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
yl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
chloroethene (127-18-4)	1.0	< 1.0	ug/L
obenzene (108-90-7)	1.0	< 1.0	ug/L
benzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-01	MW-12-91801	AQUEOUS	09/18/01	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	96 (80 - 120)
Toluene-d8	97 (88 - 110)
Bromofluorobenzene	101 (86 - 115)

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-02	MW-36-91801	AQUEOUS	09/18/01	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
rylonitrile (107-13-1)	5.0	< 5.0	ug/L	
[illegible] 1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
[illegible]thyl-t-butyl Ether (628-28-4)	**1.0**	**20**	**ug/L**	**E1**
1,1,2-Trichlorotrifluoroethane (76-13-1)	**5.0**	**12**	**ug/L**	**B, E2**
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	**1.0**	**1.9**	**ug/L**	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**2.2**	**ug/L**	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
omochloromethane (124-48-1)	1.0	< 1.0	ug/L	
achloroethene (127-18-4)	1.0	< 1.0	ug/L	
[illegible]robenzene (108-90-7)	1.0	< 1.0	ug/L	
[illegible]lbenzene (100-41-4)	**1.0**	**1.2**	**ug/L**	

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-02	MW-36-91801	AQUEOUS	09/18/01	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**52**	**ug/L**	
o-Xylene (95-47-6)	1.0	< 1.0	ug/L	
Styrene (100-42-5)	1.0	< 1.0	ug/L	
Bromoform (75-25-2)	1.0	< 1.0	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**15**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**12**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L	
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L	
[illegible]5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L	
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L	
[illegible]2,4-Trimethylbenzene (95-63-6)	**1.0**	**190**	**ug/L**	**D5**
sec-Butylbenzene (135-98-9)	**1.0**	**4.3**	**ug/L**	
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L	
p-Isopropyltoluene (99-87-6)	**1.0**	**5.0**	**ug/L**	
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L	
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L	
Naphthalene (91-20-3)	**3.0**	**10**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L	
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L	
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L	

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	98 (80 - 120)
Toluene-d8	103 (88 - 110)
Bromofluorobenzene	102 (86 - 115)

B = Consistant with laboratory background.
D5 = Reported from a 5X dilution run on 9/29/01.
E1 = Estimated value, continuing calibration criteria exceeded by 16%
E2 = Estimated value, continuing calibration criteria exceeded by 32%

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-03	MW-26-91801	AQUEOUS	09/18/01	N/A	09/29/01	5

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 5.0	ug/L	
Chloromethane (74-87-9)	1.0	< 5.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 5.0	ug/L	
Bromomethane (74-83-9)	1.0	< 5.0	ug/L	
Chloroethane (75-00-3)	1.0	< 5.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 5.0	ug/L	
Acetone (67-64-1)	10	< 50	ug/L	
Acrolein (107-02-8)	5.0	< 25	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 5.0	ug/L	
Iodomethane (74-88-4)	5.0	< 25	ug/L	
Methylene Chloride (75-09-2)	1.0	< 5.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 25	ug/L	
2-Dichloroethene (107-06-2)	1.0	< 5.0	ug/L	
yl-t-butyl Ether (628-28-4)	**1.0**	**6.5**	**ug/L**	E1
1,1,2-Trichlorotrifluoroethane (76-13-1)	**5.0**	**67**	**ug/L**	B, E2
1,1-Dichloroethane (75-34-3)	1.0	< 5.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 5.0	ug/L	
2-Butanone (78-93-3)	10	< 50	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 5.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 5.0	ug/L	
Chloroform (67-66-3)	1.0	< 5.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 5.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 5.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 5.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 5.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 5.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 5.0	ug/L	
Benzene (71-43-2)	**1.0**	**3900**	**ug/L**	D100
1,2-Dichloropropane (78-87-5)	1.0	< 5.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 5.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 5.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 50	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 5.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 5.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 5.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 5.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 5.0	ug/L	
Toluene (108-88-3)	1.0	< 5.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 5.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 50	ug/L	
2-Hexanone (591-78-6)	10	< 50	ug/L	
Dibromochloromethane (124-48-1)	1.0	< 5.0	ug/L	
T loroethene (127-18-4)	1.0	< 5.0	ug/L	
benzene (108-90-7)	1.0	< 5.0	ug/L	
enzene (100-41-4)	**1.0**	**630**	**ug/L**	

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-03	MW-26-91801	AQUEOUS	09/18/01	N/A	09/29/01	5

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 5.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**1400**	**ug/L**
o-Xylene (95-47-6)	1.0	< 5.0	ug/L
Styrene (100-42-5)	1.0	< 5.0	ug/L
Bromoform (75-25-2)	1.0	< 5.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 5.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 5.0	ug/L
Isopropyl Benzene (98-82-8)	**1.0**	**60**	**ug/L**
Bromobenzene (108-86-1)	1.0	< 5.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 5.0	ug/L
n-Propylbenzene (103-65-1)	**1.0**	**63**	**ug/L**
2-Chlorotoluene (95-49-8)	1.0	< 5.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 5.0	ug/L
[illegible] 5-Trimethylbenzene (108-67-8)	**1.0**	**240**	**ug/L**
[illegible]-Butylbenzene (98-06-6)	1.0	< 5.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**790**	**ug/L**
sec-Butylbenzene (135-98-9)	**1.0**	**13**	**ug/L**
1,3-Dichlorobenzene (541-73-1)	1.0	< 5.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 5.0	ug/L
p-Isopropyltoluene (99-87-6)	**1.0**	**11**	**ug/L**
1,2-Dichlorobenzene (95-50-1)	1.0	< 5.0	ug/L
n-Butylbenzene (104-51-8)	**1.0**	**31**	**ug/L**
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 5.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 5.0	ug/L
Naphthalene (91-20-3)	**3.0**	**190**	**ug/L**
Hexachlorobutadiene (87-68-3)	1.0	< 5.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 5.0	ug/L
2-Methyl Naphthalene (97-57-6)	**5.0**	**97**	**ug/L**
1-Methyl Naphthalene (90-12-0)	**5.0**	**46**	**ug/L**

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	102 (80 - 120)
Toluene-d8	103 (88 - 110)
Bromofluorobenzene	110 (86 - 115)

B = Consistant with laboratory background.
D100 = Reported from a 100X dilution run on 9/28/01.
E1 = Estimated value, continuing calibration criteria exceeded by 16%
E2 = Estimated value, continuing calibration criteria exceeded by 32%

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801 DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-04	MW-27-91801	AQUEOUS	09/18/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L	
1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
thyl-t-butyl Ether (628-28-4)	**1.0**	**9.3**	**ug/L**	E
,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**9.3**	**ug/L**	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	**1.0**	**1.6**	**ug/L**	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
romochloromethane (124-48-1)	1.0	< 1.0	ug/L	
achloroethene (127-18-4)	1.0	< 1.0	ug/L	
robenzene (108-90-7)	1.0	< 1.0	ug/L	
lbenzene (100-41-4)	**1.0**	**1.4**	**ug/L**	

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-04	MW-27-91801	AQUEOUS	09/18/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**4.0**	**ug/L**
o-Xylene (95-47-6)	**1.0**	**1.0**	**ug/L**
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
2,4-Trimethylbenzene (95-63-6)	**1.0**	**29**	**ug/L**
sec-Butylbenzene (135-98-9)	**1.0**	**1.7**	**ug/L**
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	**1.0**	**18**	**ug/L**
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	**3.0**	**3.1**	**ug/L**
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	**5.0**	**32**	**ug/L**

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	103 (80 - 120)
Toluene-d8	104 (88 - 110)
Bromofluorobenzene	109 (86 - 115)

E = Estimated value, continuing calibration criteria exceeded by 16%

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-05	SEEP-5-91801	AQUEOUS	09/18/01	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
yl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	**1.0**	**15**	**ug/L**
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
benzene (108-90-7)	1.0	< 1.0	ug/L
benzene (100-41-4)	**1.0**	**1.0**	**ug/L**

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-05	SEEP-5-91801	AQUEOUS	09/18/01	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**210**	**ug/L**	
o-Xylene (95-47-6)	1.0	< 1.0	ug/L	
Styrene (100-42-5)	1.0	< 1.0	ug/L	
Bromoform (75-25-2)	1.0	< 1.0	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**32**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**36**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L	
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L	
[illegible]-Trimethylbenzene (108-67-8)	**1.0**	**100**	**ug/L**	
[illegible]utylbenzene (98-06-6)	1.0	< 1.0	ug/L	
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**640**	**ug/L**	D5
sec-Butylbenzene (135-98-9)	**1.0**	**9.5**	**ug/L**	
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L	
p-Isopropyltoluene (99-87-6)	**1.0**	**17**	**ug/L**	
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L	
n-Butylbenzene (104-51-8)	**1.0**	**6.0**	**ug/L**	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L	
Naphthalene (91-20-3)	**3.0**	**29**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L	
2-Methyl Naphthalene (97-57-6)	**5.0**	**20**	**ug/L**	
1-Methyl Naphthalene (90-12-0)	**5.0**	**8.0**	**ug/L**	

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	96 (80 - 120)
Toluene-d8	102 (88 - 110)
Bromofluorobenzene	99 (86 - 115)

D5 = Reported from a 5X dilution run on 9/29/01.

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-06	MW-4-91801	AQUEOUS	09/18/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L	
[illegible],2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
[illegible]nyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L	
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**6500**	**ug/L**	D100
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L	
[illegible]chloroethene (127-18-4)	1.0	< 1.0	ug/L	
[illegible]obenzene (108-90-7)	1.0	< 1.0	ug/L	
[illegible]lbenzene (100-41-4)	**1.0**	**510**	**ug/L**	D100

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST	: VOLATILE ORGANICS EPA METHOD 8260		
CLIENT	: SAN JUAN REFINING CO.	PINNACLE I.D. :	109068
PROJECT #	: 91801	DATE RECEIVED :	09/19/01
PROJECT NAME	: MONITOR WELLS		

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-06	MW-4-91801	AQUEOUS	09/18/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**520**	**ug/L**	**D100**
o-Xylene (95-47-6)	1.0	< 1.0	ug/L	
Styrene (100-42-5)	1.0	< 1.0	ug/L	
Bromoform (75-25-2)	1.0	< 1.0	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**68**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**71**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L	
Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L	
5-Trimethylbenzene (108-67-8)	**1.0**	**110**	**ug/L**	
-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L	
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**500**	**ug/L**	**D100**
sec-Butylbenzene (135-98-9)	**1.0**	**11**	**ug/L**	
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L	
p-Isopropyltoluene (99-87-6)	**1.0**	**3.1**	**ug/L**	
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L	
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L	
Naphthalene (91-20-3)	**3.0**	**160**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L	
2-Methyl Naphthalene (97-57-6)	**5.0**	**110**	**ug/L**	
1-Methyl Naphthalene (90-12-0)	**5.0**	**56**	**ug/L**	

SURROGATE % RECOVERY	09/29/01		10/01/01
1,2-Dichloroethane-d4	96		97
	(80 - 120)		(80 - 120)
Toluene-d8	107		97
	(88 - 110)		(81 - 117)
Bromofluorobenzene	123	S	104
	(86 - 115)		(74 - 121)

D100 = Reported from 100X dilution run on 10/01/01.
S = Surrogate out of QC limits in 1X due to matrix interference.

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-07	MW-3-91801	AQUEOUS	09/18/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L	
1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
thyl-t-butyl Ether (628-28-4)	**1.0**	**5.3**	**ug/L**	**E**
,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	1.0	< 1.0	ug/L	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L	
.chloroethene (127-18-4)	1.0	< 1.0	ug/L	
robenzene (108-90-7)	1.0	< 1.0	ug/L	
ibenzene (100-41-4)	1.0	< 1.0	ug/L	

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-07	MW-3-91801	AQUEOUS	09/18/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	97 (80 - 120)
Toluene-d8	98 (88 - 110)
Bromofluorobenzene	106 (86 - 115)

E = Estimated value, continuing calibration criteria exceeded by 20%

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-08	MW-1-91801	AQUEOUS	09/18/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
nyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
chloroethene (127-18-4)	1.0	< 1.0	ug/L
benzene (108-90-7)	1.0	< 1.0	ug/L
enzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801 DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-08	MW-1-91801	AQUEOUS	09/18/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	101 (80 - 120)
Toluene-d8	103 (88 - 110)
Bromofluorobenzene	111 (86 - 115)

PINNACLE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-09	MW-9-91801	AQUEOUS	09/18/01	N/A	09/29/01	10

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 10	ug/L	
Chloromethane (74-87-9)	1.0	< 10	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 10	ug/L	
Bromomethane (74-83-9)	1.0	< 10	ug/L	
Chloroethane (75-00-3)	1.0	< 10	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 10	ug/L	
Acetone (67-64-1)	10	< 100	ug/L	
Acrolein (107-02-8)	5.0	< 50	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 10	ug/L	
Iodomethane (74-88-4)	5.0	< 50	ug/L	
Methylene Chloride (75-09-2)	1.0	< 10	ug/L	
Acrylonitrile (107-13-1)	5.0	< 50	ug/L	
1,2-Dichloroethene (107-06-2)	1.0	< 10	ug/L	
hyl-t-butyl Ether (628-28-4)	1.0	< 10	ug/L	
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 50	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 10	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 10	ug/L	
2-Butanone (78-93-3)	10	< 100	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 10	ug/L	
Bromochloromethane (74-97-5)	1.0	< 10	ug/L	
Chloroform (67-66-3)	1.0	< 10	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 10	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 10	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 10	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 10	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 10	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 10	ug/L	
Benzene (71-43-2)	**1.0**	**8300**	**ug/L**	D100
1,2-Dichloropropane (78-87-5)	1.0	< 10	ug/L	
Trichloroethene (79-01-6)	1.0	< 10	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 10	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 100	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 10	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 10	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 10	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 10	ug/L	
Dibromomethane (74-95-3)	1.0	< 10	ug/L	
Toluene (108-88-3)	**1.0**	**1500**	**ug/L**	
1,2-Dibromoethane (106-93-4)	1.0	< 10	ug/L	
4-Methyl-2-Pentanone (108-10-1)	**10**	**160**	**ug/L**	
2-Hexanone (591-78-6)	**10**	**190**	**ug/L**	
mochloromethane (124-48-1)	1.0	< 10	ug/L	
chloroethene (127-18-4)	1.0	< 10	ug/L	
obenzene (108-90-7)	1.0	< 10	ug/L	
benzene (100-41-4)	**1.0**	**820**	**ug/L**	

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-09	MW-9-91801	AQUEOUS	09/18/01	N/A	09/29/01	10

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 10	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**4700**	**ug/L**	D100
o-Xylene (95-47-6)	**1.0**	**300**	**ug/L**	
Styrene (100-42-5)	1.0	< 10	ug/L	
Bromoform (75-25-2)	1.0	< 10	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 10	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 10	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**55**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 10	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 10	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**71**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 10	ug/L	
4-Chlorotoluene (106-43-4)	1.0	< 10	ug/L	
[illegible]5-Trimethylbenzene (108-67-8)	**1.0**	**360**	**ug/L**	
[illegible]-Butylbenzene (98-06-6)	1.0	< 10	ug/L	
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**820**	**ug/L**	
sec-Butylbenzene (135-98-9)	1.0	< 10	ug/L	
1,3-Dichlorobenzene (541-73-1)	1.0	< 10	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 10	ug/L	
p-Isopropyltoluene (99-87-6)	**1.0**	**14**	**ug/L**	
1,2-Dichlorobenzene (95-50-1)	1.0	< 10	ug/L	
n-Butylbenzene (104-51-8)	1.0	< 10	ug/L	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 10	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 10	ug/L	
Naphthalene (91-20-3)	**3.0**	**150**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 10	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 10	ug/L	
2-Methyl Naphthalene (97-57-6)	5.0	< 50	ug/L	
1-Methyl Naphthalene (90-12-0)	5.0	< 50	ug/L	

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	98 (80 - 120)
Toluene-d8	100 (88 - 110)
Bromofluorobenzene	112 (86 - 115)

D100 = Reported from 100X dilution run on 10/01/01.

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
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GC/MS RESULTS

TEST	: VOLATILE ORGANICS EPA METHOD 8260		
CLIENT	: SAN JUAN REFINING CO.	PINNACLE I.D. :	109068
PROJECT #	: 91801	DATE RECEIVED :	09/19/01
PROJECT NAME	: MONITOR WELLS		

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-10	MW-11-91701	AQUEOUS	09/17/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
[illegible]rylonitrile (107-13-1)	5.0	< 5.0	ug/L	
[illegible] 1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
[illegible]ethyl-t-butyl Ether (628-28-4)	**1.0**	**95**	**ug/L**	**E1**
1,1,2-Trichlorotrifluoroethane (76-13-1)	**5.0**	**15**	**ug/L**	**B, E2**
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**4200**	**ug/L**	**D25**
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
[illegible]mochloromethane (124-48-1)	1.0	< 1.0	ug/L	
[illegible]chloroethene (127-18-4)	1.0	< 1.0	ug/L	
[illegible]robenzene (108-90-7)	1.0	< 1.0	ug/L	
[illegible]ylbenzene (100-41-4)	**1.0**	**220**	**ug/L**	**D25**

PINNACLE LABORATORES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801 DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-10	MW-11-91701	AQUEOUS	09/17/01	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**2700**	**ug/L**	**D25**
o-Xylene (95-47-6)	1.0	< 1.0	ug/L	
Styrene (100-42-5)	1.0	< 1.0	ug/L	
Bromoform (75-25-2)	1.0	< 1.0	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**47**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**49**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L	
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L	
-Trimethylbenzene (108-67-8)	**1.0**	**190**	**ug/L**	**D25**
Butylbenzene (98-06-6)	1.0	< 1.0	ug/L	
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**710**	**ug/L**	**D25**
sec-Butylbenzene (135-98-9)	**1.0**	**10**	**ug/L**	
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L	
p-Isopropyltoluene (99-87-6)	**1.0**	**16**	**ug/L**	
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L	
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L	
Naphthalene (91-20-3)	**3.0**	**93**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L	
2-Methyl Naphthalene (97-57-6)	**5.0**	**26**	**ug/L**	
1-Methyl Naphthalene (90-12-0)	**5.0**	**7.7**	**ug/L**	

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	98 (80 - 120)
Toluene-d8	108 (88 - 110)
Bromofluorobenzene	109 (86 - 115)

B = Consistant with laboratory background.
D25 = Reported from 25X dilution run on 10/01/01.
E1 = Estimated value, continuing calibration criteria exceeded by 16%
E2 = Estimated value, continuing calibration criteria exceeded by 32%

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-11	MW-35-91701	AQUEOUS	09/17/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L	
[illegible] 1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
[illegible]thyl-t-butyl Ether (628-28-4)	**1.0**	**74**	**ug/L**	E
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	**1.0**	**3.2**	**ug/L**	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**1.8**	**ug/L**	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
[illegible]mochloromethane (124-48-1)	1.0	< 1.0	ug/L	
[illegible]chloroethene (127-18-4)	1.0	< 1.0	ug/L	
[illegible]obenzene (108-90-7)	1.0	< 1.0	ug/L	
[illegible]lbenzene (100-41-4)	1.0	< 1.0	ug/L	

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-11	MW-35-91701	AQUEOUS	09/17/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**15**	**ug/L**
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	**1.0**	**1.4**	**ug/L**
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]5-Trimethylbenzene (108-67-8)	**1.0**	**1.8**	**ug/L**
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**39**	**ug/L**
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	**1.0**	**1.0**	**ug/L**
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	**3.0**	**3.8**	**ug/L**
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	96 (80 - 120)
Toluene-d8	98 (88 - 110)
Bromofluorobenzene	103 (86 - 115)

E = Estimated value, continuing calibration criteria exceeded by 20%

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-12	MW-34-91701	AQUEOUS	09/17/01	N/A	09/30/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L	
,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
hyl-t-butyl Ether (628-28-4)	**1.0**	**28**	**ug/L**	E
,2-Trichlorotrifluoroethane (76-13-1)	**5.0**	**9.1**	**ug/L**	B, E2
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	**1.0**	**3.3**	**ug/L**	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**77**	**ug/L**	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
Di mochloromethane (124-48-1)	1.0	< 1.0	ug/L	
hloroethene (127-18-4)	1.0	< 1.0	ug/L	
obenzene (108-90-7)	1.0	< 1.0	ug/L	
benzene (100-41-4)	**1.0**	**11**	**ug/L**	

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-12	MW-34-91701	AQUEOUS	09/17/01	N/A	09/30/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**76**	**ug/L**	
o-Xylene (95-47-6)	1.0	< 1.0	ug/L	
Styrene (100-42-5)	1.0	< 1.0	ug/L	
Bromoform (75-25-2)	1.0	< 1.0	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**36**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**30**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L	
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L	
5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L	
Butylbenzene (98-06-6)	1.0	< 1.0	ug/L	
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**430**	**ug/L**	D5
sec-Butylbenzene (135-98-9)	**1.0**	**9.4**	**ug/L**	
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L	
p-Isopropyltoluene (99-87-6)	**1.0**	**10**	**ug/L**	
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L	
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L	
Naphthalene (91-20-3)	**3.0**	**56**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L	
2-Methyl Naphthalene (97-57-6)	**5.0**	**7.7**	**ug/L**	
1-Methyl Naphthalene (90-12-0)	**5.0**	**6.5**	**ug/L**	

SURROGATE % RECOVERY

1,2-Dichloroethane-d4	99 (80 - 120)
Toluene-d8	107 (88 - 110)
Bromofluorobenzene	108 (86 - 115)

B = Consistant with laboratory background.
D5 = Reported from a 5X dilution run on 10/01/01.
E1 = Estimated value, continuing calibration criteria exceeded by 16%
E2 = Estimated value, continuing calibration criteria exceeded by 32%

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-13	MW-8-91701	AQUEOUS	09/17/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	5.0	< 5.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L	
[illegible] 2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
[illegible]yl-t-butyl Ether (628-28-4)	**1.0**	**2.4**	**ug/L**	E
[illegible],2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	1.0	< 1.0	ug/L	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L	
Te[illegible]oroethene (127-18-4)	1.0	< 1.0	ug/L	
C[illegible]enzene (108-90-7)	1.0	< 1.0	ug/L	
E[illegible]zene (100-41-4)	1.0	< 1.0	ug/L	

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-13	MW-8-91701	AQUEOUS	09/17/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	95 (80 - 120)
Toluene-d8	96 (88 - 110)
Bromofluorobenzene	105 (86 - 115)

E = Estimated value, continuing calibration criteria exceeded by 20%

PINNACLE
LABORATORES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109068
DATE RECEIVED : 09/19/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-14	RW-15-91701	AQUEOUS	09/17/01	N/A	09/30/01	10

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 10	ug/L	
Chloromethane (74-87-9)	1.0	< 10	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 10	ug/L	
Bromomethane (74-83-9)	1.0	< 10	ug/L	
Chloroethane (75-00-3)	1.0	< 10	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 10	ug/L	
Acetone (67-64-1)	10	< 100	ug/L	
Acrolein (107-02-8)	5.0	< 50	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 10	ug/L	
Iodomethane (74-88-4)	5.0	< 50	ug/L	
Methylene Chloride (75-09-2)	1.0	< 10	ug/L	
Acrylonitrile (107-13-1)	5.0	< 50	ug/L	
,2-Dichloroethene (107-06-2)	1.0	< 10	ug/L	
yl-t-butyl Ether (628-28-4)	**1.0**	**25**	**ug/L**	E
,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 50	ug/L	
1,1-Dichloroethane (75-34-3)	1.0	< 10	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 10	ug/L	
2-Butanone (78-93-3)	10	< 100	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 10	ug/L	
Bromochloromethane (74-97-5)	1.0	< 10	ug/L	
Chloroform (67-66-3)	1.0	< 10	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 10	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 10	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 10	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 10	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 10	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 10	ug/L	
Benzene (71-43-2)	**1.0**	**9000**	**ug/L**	D100
1,2-Dichloropropane (78-87-5)	1.0	< 10	ug/L	
Trichloroethene (79-01-6)	1.0	< 10	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 10	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 100	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 10	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 10	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 10	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 10	ug/L	
Dibromomethane (74-95-3)	1.0	< 10	ug/L	
Toluene (108-88-3)	**1.0**	**17000**	**ug/L**	D100
1,2-Dibromoethane (106-93-4)	1.0	< 10	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 100	ug/L	
2-Hexanone (591-78-6)	10	< 100	ug/L	
Di mochloromethane (124-48-1)	1.0	< 10	ug/L	
T loroethene (127-18-4)	1.0	< 10	ug/L	
enzene (108-90-7)	1.0	< 10	ug/L	
enzene (100-41-4)	**1.0**	**4400**	**ug/L**	D100

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
DATE RECEIVED : 09/19/01
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109068-14	RW-15-91701	AQUEOUS	09/17/01	N/A	09/30/01	10

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 10	ug/L	
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**19000**	**ug/L**	**D100**
o-Xylene (95-47-6)	**1.0**	**6000**	**ug/L**	**D100**
Styrene (100-42-5)	1.0	< 10	ug/L	
Bromoform (75-25-2)	1.0	< 10	ug/L	
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 10	ug/L	
1,2,3-Trichloropropane (96-18-4)	1.0	< 10	ug/L	
Isopropyl Benzene (98-82-8)	**1.0**	**130**	**ug/L**	
Bromobenzene (108-86-1)	1.0	< 10	ug/L	
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 10	ug/L	
n-Propylbenzene (103-65-1)	**1.0**	**530**	**ug/L**	
2-Chlorotoluene (95-49-8)	1.0	< 10	ug/L	
4-Chlorotoluene (106-43-4)	1.0	< 10	ug/L	
-Trimethylbenzene (108-67-8)	**1.0**	**940**	**ug/L**	
utylbenzene (98-06-6)	1.0	< 10	ug/L	
-Trimethylbenzene (95-63-6)	**1.0**	**3100**	**ug/L**	**D100**
sec-Butylbenzene (135-98-9)	**1.0**	**26**	**ug/L**	
1,3-Dichlorobenzene (541-73-1)	1.0	< 10	ug/L	
1,4-Dichlorobenzene (106-46-7)	1.0	< 10	ug/L	
p-Isopropyltoluene (99-87-6)	1.0	< 10	ug/L	
1,2-Dichlorobenzene (95-50-1)	1.0	< 10	ug/L	
n-Butylbenzene (104-51-8)	1.0	< 10	ug/L	
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 10	ug/L	
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 10	ug/L	
Naphthalene (91-20-3)	**3.0**	**820**	**ug/L**	
Hexachlorobutadiene (87-68-3)	1.0	< 10	ug/L	
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 10	ug/L	
2-Methyl Naphthalene (97-57-6)	**5.0**	**310**	**ug/L**	
1-Methyl Naphthalene (90-12-0)	**5.0**	**130**	**ug/L**	

SURROGATE % RECOVERY

1,2-Dichloroethane-d4	98 (80 - 120)
Toluene-d8	101 (88 - 110)
Bromofluorobenzene	107 (86 - 115)

D100 = Reported from 100X dilution run on 10/01/01.
E = Estimated value, continuing calibration criteria exceeded by 16%

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	092801	AQUEOUS	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
[illegible]-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
[illegible]thyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
[illegible],1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
[illegible]chloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]obenzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]benzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	092801	AQUEOUS	N/A	09/28/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
[illegible]2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	102 (80 - 120)
Toluene-d8	106 (88 - 110)
Bromofluorobenzene	107 (86 - 115)

PINNACLE
LABORATORIES

2709-D Pan American Freeway NE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	092901	AQUEOUS	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
yl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
T [illegible]hloroethene (127-18-4)	1.0	< 1.0	ug/L
benzene (108-90-7)	1.0	< 1.0	ug/L
enzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORES

2709-D Pan American Freeway NE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	092901	AQUEOUS	N/A	09/29/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1 Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
tylbenzene (98-06-6)	1.0	< 1.0	ug/L
Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	102 (80 - 120)
Toluene-d8	104 (88 - 110)
Bromofluorobenzene	110 (86 - 115)

PINNACLE LABORATORES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 109068
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	100101	AQUEOUS	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
[illegible]2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
[illegible]yl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
[illegible],2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]benzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]enzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109068
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	100101	AQUEOUS	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	105 (80 - 120)
Toluene-d8	105 (88 - 110)
Bromofluorobenzene	102 (86 - 115)

PINNACLE LABORATORIES

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MATRIX SPIKE/MATRIX SPIKE DUPLICATE RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
SPIKED SAMPLE : 109068-13
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91801
PROJECT NAME : MONITOR WELLS

PINNACLE I.D. : 109068
DATE ANALYZED : 10/01/01
UNITS : ug/L (PPB)

COMPOUND	SAMPLE CONC.	SPIKE ADDED	MS RESULT	MSD RESULT	MS %REC	MSD %REC	RPD	QC LIMITS RPD	QC LIMITS %RECOVERY
1,1-DICHLOROETHENE	<1.0	50.0	45.2	45.3	90	91	0	14	61-145
BENZENE	<1.0	50.0	53.2	55.5	106	111	4	11	76-127
TRICHLOROETHENE	<1.0	50.0	48.7	48.1	97	96	1	14	71-120
TOLUENE	<1.0	50.0	52.9	51.9	106	104	2	13	76-125
CHLOROBENZENE	<1.0	50.0	53.4	53.5	107	107	0	13	75-130

Preliminary Results
Final report will be issued following data review

11-08-01

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 111028
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	110701	AQUEOUS	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-3)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	1.0	< 1.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
Methyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
Chlorobenzene (108-90-7)	1.0	< 1.0	ug/L
Ethylbenzene (100-41-4)	1.0	< 1.0	ug/L
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L

Preliminary Results
Final report will be issued following data review

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 111028
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	110701	AQUEOUS	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
tert-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-8)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	99 (80 - 120)
Toluene-d8	102 (88 - 110)
Bromofluorobenzene	98 (86 - 115)

11-08-01

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
SPIKED SAMPLE : 111004-01
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

PINNACLE I.D. : 111026
DATE ANALYZED : 11/07/01
UNITS : ug/L (PPB)

COMPOUND	SAMPLE CONC.	SPIKE ADDED	MS RESULT	MSD RESULT	MS %REC	MSD %REC	RPD	QC LIMITS RPD	QC LIMITS %RECOVERY
1,1-DICHLOROETHENE	<1.0	50.0	47.5	46.8	95	94	1	14	61-145
BENZENE	<1.0	50.0	53.4	52.5	107	105	2	11	76-127
TRICHLOROETHENE	1.4	50.0	54.7	53.4	107	104	2	14	71-120
TOLUENE	<1.0	50.0	53.8	52.5	108	105	2	13	76-125
CHLOROBENZENE	<1.0	50.0	54.8	52.8	110	106	4	13	75-130

BP 11-08-01

Preliminary Results
Final report will be issued following data review

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 111028
PROJECT # : 11601HD DATE RECEIVED : 11/7/01
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
111028-01	11601HD	AQUEOUS	11/06/01	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-3)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	1.0	< 1.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
Methyl-t-butyl Ether (626-28-4)	1.0	< 1.0	ug/L
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
Chlorobenzene (108-90-7)	1.0	< 1.0	ug/L
Ethylbenzene (100-41-4)	1.0	< 1.0	ug/L
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	**1.1**	**ug/L**

Preliminary Results

Final report will be issued following data review

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

PINNACLE I.D. : 111028
DATE RECEIVED : 11/7/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
111028-01	11601HD	AQUEOUS	11/06/01	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	1.0	**2.4**	**ug/L**
tert-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	93 (80 - 120)
Toluene-d8	97 (88 - 110)
Bromofluorobenzene	100 (86 - 115)

PINNACLE
LABORATORIES

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Pinnacle Lab ID number **109075**
October 05, 2001

SAN JUAN REFINING CO.
#50 ROAD 4990
BLOOMFIELD, NM 87413

Project Name MONITOR WELLS
Project Number 91901

Attention: CINDY HURTADO

On 09/20/01 Pinnacle Laboratories, Inc., (ADHS License No. AZ0592 pending), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

H Mitchell

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: jt

Enclosure

PINNACLE LABORATORIES

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LIENT : SAN JUAN REFINING CO.
ROJECT # : 91901
ROJECT NAME : MONITOR WELLS

PINNACLE ID : 109075
DATE RECEIVED : 09/20/01
REPORT DATE : 10/05/01

INNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
09075 - 01	SEEP-2 91901	AQUEOUS	09/19/01

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91901
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109075
DATE RECEIVED : 09/20/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109075-01	Seep-2 91901	AQUEOUS	09/19/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS	
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L	
Chloromethane (74-87-9)	1.0	< 1.0	ug/L	
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L	
Bromomethane (74-83-9)	1.0	< 1.0	ug/L	
Chloroethane (75-00-3)	1.0	< 1.0	ug/L	
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L	
Acetone (67-64-1)	10	< 10	ug/L	
Acrolein (107-02-8)	5.0	< 5.0	ug/L	
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L	
Iodomethane (74-88-4)	1.0	< 1.0	ug/L	
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L	
crylonitrile (107-13-1)	5.0	< 5.0	ug/L	
-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L	
ethyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L	
1,1,2-Trichlorotrifluoroethane (76-13-1)	**5.0**	**5.1**	**ug/L**	B,E
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L	
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L	
2-Butanone (78-93-3)	10	< 10	ug/L	
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L	
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L	
Chloroform (67-66-3)	1.0	< 1.0	ug/L	
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L	
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L	
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L	
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L	
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L	
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L	
Benzene (71-43-2)	**1.0**	**28**	**ug/L**	
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L	
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L	
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L	
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L	
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L	
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L	
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L	
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L	
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L	
Toluene (108-88-3)	1.0	< 1.0	ug/L	
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L	
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L	
2-Hexanone (591-78-6)	10	< 10	ug/L	
romochloromethane (124-48-1)	1.0	< 1.0	ug/L	
rachloroethene (127-18-4)	1.0	< 1.0	ug/L	
orobenzene (108-90-7)	1.0	< 1.0	ug/L	
hylbenzene (100-41-4)	**1.0**	**2.9**	**ug/L**	

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91901
PROJECT NAME : MONITOR WELLS
PINNACLE I.D. : 109075
DATE RECEIVED : 09/20/01

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
109075-01	Seep-2 91901	AQUEOUS	09/19/01	N/A	10/01/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**16**	**ug/L**
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
[illegible]-Trimethylbenzene (108-67-8)	**1.0**	**3.5**	**ug/L**
[illegible]-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	**1.0**	**11**	**ug/L**
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	**3.0**	**8.6**	**ug/L**
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	93 (80 - 120)
Toluene-d8	95 (88 - 110)
Bromofluorobenzene	106 (86 - 115)

B = Result is consistant with laboratory background levels.
E = Value is an estimate

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109075
PROJECT # : 91901
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	100201	AQUEOUS	N/A	10/02/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	1.0	< 1.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
[illegible]lonitrile (107-13-1)	5.0	< 5.0	ug/L
[illegible],2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
[illegible]ethyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
1,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
[illegible]mochloromethane (124-48-1)	1.0	< 1.0	ug/L
[illegible]chloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]robenzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]ylbenzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 109075
PROJECT # : 91901
PROJECT NAME : MONITOR WELLS

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	100201	AQUEOUS	N/A	10/02/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
1,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	1.0	< 1.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	105 (80 - 120)
Toluene-d8	105 (88 - 110)
Bromofluorobenzene	102 (86 - 115)

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
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Phone (505) 344-3777
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MATRIX SPIKE/MATRIX SPIKE DUPLICATE RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
SPIKED SAMPLE : 109068-13
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 91901
PROJECT NAME : MONITOR WELLS

PINNACLE I.D. : 109075
DATE ANALYZED : 10/01/01
UNITS : ug/L (PPB)

COMPOUND	SAMPLE CONC.	SPIKE ADDED	MS RESULT	MSD RESULT	MS %REC	MSD %REC	RPD	QC LIMITS RPD	QC LIMITS %RECOVERY
1,1-DICHLOROETHENE	<1.0	50.0	45.2	45.3	90	91	0	14	61-145
BENZENE	<1.0	50.0	53.2	55.5	106	111	4	11	76-127
TRICHLOROETHENE	<1.0	50.0	48.7	48.1	97	96	1	14	71-120
TOLUENE	<1.0	50.0	52.9	51.9	106	104	2	13	76-125
CHLOROBENZENE	<1.0	50.0	53.4	53.5	107	107	0	13	75-130

PINNACLE LABORATORIES

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Pinnacle Lab ID number **111028**
November 14, 2001

SAN JUAN REFINING CO.
#50 ROAD 4990
BLOOMFIELD, NM 87413

Project Name HAMMOND DITCH
Project Number 11601HD

Attention: BARRY HOLMAN

On 11/07/01 Pinnacle Laboratories, Inc., (ADHS License No. AZ0592 pending), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: jt

Enclosure

PINNACLE LABORATORIES

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Albuquerque, New Mexico 87107
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Fax (505) 344-4413

CLIENT	: SAN JUAN REFINING CO.	PINNACLE ID	: 111028
PROJECT #	: 11601HD	DATE RECEIVED	: 11/07/01
PROJECT NAME	: HAMMOND DITCH	REPORT DATE	: 11/14/01

PINNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
111028 - 01	11601HD	AQUEOUS	11/06/01

PINNACLE LABORATORIES

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Phone (505) 344-3777
Fax (505) 344-4413

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 111028
PROJECT # : 11601HD
DATE RECEIVED : 11/07/01
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
111028-01	11601HD	AQUEOUS	11/06/01	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	1.0	< 1.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
[illegible]hyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
[illegible]2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
[illegible],1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]robenzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]benzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 111028
PROJECT # : 11601HD DATE RECEIVED : 11/07/01
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
111028-01	11601HD	AQUEOUS	11/06/01	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	**1.0**	**1.1**	**ug/L**
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	**1.0**	**2.4**	**ug/L**
t-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	93 (80 - 120)
Toluene-d8	97 (88 - 110)
Bromofluorobenzene	100 (86 - 115)

PINNACLE
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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 111028
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	110701	AQUEOUS	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	1.0	< 1.0	ug/L
Chloroethane (75-00-3)	1.0	< 1.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	1.0	< 1.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
[illegible]thyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
[illegible],2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
[illegible],1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]robenzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]lbenzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 111028
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	110701	AQUEOUS	N/A	11/07/01	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
t-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-9)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L
2-Methyl Naphthalene (97-57-6)	5.0	< 5.0	ug/L
1-Methyl Naphthalene (90-12-0)	5.0	< 5.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	99 (80 - 120)
Toluene-d8	102 (88 - 110)
Bromofluorobenzene	96 (86 - 115)

PINNACLE LABORATORIES

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MATRIX SPIKE/MATRIX SPIKE DUPLICATE RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
SPIKED SAMPLE : 111004-01
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 11601HD
PROJECT NAME : HAMMOND DITCH

PINNACLE I.D. : 111028
DATE ANALYZED : 11/07/01
UNITS : ug/L (PPB)

COMPOUND	SAMPLE CONC.	SPIKE ADDED	MS RESULT	MSD RESULT	MS %REC	MSD %REC	RPD	QC LIMITS RPD	QC LIMITS %RECOVERY
1,1-DICHLOROETHENE	<1.0	50.0	47.5	46.8	95	94	1	14	61-145
BENZENE	<1.0	50.0	53.4	52.5	107	105	2	11	76-127
TRICHLOROETHENE	1.4	50.0	54.7	53.4	107	104	2	14	71-120
TOLUENE	<1.0	50.0	53.8	52.5	108	105	2	13	76-125
CHLOROBENZENE	<1.0	50.0	54.8	52.8	110	106	4	13	75-130

Pinnacle Laboratories Inc.

.IN OF CUSTODY

DATE: 11/6/01 PAGE: 1 OF 1

PLI Accession #: 111028

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER:

COMPANY: SAN JUAN Refining Co.
ADDRESS: #50 CR4990
Bloomfield, NM 87413
PHONE: 505-632-4168
FAX: 505-632-3911

BILL TO: SAme
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject		(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline) MTBE	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081/8082)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310/8270-SIMS)	General Chemistry:		Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:	NUMBER OF CONTAINERS
11601HD	11/6/01	1055	H_2O	07													X															2

PROJECT INFORMATION

PROJ. NO.: 11601HD
PROJ. NAME: Hammond Ditch
P.O. NO.:
SHIPPED VIA: Fed Ex

SAMPLE RECEIPT

NO. CONTAINERS	2
CUSTODY SEALS	Y [✓ N] NA
RECEIVED INTACT	Y
[✓ BLUE ICE]/ICE	6°C

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☒ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☐
CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER
METHANOL PRESERVATION ☐
COMMENTS: FIXED FEE ☐

24 HR RUSH

RELINQUISHED BY: 1.
Signature: Barry Hol Time: 11:40 Am
Printed Name: BARRY Holman Date: 11/6/01
Company: Giant Industries
See reverse side (Force Majeure)

RELINQUISHED BY: 2.
Signature: UPS Time:
Printed Name: Date:
Company:

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: Time: 7:56
Printed Name: Bryan T Pence Date: 11-07-01
Pinnacle Laboratories Inc.

11/10/98 PLI Inc.: Pinnacle Laboratories, Inc. • 2709-D Pan American Freeway, NE • Albuquerque, New Mexico 87107 • (505) 344-3777 • Fax (505) 344-4413 • E-mail: PIN_LAB@WORLDNET.ATT.NET DISTRIBUTION: White - PLI, Canary - Originato

Groundwater Monitoring Analytical Reports

2002

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

PL I.D. **201071**

February 1, 2002

Giant Refining Co.
#50 CR 4990
Bloomfield, NM 87417

Project Name/Number: HAMMOND DITEL 021401

Attention: Barry Holman

On **01/15/02**, Pinnacle Laboratories Inc., (ADHS License No. AZ0592 pending), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

All analyses were performed by EnviroTest Laboratories, LLC. Casper, WY.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

H. Mitchell Rubenstein, Ph.D.
General Manager

MR:jt

Enclosure

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

CLIENT : GIANT REFINING CO.
PROJECT # : 021401
PROJECT NAME : HAMMOND DITEL
DATE RECEIVED : 01/15/02
REPORT DATE : 02/01/02

PL ID: 201071

	PINNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	201071-01	IP #22 HAMMOND	AQUEOUS	01/14/02

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	1

Enviro-Test Laboratories LLC.

Chemical Analysis Report

PINNACLE LABORATORIES, INC
Attn: PROJECT MANAGER
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

Date: 30 JAN 2002

Lab Work Order #: L4438

Date Received: 15 JAN 2002

Project P.O. #:

Project Reference: GIANT REFINERY

Comments:

APPROVED BY: ______________________
Dave Demorest
Project Manager

Date: January 29, 2002
Client: Pinnacle Laboratories, Inc.
Job Number: L4438

SAMPLE DELIVERY GROUP NARRATIVE

The following information is relevant to the interpretation of the data for the above job:

8260 VOLATILES:

1,1-Dichloroethylene in the LCS/LCSD showed very high recovery. This would suggest that any 1,1-Dichloroethylene in the samples might be biased high. As there was no 1,1-DCE in any of the samples, however, any potential high bias is not relevant.

Paul Reeks
Organics Lab Supervisor

Chemical Analysis Report

PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107
ATTN: PROJECT MANAGER

Project: GIANT REFINERY
Purchase Order:

Page: 2 of 4
Report Date: 30-JAN-02
Work Order: L4438
Lab Sample ID: L4438-1
Client Sample ID: IP#22
Date Collected: 14-JAN-02
Sampled By: CLIENT
Date Received: 15-JAN-02
Matrix: WATER

Parameter	Result	Qualifier	MDL	PQL	Units	DF	Run ID	Analyzed	By
Misc									
Volatiles By SW-846 8260B									
Dichlorodifluoromethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Chloromethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Vinyl Chloride	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Bromomethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Chloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Trichlorofluoromethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1-Dichloroethylene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Carbon Disulfide	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1,2-Trichlorotrifluoroethane	<50		50	15	ug/L		R15520	16-JAN-01 21:48	PGR
Iodomethane	<50		50	15	ug/L		R15520	16-JAN-01 21:48	PGR
Acrolein	<50		50	15	ug/L		R15520	16-JAN-01 21:48	PGR
Methylene Chloride	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Acetone	<100		100	30	ug/L		R15520	16-JAN-01 21:48	PGR
trans-1,2-Dichloroethylene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Methyl-tert-Butyl Ether	20		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1-Dichloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Acrylonitrile	<50		50	15	ug/L		R15520	16-JAN-01 21:48	PGR
Vinyl Acetate	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
cis-1,2-Dichloroethylene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
2,2-Dichloropropane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Bromochloromethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Chloroform	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Carbon Tetrachloride	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1,1-Trichloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
2-Butanone	<100		100	30	ug/L		R15520	16-JAN-01 21:48	PGR
1,1-Dichloropropene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Benzene	440		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2-Dichloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Trichloroethylene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Dibromomethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2-Dichloropropane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Bromodichloromethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
2-Chloroethyl Vinyl Ether	<100		100	30	ug/L		R15520	16-JAN-01 21:48	PGR
cis-1,3-Dichloropropene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Toluene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
4-Methyl-2-pentanone	<100		100	30	ug/L		R15520	16-JAN-01 21:48	PGR
trans-1,3-Dichloropropene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Tetrachloroethylene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1,2-Trichloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Dibromochloromethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,3-Dichloropropane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR

Chemical Analysis Report

PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107
ATTN: PROJECT MANAGER

Project: GIANT REFINERY
Purchase Order:

Page: 3 of 4
Report Date: 30-JAN-02
Work Order: L4438
Lab Sample ID: L4438-1
Client Sample ID: IP#22
Date Collected: 14-JAN-02
Sampled By: CLIENT
Date Received: 15-JAN-02
Matrix: WATER

Misc

Volatiles By SW-846 8260B

Parameter	Result	Qualifier	MDL	PQL	Units	DF	Run ID	Analyzed	By
1,2-Dibromoethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
2-Hexanone	<100		100	30	ug/L		R15520	16-JAN-01 21:48	PGR
Ethyl Benzene	120		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Chlorobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1,1,2-Tetrachloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
m+p-Xylenes	2300		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
o-Xylene	120		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Styrene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Bromoform	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Isopropylbenzene	30		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
n-Propylbenzene	30		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,1,2,2-Tetrachloroethane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Bromobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,3,5-Trimethylbenzene	130		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
trans-1,4-Dichloro-2-Butene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
2-Chlorotoluene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2,3-Trichloropropane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
4-Chlorotoluene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
tert-Butylbenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2,4-Trimethylbenzene	430		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Sec-Butylbenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
p-Isopropyltoluene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,3-dichlorobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,4-Dichlorobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
n-Butylbenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2-Dichlorobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2-Dibromo-3-chloropropane	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Hexachlorobutadiene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2,4-Trichlorobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
Naphthalene	20		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
1,2,3-Trichlorobenzene	<10		10	3	ug/L		R15520	16-JAN-01 21:48	PGR
2-Methylnaphthalene	400		200	60	ug/L		R15520	16-JAN-01 21:48	PGR
1-Methylnaphthalene	400		200	60	ug/L		R15520	16-JAN-01 21:48	PGR
Surrogate: Dibromofluoromethane (surr)	106		N/A		%		R15520	16-JAN-01 21:48	PGR
Surrogate: 1,2-Dichloroethane-d4 (Surr)	110		N/A		%		R15520	16-JAN-01 21:48	PGR
Surrogate: Toluene-d8 (surr)	103		N/A		%		R15520	16-JAN-01 21:48	PGR
Surrogate: 4-Bromofluorobenzene (surr)	105		N/A		%		R15520	16-JAN-01 21:48	PGR

Reference Information

The following is the Description of sample Qualifiers where applicable:

The following Preparation/Extraction Methods were performed:

ETL Test Code and Matrix		Test Description	Methodology Reference (Based On)
8260-PINNACLE-CA	Water	Volatiles By SW-846 8260B	

The following Analytical Methods were performed:

ETL Test Code and Matrix		Test Description	Methodology Reference (Based On)
8260-PINNACLE-CA	Water	Volatiles By SW-846 8260B	SW-846 Method 8260B

ENVIRO-TEST QC REPORT

Client: PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

Contact: PROJECT MANAGER

Page 1 of 4
Report Date: Jan. 30, 2002
Workorder: L4438

Test	Matrix	Reference	Result	Qualifier	Units	Limit	Analyzed
8260-PINNACLE-CA	Water						
Batch R15520							
WG12223-1 BLANK							
1,1,1,2-Tetrachloroethane			<1		ug/L		15-JAN-01
1,1,1-Trichloroethane			<1		ug/L		15-JAN-01
1,1,2,2-Tetrachloroethane			<1		ug/L		15-JAN-01
1,1,2-Trichloroethane			<1		ug/L		15-JAN-01
1,1,2-Trichlorotrifluoroethane			<5		ug/L		15-JAN-01
1,1-Dichloroethane			<1		ug/L		15-JAN-01
1,1-Dichloroethylene			<1		ug/L		15-JAN-01
1,1-Dichloropropene			<1		ug/L		15-JAN-01
1,2,3-Trichlorobenzene			<1		ug/L		15-JAN-01
1,2,3-Trichloropropane			<1		ug/L		15-JAN-01
1,2,4-Trichlorobenzene			<1		ug/L		15-JAN-01
1,2,4-Trimethylbenzene			<1		ug/L		15-JAN-01
1,2-Dibromo-3-chloropropane			<1		ug/L		15-JAN-01
1,2-Dichlorobenzene			<1		ug/L		15-JAN-01
2-Dichloroethane			<1		ug/L		15-JAN-01
2-Dichloropropane			<1		ug/L		15-JAN-01
1,3,5-Trimethylbenzene			<1		ug/L		15-JAN-01
1,3-dichlorobenzene			<1		ug/L		15-JAN-01
1,3-Dichloropropane			<1		ug/L		15-JAN-01
1,4-Dichlorobenzene			<1		ug/L		15-JAN-01
1-Methylnaphthalene			<20		ug/L		15-JAN-01
2,2-Dichloropropane			<1		ug/L		15-JAN-01
2-Chloroethyl Vinyl Ether			<10		ug/L		15-JAN-01
2-Chlorotoluene			<1		ug/L		15-JAN-01
2-Hexanone			<10		ug/L		15-JAN-01
2-Methylnaphthalene			<20		ug/L		15-JAN-01
4-Chlorotoluene			<1		ug/L		15-JAN-01
p-Isopropyltoluene			<1		ug/L		15-JAN-01
Acetone			<10		ug/L		15-JAN-01
Acrolein			<5		ug/L		15-JAN-01
Acrylonitrile			<5		ug/L		15-JAN-01
Benzene			<1		ug/L		15-JAN-01
Bromobenzene			<1		ug/L		15-JAN-01
Bromochloromethane			<1		ug/L		15-JAN-01

ENVIRO-TEST QC REPORT

Client: PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

Contact: PROJECT MANAGER

Page 2 of 4
Report Date: Jan. 30, 2002
Workorder: L4438

Test	Matrix	Reference	Result	Qualifier	Units	Limit	Analyzed
8260-PINNACLE-CA	Water						
Batch	R15520						
WG12223-1	BLANK						
Bromodichloromethane			<1		ug/L		15-JAN-01
Bromoform			<1		ug/L		15-JAN-01
Bromomethane			<1		ug/L		15-JAN-01
Carbon Disulfide			<1		ug/L		15-JAN-01
Carbon Tetrachloride			<1		ug/L		15-JAN-01
Chlorobenzene			<1		ug/L		15-JAN-01
Dibromochloromethane			<1		ug/L		15-JAN-01
Chloroethane			<1		ug/L		15-JAN-01
Chloroform			<1		ug/L		15-JAN-01
Chloromethane			<1		ug/L		15-JAN-01
cis-1,2-Dichloroethylene			<1		ug/L		15-JAN-01
cis-1,3-Dichloropropene			<1		ug/L		15-JAN-01
Dibromomethane			<1		ug/L		15-JAN-01
Dichlorodifluoromethane			<1		ug/L		15-JAN-01
yl Benzene			<1		ug/L		15-JAN-01
[illegible]2-Dibromoethane			<1		ug/L		15-JAN-01
Hexachlorobutadiene			<1		ug/L		15-JAN-01
Iodomethane			<5		ug/L		15-JAN-01
Isopropylbenzene			<1		ug/L		15-JAN-01
m+p-Xylenes			<1		ug/L		15-JAN-01
2-Butanone			<10		ug/L		15-JAN-01
4-Methyl-2-pentanone			<10		ug/L		15-JAN-01
Methyl-tert-Butyl Ether			<1		ug/L		15-JAN-01
Methylene Chloride			<1		ug/L		15-JAN-01
n-Butylbenzene			<1		ug/L		15-JAN-01
n-Propylbenzene			<1		ug/L		15-JAN-01
Naphthalene			<1		ug/L		15-JAN-01
o-Xylene			<1		ug/L		15-JAN-01
Sec-Butylbenzene			<1		ug/L		15-JAN-01
Styrene			<1		ug/L		15-JAN-01
tert-Butylbenzene			<1		ug/L		15-JAN-01
Tetrachloroethylene			<1		ug/L		15-JAN-01
Toluene			<1		ug/L		15-JAN-01
trans-1,2-Dichloroethylene			<1		ug/L		15-JAN-01

ENVIRO-TEST QC REPORT

Client: PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

Contact: PROJECT MANAGER

Page 3 of 4
Report Date: Jan. 30, 2002
Workorder: L4438

Test	Matrix	Reference	Result	Qualifier	Units		Limit	Analyzed
8260-PINNACLE-CA	Water							
Batch R15520								
WG12223-1 BLANK								
trans-1,3-Dichloropropene			<1		ug/L			15-JAN-01
trans-1,4-Dichloro-2-Butene			<1		ug/L			15-JAN-01
Trichloroethylene			<1		ug/L			15-JAN-01
Trichlorofluoromethane			<1		ug/L			15-JAN-01
Vinyl Acetate			<1		ug/L			15-JAN-01
Vinyl Chloride			<1		ug/L			15-JAN-01
WG12223-2 LCS						Amount		
1,1-Dichloroethylene			192		%	N/A	70-130	15-JAN-01
Benzene			108		%	N/A	70-130	15-JAN-01
Chlorobenzene			101		%	N/A	70-130	15-JAN-01
Toluene			96		%	N/A	70-130	15-JAN-01
Trichloroethylene			107		%	N/A	70-130	15-JAN-01
WG12223-3 LCSD		WG12223-2						
1,1-Dichloroethylene			210		%	10	20	15-JAN-01
Benzene			110		%	1.8	20	15-JAN-01
[illegible]lorobenzene			110		%	3.9	20	15-JAN-01
Toluene			100		%	5.1	20	15-JAN-01
Trichloroethylene			110		%	1.9	20	15-JAN-01

Product - Batch and Sample Number Relations:

8260-PINNACLE-CA 1
R15485 L4438-1
8260-PINNACLE-CA 1
R15520 L4438-1

Reference Information

Page 4 of 4
Report Date: Jan. 30, 2002
Work Order L4438

The following is a description of Sample types that where applicable:

BLANK	Laboratory Blank
LCS	Laboratory Control Spike
LCSD	Lab Control Spike Duplicate

The following is a description of sample Qualifiers that where applicable:

ETL EnviroTest LABORATORIES

Sample Condition Notification Form

Client Pinnacle Date 1/15/02 Job Number L4438

Condition Reported		Explanation
Samples received out of holding time		
Samples not preserved correctly	✓	Samples arrived in 2·8oz jars poured off into 3) VOA's HCl as per paul JRS 1/15/02
Containers broken/spilled in shipment		
Insufficient sample received		
Incorrect containers used		
Chain of Custody does not match labels		
Samples not chilled to ± 2-4°C		
Volatiles have headspace		
Chain of Custody not received or incomplete		
Other problems as noted		

Comments:

Form #SCNF, Revision 0, Effective date 02/26/01

ETL **Enviro • Test**
LABORATORIES LLC.

Sample Receipt Checklist

Client	Pinnacle Labs.	Job Number	L4438

Samples Shipped	[✓ UPS]	Federal Express	Airborn:
Samples Hand Delivered	Client	ETL Lab Courier	Other:

*Air Bill #: 1Z8818390110092041	# of Packages Received: 1

	Yes	No	N\A	Comments
1. Chain - of - Custody present?	✓			If no, please fill one out.
2. Are the COC and sample labels legible?	✓			
3. Custody Seal on shipping container?		✓		
If yes, intact on shipping container?				
4. Custody seals on sample containers?		✓		
If yes, intact on sample container?				
5. Samples chilled?	✓			
Is temperature of cooler: 4 ± 2°C ?	✓			*Record temp: 3°C
6. Samples received intact (good condition)?	✓			
If volatiles required, any with headspace?				
7. Adequate sample volume provided?	✓			
8. Samples preserved correctly?		✓		$Na_2S_2O_3$, ZnAc, HNO_3, HCl
Circle preservative types in shipment				H_2SO_4, NaOH, [✓ Plain], Other
9. Correct containers used?		✓		poured off into 3 VOA's
10. Samples received within holding time?	✓			
11. Agreement between COC and sample labels?	✓			
12. Gamma Screen μR/Hr @ surface within Bkg?	✓			FOR INTERNAL USE ONLY @ Bkg
13. Samples OK to release to Lab/Screening?	✓			

Additional Comments:

Sample Container (size/material): 2) 8oz glass jars

Received and inspected by: JKS

Date/Time: 1-15-02 0945

* = for multiple packages, see attached page(s) for shipping numbers and temperatures.

Form SR Checklist.doc Rev 1 Effective Date 5/21/01

PINNACLE LABORATORIES

Pinnacle Laboratories Inc.

CH..IN OF CUSTODY

DATE: 1/14/02 PAGE: 1 OF 1

PLI Accession #: 201071

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PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: B.G. Holman
COMPANY: Giant Refining Co.
ADDRESS: #50 CR 4990
Bloomfield NM. 87413
PHONE: 505-632-4168
FAX: 505 632-3911
BILL TO: SAme
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject		(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline) MTBE	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081/8082)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310/8270-SIMS)	General Chemistry:		Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
TP#22 Hammond	1/14/02	1pm	H2O															X															2

PROJECT INFORMATION

PROJ. NO.: 021401
PROJ. NAME: Hammond Ditch
P.O. NO.:
SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	
CUSTODY SEALS	Y / N / NA
RECEIVED INTACT	
BLUE ICE/ICE	

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☒24hr ☐48hr ☐72hr ☐1 WEEK (NORMAL) ☐
CERTIFICATION REQUIRED: ☐NM ☐SDWA ☐OTHER
METHANOL PRESERVATION ☐
COMMENTS: FIXED FEE ☐

RELINQUISHED BY: 1.
Signature: Time: 1pm
Printed Name: BARRY HOLMAN Date: 1/14/02
Company:
See reverse side (Force Majure)

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: Tammie Scheetz Time: 0945
Printed Name: TAmmie Scheetz Date: 1-15-0
Pinnacle Laboratories Inc.

11/10/98 PLI Inc.: Pinnacle Laboratories, Inc. • 2709-D Pan American Freeway, NE • Albuquerque, New Mexico 87107 • (505) 344-3777 • Fax (505) 344-4413 • E-mail: PIN_LAB@WORLDNET.ATT.NET DISTRIBUTION: White - PLI, Canary - Originator

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Pinnacle Lab ID number **201076**
January 28, 2002

SAN JUAN REFINING CO.
#50 ROAD 4990
BLOOMFIELD, NM 87413

Project Name	HAMMOND DITCH WEST
Project Number	021601

Attention: BARRY HOLMAN

On 01/17/02 Pinnacle Laboratories, Inc., (ADHS License No. AZ0592 pending), received a request to analyze **aqueous and non-aq** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

H. Mitchell Rubenstein

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: jt

Enclosure

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CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE ID : 201076
DATE RECEIVED : 01/17/02
REPORT DATE : 01/28/02.

PINNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
201076 - 01	#1 HAMMOND	NON-AQ	01/15/02
201076 - 02	#2 HAMMOND	NON-AQ	01/15/02
201076 - 03	#1 DITCH	NON-AQ	01/16/02
201076 - 04	#2 DITCH	NON-AQ	01/16/02
201076 - 05	#1 WATER	AQUEOUS	01/18/02
201076 - 06	#2 WATER	AQUEOUS	01/18/02

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GENERAL CHEMISTRY RESULTS
418.1

CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST
PINNACLE I.D. : 201076
DATE RECEIVED : 01/17/02

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	#1 HAMMOND	NON-AQ	01/15/02	01/18/02	01/18/02	10
02	#2 HAMMOND	NON-AQ	01/15/02	01/18/02	01/18/02	1
03	#1 DITCH	NON-AQ	01/16/02	01/18/02	01/18/02	1

PARAMETER	DET. LIMIT	UNITS	#1 HAMMOND	#2 HAMMOND	#1 DITCH
PETROLEUM HYDROCARBONS	20	**MG/KG**	**3400**	**250**	< 20
DRY WEIGHT (%)			89	91	78

CHEMIST NOTES:

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GENERAL CHEMISTRY RESULTS
418.1

CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE RECEIVED : 01/17/02

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	#2 DITCH	NON-AQ	01/16/02	01/18/02	01/18/02	1

PARAMETER	DET. LIMIT	UNITS	#2 DITCH
PETROLEUM HYDROCARBONS	20	**MG/KG**	**21**
DRY WEIGHT (%)			83

CHEMIST NOTES:
N/A

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GENERAL CHEMISTRY - REAGENT BLANK
418.1

CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST
PINNACLE I.D. : 201076
SAMPLE MATRIX : NON-AQ
UNITS : MG/KG

PARAMETER	REAGENT BLANK I.D.	SAMPLE RESULT
PETROLEUM HYDROCARBONS	011802	<20

CHEMIST NOTES:
N/A

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GENERAL CHEMISTRY - QUALITY CONTROL
418.1

CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST
PINNACLE I.D. : 201076
SAMPLE MATRIX : NON-AQ
UNITS : MG/KG

PARAMETER	BLANK I.D.	SAMPLE RESULT	DUP. RESULT	% RPD	SPIKED SAMPLE	SPIKE CONC.	% REC
PETROLEUM HYDROCARBONS	201076-03	<20	<20	N/A	159	154	103%

CHEMIST NOTES:
N/A

$$\% \text{ Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \text{ X } 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{\text{(Sample Result - Duplicate Result)}}{\text{Average Result}} \text{ X } 100$$

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GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D.: 201076
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	#1 HAMMOND	NON-AQ	01/15/02	01/17/02	01/18/02	25
02	#2 HAMMOND	NON-AQ	01/15/02	01/17/02	01/18/02	1
03	#1 DITCH	NON-AQ	01/16/02	01/17/02	01/18/02	1

PARAMETER	DET. LIMIT	UNITS	#1 HAMMOND	#2 HAMMOND	#1 DITCH
BENZENE	0.025	**MG/KG**	**2.6**	< 0.025	< 0.025
TOLUENE	0.025	**MG/KG**	**3.3**	**0.065**	< 0.025
ETHYLBENZENE	0.025	**MG/KG**	**11**	**0.22**	< 0.025
TOTAL XYLENES	0.050	**MG/KG**	**130**	**2.2**	**0.056**

S[illegible]OGATE:					
B[illegible]MOFLUOROBENZENE (%)			100	118	86
SURROGATE LIMITS	(65 - 120)				

CHEMIST NOTES:
N/A

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GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D.: 201076
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	#2 DITCH	NON-AQ	01/16/02	01/17/02	01/18/02	1

PARAMETER	DET. LIMIT	UNITS	#2 DITCH
BENZENE	0.025	**MG/KG**	**0.038**
TOLUENE	0.025	MG/KG	< 0.025
ETHYLBENZENE	0.025	**MG/KG**	**0.065**
TOTAL XYLENES	0.050	**MG/KG**	**1.5**

SURROGATE:
BROMOFLUOROBENZENE (%) 120
SURROGATE LIMITS (65 - 120)

CHEMIST NOTES:
N/A

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GAS CHROMATOGRAPHY RESULTS
REAGENT BLANK

TEST	: EPA 8021 MODIFIED	PINNACLE I.D.	:	201076
BLANK I. D.	: SRB 11702B	DATE EXTRACTED	:	01/17/02
CLIENT	: SAN JUAN REFINING CO.	DATE ANALYZED	:	01/18/02
PROJECT #	: 021601	SAMPLE MATRIX	:	NON-AQ
PROJECT NAME	: HAMMOND DITCH WEST			

PARAMETER	UNITS	
BENZENE	MG/KG	<0.025
TOLUENE	MG/KG	<0.025
ETHYLBENZENE	MG/KG	<0.025
TOTAL XYLENES	MG/KG	<0.050

SURROGATE:
BROMOFLUOROBENZENE (%) 104
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N[illegible]

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GAS CHROMATOGRAPHY QUALITY CONTROL
LCS/LCSD

TEST : EPA 8021 MODIFIED
BATCH ID# : 011802
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXRACTED : 01/17/02
DATE ANALYZED : 01/18/02
SAMPLE MATRIX : NON-AQ
UNITS : MG/KG

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
BENZENE	<0.025	1.00	1.02	103	0.99	99	3	(68 - 120)	20
TOLUENE	<0.025	1.00	1.02	102	0.99	99	3	(64 - 120)	20
ETHYLBENZENE	<0.025	1.00	1.02	103	0.99	100	3	(49 - 127)	20
TOTAL XYLENES	<0.050	3.00	3.13	105	3.03	101	3	(58 - 120)	20
METHYL-t-BUTYL ETHER	<0.13	1.00	1.08	108	1.00	101	8	(66 - 120)	20

CHEMIST NOTES:
N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

NACLE
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GAS CHROMATOGRAPHY QUALITY CONTROL
MS/MSD

T : EPA 8021 MODIFIED
MSD # : 201076-03
ENT : SAN JUAN REFINING CO.
JECT # : 021601
JECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXTRACTED : 01/17/02
DATE ANALYZED : 01/18/02
SAMPLE MATRIX : NON-AQ
UNITS : MG/KG

RAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
NZENE	<0.025	1.00	0.94	94	0.94	94	0	(68 - 120)	20
LUENE	<0.025	1.00	0.98	98	0.97	97	1	(64 - 120)	20
HYLBENZENE	<0.025	1.00	0.92	92	0.92	92	0	(49 - 127)	20
TAL XYLENES	**0.056**	3.00	2.85	93	2.82	92	1	(58 - 120)	20
THYL-t-BUTYL ETHER	<0.13	1.00	1.01	101	0.94	94	7	(66 - 120)	20

IEMIST NOTES:
A

$$\text{Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \text{ X 100}$$

$$\text{D (Relative Percent Difference)} = \frac{\text{(Sample Result - Duplicate Result)}}{\text{Average Result}} \text{ X 100}$$

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GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D.: 201076
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
05	#1 WATER	AQUEOUS	01/18/02	NA	01/18/02	10
06	#2 WATER	AQUEOUS	01/18/02	NA	01/18/02	10

PARAMETER	DET. LIMIT	UNITS	#1 WATER	#2 WATER
BENZENE	0.5	**UG/L**	**54**	**110**
TOLUENE	0.5	UG/L	< 5.0	< 5.0
ETHYLBENZENE	0.5	**UG/L**	**22**	**36**
TOTAL XYLENES	1.0	**UG/L**	**420**	**700**

SURROGATE:

B[illegible]OFLUOROBENZENE (%)			117	108
S[illegible]ROGATE LIMITS	(80 - 120)			

CHEMIST NOTES:
N/A

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GAS CHROMATOGRAPHY RESULTS
REAGENT BLANK

TEST : EPA 8021 MODIFIED
BLANK I. D. : 011702
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXTRACTED : N/A
DATE ANALYZED : 01/17/02
SAMPLE MATRIX : AQUEOUS

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<1.0

SURROGATE:
BROMOFLUOROBENZENE (%) 103
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N/A

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GAS CHROMATOGRAPHY RESULTS
REAGENT BLANK

TEST : EPA 8021 MODIFIED
BLANK I. D. : 011802
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXTRACTED : N/A
DATE ANALYZED : 01/18/02
SAMPLE MATRIX : AQUEOUS

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<1.0

SURROGATE:
BROMOFLUOROBENZENE (%) 105
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N

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GAS CHROMATOGRAPHY QUALITY CONTROL
LCS/LCSD

TEST : EPA 8021 MODIFIED
BATCH ID# : 011702
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXTRACTED : N/A
DATE ANALYZED : 01/17/02
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
BENZENE	<0.5	20.0	20.7	104	20.2	101	2	(80 - 120)	20
TOLUENE	<0.5	20.0	20.7	104	20.1	101	3	(80 - 120)	20
ETHYLBENZENE	<0.5	20.0	20.8	104	20.3	102	2	(80 - 120)	20
TOTAL XYLENES	<1.0	60.0	63.2	105	62.4	104	1	(80 - 120)	20
METHYL-t-BUTYL ETHER	<2.5	20.0	20.6	103	20.4	102	1	(70 - 133)	20

C[illegible]IST NOTES:
N/A

$$\% \text{ Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \text{ X } 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{\text{(Sample Result - Duplicate Result)}}{\text{Average Result}} \text{ X } 100$$

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GAS CHROMATOGRAPHY QUALITY CONTROL
LCS/LCSD

TEST : EPA 8021 MODIFIED
BATCH ID# : 011802
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXRACTED : N/A
DATE ANALYZED : 01/18/02
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
BENZENE	<0.5	20.0	20.5	103	19.8	99	3	(80 - 120)	20
TOLUENE	<0.5	20.0	20.4	102	19.8	99	3	(80 - 120)	20
ETHYLBENZENE	<0.5	20.0	20.5	103	19.9	100	3	(80 - 120)	20
TOTAL XYLENES	<1.0	60.0	62.7	105	60.6	101	3	(80 - 120)	20
METHYL-t-BUTYL ETHER	<2.5	20.0	21.6	108	20.1	101	7	(70 - 133)	20

C[illegible]ST NOTES:
N/A

$$\text{\% Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \text{ X 100}$$

$$\text{RPD (Relative Percent Difference)} = \frac{\text{(Sample Result - Duplicate Result)}}{\text{Average Result}} \text{ X 100}$$

PINNACLE
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GAS CHROMATOGRAPHY QUALITY CONTROL
MSMSD

TEST : EPA 8021 MODIFIED
MSMSD # : 201074-01
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE EXRACTED : N/A
DATE ANALYZED : 01/17/02
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
BENZENE	<0.5	20.0	20.8	104	20.4	102	2	(80 - 120)	20
TOLUENE	<0.5	20.0	20.7	104	20.6	103	0	(80 - 120)	20
ETHYLBENZENE	<0.5	20.0	20.7	104	20.7	104	0	(80 - 120)	20
TOTAL XYLENES	<1.0	60.0	63.1	105	62.7	105	1	(80 - 120)	20
METHYL-t-BUTYL ETHER	<2.5	20.0	18.2	91	17.6	88	3	(70 - 133)	20

[illegible]MIST NOTES:
N/A

$$\% \text{ Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \text{ X } 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{\text{(Sample Result - Duplicate Result)}}{\text{Average Result}} \text{ X } 100$$

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

Pinnacle Laboratories Inc.

C IN OF CUSTODY

DATE: 1-17-02 PAGE: 1 OF 1

PLI Accession #: 201076

PROJECT MANAGER: BARRY Holman

COMPANY: SAN JUAN Refining Co.

ADDRESS: #50 CR 4990
Bloomfield Nm. 87413

PHONE: 505-632-4168

FAX: 505-632-3911

BILL TO: Same

COMPANY:

ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject		(M8015) Gas/Purge & Trap	8021 (BTEX)/~~8015 (Gasoline) MTBE~~	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081/8082)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310/8270-SIMS)	General Chemistry:		Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
#1 Hammond	1-15-02	215 pm	Soil	01	X				X																								1
#2 Hammond	1-15-02	330 pm	Soil	02	X				X																								1
#1 Ditch	1-16-02	110 pm	Soil	03	X				X																								1
#2 Ditch	1-16-02	110 pm	Soil	04	X				X																								1
#1 Water	1-18-02	850 Am	H2o	05					X																								2
#2 Water	1-18-02	855 Am	H2o	06					X																								2

PROJECT INFORMATION

PROJ. NO.: 0216 01

PROJ. NAME: Hammond Ditch West

P.O. NO.:

SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	8
CUSTODY SEALS	Y/N [✓ NA]
RECEIVED INTACT	Yes
BLUE ICE/[✓ ICE]	3.5°

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☒ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☐

CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER

METHANOL PRESERVATION ☐

COMMENTS: FIXED FEE ☐

RELINQUISHED BY: 1.

Signature: Time: 920 am

Printed Name: BARRY HOLMAN Date: 1/18/02

Company:

See reverse side (Force Majeure)

RECEIVED BY: 1.

Signature: Time:

Printed Name: Date:

Company:

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date:

Company:

RECEIVED BY: (LAB) 2.

Signature: Francine Time: 1630

Printed Name: Francine Tarvio Date: 1/18/02

Pinnacle Laboratories Inc.

11/10/98 PLI Inc.: Pinnacle Laboratories, Inc. • 2709-D Pan American Freeway, NE • Albuquerque, New Mexico 87107 • (505) 344-3777 • Fax (505) 344-4413 • E-mail: PIN_LAB@WORLDNET.ATT.NET DISTRIBUTION: White - PLI Canary - Originator

3.2.2.1

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED requested a summary table presenting the 2000 groundwater sampling data related to Plate 20 benzene isopleths for 2000.

NMED also stated "The last paragraph in the "Naphthalene" section mentions a reduction in dissolved iron concentrations as being indicative on biodegradation of hydrocarbons along with decreased dissolved oxygen, nitrate, and sulfate. Iron and manganese reducing bacteria transform these metals from an insoluble to a more soluble state which would result in increased dissolved iron concentrations therefore decreased dissolved iron concentrations are not indicative of biodegradation."

NMED therefore requested background concentrations for RCRA metals and OCD groundwater quality parameters must be established in soil and groundwater. Background sampling should be conducted at a location upgradient of the new evaporation ponds. In addition, the causes for the detection of elevated concentrations of concentrations of constituents in groundwater samples obtained from monitoring well MW-8 should be discussed.

Response

This attachment includes a summary table of the VOC information provided in Attachment 3.2.2 as well as the laboratory results.

BRC is installing a new well to establish background concentrations. Information on this well is provided in the monitoring and sampling plan provided in Attachment 6. Result from the new well will be used to establish the background concentrations for RCRA metals and OCD groundwater quality parameters.

Laboratory Results

Table 5
Groundwater Sampling Event
September 2000

Method	SW-846 5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	5030A/ 8021B	RSK 147	EPA 300.0	EPA 300.0	EPA 4.1.1/ 200.71 CP
Liquid Reporting Limit (μg/L)[a]	5	750	700	620[b]	620[b]	30[c]	100	600,000	10,000	1,000
Location	Benzene	Toluene	Ethylbenzene	o-Xylene	mp-Xylenes	Napthalene	Methane	Sulfate	Nitrate	Iron
SEEP #1	1600	ND	720	ND	97	360	—	—	—	—
SEEP #4	ND	ND	ND	ND	ND	ND	—	—	—	—
SEEP #5	ND	ND	ND	ND	24	11	—	—	—	—
MW-1	ND	ND	ND	ND	ND	ND	—	130	1.4	—
MW-3	ND	ND	ND	ND	ND	ND	—	980	41	—
MW-4	9100	ND	850	ND	ND	ND	—	ND	ND	—
MW-8	ND	ND	ND	ND	ND	ND	ND	830	12	0.07
MW-9	15000	260	940	340	4400	510	—	13.6	ND	—
MW-11	250	ND	15	ND	160	ND	3.7	46	ND	15.3
MW-12	10	ND	2.3	ND	31	2.0	—	2100	ND	—
MW-26	4600	ND	1000	ND	4300	170	—	1.0	ND	—
MW-27	18	ND	9.9	ND	64	50	—	49	ND	—
MW-34	140	ND	17	ND	85	47	3.9	55	ND	5.72
MW-35	21	ND	4.6	ND	100	9.5	ND	120	ND	2.77
MW-36	7.7	ND	15	ND	150	15	—	90	ND	—
RW-1	180	ND	18	ND	25	38	—	346	ND	—
RW-15	7600	14000	3300	4600	14000	890	0.79	2.26	ND	3.42

a Based on EPA Region 6 Human Health Medium-Specific Screening Levels (2001) and NM WQCC Regulations (1999). Analytical detection limits are required to be lower than reporting limits.

b Regulatory limits for individual isomers combined into a "total" limit for these compounds

c Total naphthalene plus monomethylnaphthalenes regulatory limit is <30 μg/L for aqueous samples

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FAX TRANSMITTAL SHEET

DELIVER TO: Barry H **PHONE NUMBER:**

COMPANY: ST Refining **FAX NUMBER:** 505.632.3911

NUMBER OF PAGES BEING SENT: 6 (INCLUDING THIS PAGE)

From:

[✓ H. Mitchell Rubenstein, Ph.D., President/CEO]
Jacinta A. Tenorio, Project Manager
Francine J. Torivio, Sample Control
Deb Rezanka, Asst. Lab Manager
Brian Pence, Senior Chemist

Date: 01.19

Time: 1705

FAX NUMBER:
(505) 344-4413

COMMENTS:

Barry

418.1 & 8021 Results

Mitch

If you did not receive all page of this transmission or if you experience Fax Transmission problems. Please call (505) 344-3777, as soon as possible.

Preliminary Results

Final report will be issued following data review

GENERAL CHEMISTRY RESULTS

418.1

CLIENT : SAN JUAN REFINING CO.
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

PINNACLE I.D. : 201076
DATE RECEIVED : 1/17/02

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	[redacted]MMOND	NON-AQ	[redacted]	1/18/02	1/18/02	10
02	[redacted]MMOND	NON-AQ	[redacted]	1/18/02	1/18/02	1
03	[redacted]CH	NON-AQ	[redacted]	1/18/02	1/18/02	1

PARAMETER	DET. LIMIT	UNITS	#1 HAMMOND	#2 HAMMOND	#1 DITCH
PETROLEUM HYDROCARBONS	20	**MG/KG**	**3400** ✓	**250** ✓	< 20 ✓
DRY WEIGHT (%)			89 ✓	91 ✓	78 ✓

CHEMIST NOTES:
N/A

01/19/02

H 011902

Preliminary Results

Final report will be issued
following data review

GENERAL CHEMISTRY RESULTS
418.1

CLIENT	: SAN JUAN REFINING CO.	PINNACLE I.D.	: 201076
PROJECT #	: 021601	DATE RECEIVED	: 1/17/02
PROJECT NAME	: HAMMOND DITCH WEST		

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	[redacted]CH	NON-AQ	[redacted]	1/18/02	1/18/02	1

PARAMETER	DET. LIMIT	UNITS	#2 DITCH
PETROLEUM HYDROCARBONS	20	**MG/KG**	**21** ✓
DRY WEIGHT (%)			83 ✓

C[illegible]IST NOTES:
N[illegible]

LJ
11902
01/19/02
CR

Preliminary Results
Final report will be issued following data review

GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D.: 201076
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	[redacted]MMOND	NON-AQ	[redacted]	1/17/02	1/18/02	25 ✓
02	[redacted]MMOND	NON-AQ	[redacted]	1/17/02	1/18/02	1
03	[redacted]CH	NON-AQ	[redacted]	1/17/02	1/18/02	1

PARAMETER	DET. LIMIT	UNITS	#1 HAMMOND	#2 HAMMOND	#1 DITCH
BENZENE	0.025	**MG/KG**	**2.6** ✓	< 0.025	< 0.025
TOLUENE	0.025	**MG/KG**	**3.3** ✓	**0.065** ✓	< 0.025
ETHYLBENZENE	0.025	**MG/KG**	**11** ✓	**0.22** ✓	< 0.025
T[illegible]L XYLENES	0.025	**MG/KG**	**130** ✓	**2.2** ✓	**0.056** ✓

SURROGATE:

BROMOFLUOROBENZENE (%)		100 ✓	118 ✓	86 ✓
SURROGATE LIMITS	(65 - 120)			

CHEMIST NOTES:
N/A

01/19/02
CH

H
01.19.02

Preliminary Results

Final report will be issued following data review

GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D.: 201076
PROJECT # : 021601
PROJECT NAME : HAMMOND DITCH WEST

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	[redacted]CH	NON-AQ	[redacted]	1/17/02	1/18/02	1

PARAMETER	DET. LIMIT	UNITS	#2 DITCH
BENZENE	0.025	**MG/KG**	**0.038** ✓
TOLUENE	0.025	MG/KG	< 0.025
ETHYLBENZENE	0.025	**MG/KG**	**0.065** ✓
TOTAL XYLENES	0.025	**MG/KG**	**1.5** ✓

S[illegible]OGATE:

BR[illegible]MOFLUOROBENZENE (%)		120 ✓
SURROGATE LIMITS	(65 - 120)	

CHEMIST NOTES:
N/A

01.19.02

01/19/02
am

Preliminary Results

Final report will be issued following data review

GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED

CLIENT : SAN JUAN REFINING CO. PINNACLE I.D.: 201076

PROJECT # : 021601

PROJECT NAME : HAMMOND DITCH WEST

SAMPLE ID #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
05	[redacted]TER	AQUEOUS	[redacted]	NA	1/18/02	10
06	[redacted]TER	AQUEOUS	[redacted]	NA	1/18/02	10

PARAMETER	DET. LIMIT	UNITS	#1 WATER	#2 WATER
BENZENE	0.5	**UG/L**	**54** ✓	**110** ✓
TOLUENE	0.5	UG/L	< 5.0	< 5.0 ✓
ETHYLBENZENE	0.5	**UG/L**	**22** ✓	**36** ✓
TOTAL XYLENES	0.5	**UG/L**	**420** ✓	**700** ✓

SURROGATE:				
BROMOFLUOROBENZENE (%)			117 ✓	108 ✓
SURROGATE LIMITS	(80 - 120)			

CHEMIST NOTES:
N/A

10
01.19.02

01/19/02

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LABORATORIES

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Pinnacle Lab ID number **203052**
March 27, 2002

SAN JUAN REFINING CO.
#50 ROAD 4990
BLOOMFIELD, NM 87413

Project Name HD-EAST OUTFALL
Project Number 31402

Attention: CINDY HURTADO

On 03/15/02 Pinnacle Laboratories, Inc., (ADHS License No. AZ0592 pending), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

H Mitchell

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: jt

Enclosure

PINNACLE LABORATORIES

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CLIENT : SAN JUAN REFINING CO.
PROJECT # : 31402
PROJECT NAME : HD-EAST OUTFALL
PINNACLE ID : 203052
DATE RECEIVED : 03/15/02
REPORT DATE : 03/27/02

PINNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
203052 - 01	OUTFALL #1-HD	AQUEOUS	03/14/02
203052 - 02	OUTFALL #2-HD	AQUEOUS	03/14/02

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 31402
PROJECT NAME : HD-EAST OUTFALL
PINNACLE I.D. : 203052
DATE RECEIVED : 03/15/02

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
203052-01	OUTFALL #1-HD	AQUEOUS	03/14/02	N/A	03/20/02	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	2.0	< 2.0	ug/L
Chloroethane (75-00-3)	2.0	< 2.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
[illegible]ethyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
[illegible],1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
1,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]lorobenzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]ylbenzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 203052
PROJECT # : 31402
DATE RECEIVED : 03/15/02
PROJECT NAME : HD-EAST OUTFALL

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
203052-01	OUTFALL #1-HD	AQUEOUS	03/14/02	N/A	03/20/02	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
[illegible]ert-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
[illegible],2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-8)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L

SURROGATE % RECOVERY

1,2-Dichloroethane-d4	101 (80 - 120)
Toluene-d8	101 (88 - 110)
Bromofluorobenzene	101 (86 - 115)

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO.
PINNACLE I.D. : 203052
PROJECT # : 31402
DATE RECEIVED : 03/15/02
PROJECT NAME : HD-EAST OUTFALL

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
203052-02	OUTFALL #2-HD	AQUEOUS	03/14/02	N/A	03/20/02	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	2.0	< 2.0	ug/L
Chloroethane (75-00-3)	2.0	< 2.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
ethyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
,1,2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
,1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
lorobenzene (108-90-7)	1.0	< 1.0	ug/L
ylbenzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE
LABORATORIES

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GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 203052
PROJECT # : 31402 DATE RECEIVED : 03/15/02
PROJECT NAME : HD-EAST OUTFALL

SAMPLE ID #	CLIENT ID	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
203052-02	OUTFALL #2-HD	AQUEOUS	03/14/02	N/A	03/20/02	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
rt-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
,2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
sec-Butylbenzene (135-98-8)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8)	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	102 (80 - 120)
Toluene-d8	102 (88 - 110)
Bromofluorobenzene	102 (86 - 115)

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 203052
PROJECT # : 31402
PROJECT NAME : HD-EAST OUTFALL

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	032002A	AQUEOUS	N/A	03/20/02	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
Dichlorodifluoromethane (75-71-8)	1.0	< 1.0	ug/L
Chloromethane (74-87-9)	1.0	< 1.0	ug/L
Vinyl Chloride (75-01-4)	1.0	< 1.0	ug/L
Bromomethane (74-83-9)	2.0	< 2.0	ug/L
Chloroethane (75-00-3)	2.0	< 2.0	ug/L
Trichlorofluoromethane (75-69-4)	1.0	< 1.0	ug/L
Acetone (67-64-1)	10	< 10	ug/L
Acrolein (107-02-8)	5.0	< 5.0	ug/L
1,1-Dichloroethene (75-35-4)	1.0	< 1.0	ug/L
Iodomethane (74-88-4)	5.0	< 5.0	ug/L
Methylene Chloride (75-09-2)	1.0	< 1.0	ug/L
Acrylonitrile (107-13-1)	5.0	< 5.0	ug/L
cis-1,2-Dichloroethene (107-06-2)	1.0	< 1.0	ug/L
Methyl-t-butyl Ether (628-28-4)	1.0	< 1.0	ug/L
[illegible],2-Trichlorotrifluoroethane (76-13-1)	5.0	< 5.0	ug/L
[illegible]1-Dichloroethane (75-34-3)	1.0	< 1.0	ug/L
trans-1,2-Dichloroethene (156-60-5)	1.0	< 1.0	ug/L
2-Butanone (78-93-3)	10	< 10	ug/L
Carbon Disulfide (75-15-0)	1.0	< 1.0	ug/L
Bromochloromethane (74-97-5)	1.0	< 1.0	ug/L
Chloroform (67-66-3)	1.0	< 1.0	ug/L
2,2-Dichloropropane (594-20-7)	1.0	< 1.0	ug/L
1,2-Dichloroethane (107-06-2)	1.0	< 1.0	ug/L
Vinyl Acetate (108-05-4)	1.0	< 1.0	ug/L
1,1,1-Trichloroethane (71-55-6)	1.0	< 1.0	ug/L
1,1-Dichloropropene (563-58-6)	1.0	< 1.0	ug/L
Carbon Tetrachloride (56-23-5)	1.0	< 1.0	ug/L
Benzene (71-43-2)	1.0	< 1.0	ug/L
1,2-Dichloropropane (78-87-5)	1.0	< 1.0	ug/L
Trichloroethene (79-01-6)	1.0	< 1.0	ug/L
Bromodichloromethane (75-27-4)	1.0	< 1.0	ug/L
2-Chloroethyl Vinyl Ether (110-75-8)	10	< 10	ug/L
cis-1,3-Dichloropropene (10061-01-5)	1.0	< 1.0	ug/L
trans-1,3-Dichloropropene (10061-02-6)	1.0	< 1.0	ug/L
1,1,2-Trichloroethane (79-00-5)	1.0	< 1.0	ug/L
1,3-Dichloropropane (142-28-9)	1.0	< 1.0	ug/L
Dibromomethane (74-95-3)	1.0	< 1.0	ug/L
Toluene (108-88-3)	1.0	< 1.0	ug/L
1,2-Dibromoethane (106-93-4)	1.0	< 1.0	ug/L
4-Methyl-2-Pentanone (108-10-1)	10	< 10	ug/L
2-Hexanone (591-78-6)	10	< 10	ug/L
Dibromochloromethane (124-48-1)	1.0	< 1.0	ug/L
Tetrachloroethene (127-18-4)	1.0	< 1.0	ug/L
[illegible]robenzene (108-90-7)	1.0	< 1.0	ug/L
[illegible]lbenzene (100-41-4)	1.0	< 1.0	ug/L

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GC/MS RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
CLIENT : SAN JUAN REFINING CO. PINNACLE I.D. : 203052
PROJECT # : 31402
PROJECT NAME : HD-EAST OUTFALL

SAMPLE ID #	BATCH	MATRIX	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
REAGENT BLANK	032002A	AQUEOUS	N/A	03/20/02	1

PARAMETER (CAS#)	DET. LIMIT	RESULT	UNITS
1,1,1,2-Tetrachloroethane (630-20-6)	1.0	< 1.0	ug/L
m&p Xylenes (108-38-3, 106-42-3)	1.0	< 1.0	ug/L
o-Xylene (95-47-6)	1.0	< 1.0	ug/L
Styrene (100-42-5)	1.0	< 1.0	ug/L
Bromoform (75-25-2)	1.0	< 1.0	ug/L
1,1,2,2-Tetrachloroethane (79-34-5)	1.0	< 1.0	ug/L
1,2,3-Trichloropropane (96-18-4)	1.0	< 1.0	ug/L
Isopropyl Benzene (98-82-8)	1.0	< 1.0	ug/L
Bromobenzene (108-86-1)	1.0	< 1.0	ug/L
trans-1,4-Dichloro-2-Butene (110-57-6)	1.0	< 1.0	ug/L
n-Propylbenzene (103-65-1)	1.0	< 1.0	ug/L
2-Chlorotoluene (95-49-8)	1.0	< 1.0	ug/L
4-Chlorotoluene (106-43-4)	1.0	< 1.0	ug/L
1,3,5-Trimethylbenzene (108-67-8)	1.0	< 1.0	ug/L
tert-Butylbenzene (98-06-6)	1.0	< 1.0	ug/L
[illegible] 2,4-Trimethylbenzene (95-63-6)	1.0	< 1.0	ug/L
[illegible]ec-Butylbenzene (135-98-8)	1.0	< 1.0	ug/L
1,3-Dichlorobenzene (541-73-1)	1.0	< 1.0	ug/L
1,4-Dichlorobenzene (106-46-7)	1.0	< 1.0	ug/L
p-Isopropyltoluene (99-87-6)	1.0	< 1.0	ug/L
1,2-Dichlorobenzene (95-50-1)	1.0	< 1.0	ug/L
n-Butylbenzene (104-51-8)	1.0	< 1.0	ug/L
1,2-Dibromomo-3-chloropropane (96-12-8	1.0	< 1.0	ug/L
1,2,4-Trichlorobenzene (120-82-1)	1.0	< 1.0	ug/L
Naphthalene (91-20-3)	3.0	< 3.0	ug/L
Hexachlorobutadiene (87-68-3)	1.0	< 1.0	ug/L
1,2,3-Trichlorobenzene (87-61-6)	1.0	< 1.0	ug/L

SURROGATE % RECOVERY	
1,2-Dichloroethane-d4	93 (80 - 120)
Toluene-d8	97 (88 - 110)
Bromofluorobenzene	96 (86 - 115)

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

LABORATORY CONTROL SPIKE RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
BATCH : 032002A
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 31402
PROJECT NAME : HD-EAST OUTFALL

PINNACLE I.D. : 203052
DATE ANALYZED : 03/20/02
UNITS : ug/L (PPB)

COMPOUND	SPIKE ADDED	LCS RESULT	LCS % RECOVERY	QC LIMITS %RECOVERY
1,1-DICHLOROETHENE	50.0	42.4	85	61-145
BENZENE	50.0	49.2	98	76-127
TRICHLOROETHENE	50.0	46.9	94	71-120
TOLUENE	50.0	49.6	99	76-125
CHLOROBENZENE	50.0	52.1	104	75-130

PINNACLE LABORATORES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
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MATRIX SPIKE/MATRIX SPIKE DUPLICATE RESULTS

TEST : VOLATILE ORGANICS EPA METHOD 8260
SPIKED SAMPLE : 203045-01
CLIENT : SAN JUAN REFINING CO.
PROJECT # : 31402
PROJECT NAME : HD-EAST OUTFALL

PINNACLE I.D. : 203052
DATE ANALYZED : 03/20/02
UNITS : ug/L (PPB)

COMPOUND	SAMPLE CONC.	SPIKE ADDED	MS RESULT	MSD RESULT	MS %REC	MSD %REC	RPD	QC LIMITS RPD	QC LIMITS %RECOVERY
1,1-DICHLOROETHENE	<1.0	50.0	43.0	43.5	86	87	1	14	61-145
BENZENE	<1.0	50.0	50.2	50.4	100	101	0	11	76-127
TRICHLOROETHENE	<1.0	50.0	47.9	47.6	96	95	1	14	71-120
TOLUENE	<1.0	50.0	50.1	50.4	100	101	1	13	76-125
CHLOROBENZENE	<1.0	50.0	52.1	52.3	104	105	0	13	75-130

PINNACLE LABORATORIES

Pinnacle Laboratories Inc.

CHAIN OF CUSTODY

DATE: ________ PAGE: ___ OF ___

PLI Accession #: 203052

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Cindy Hurtado

COMPANY: San Juan Refining
ADDRESS: #50 CR 4990
Bloomfield, NM 87413
PHONE: 505-632-4161
FAX: 505-632-3911

BILL TO: SAME
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject		(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline) MTBE	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081/8082)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310/8270-SIMS)	General Chemistry:		Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
outfall #1 - HD	3-14-02	205p	H2O	01														X															2
outfall #2 - HD	3-14-02	150p	H2O	02														X															2

PROJECT INFORMATION

PROJ. NO.: 31402
PROJ. NAME: HD - East outfall
P.O. NO.:
SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	4
CUSTODY SEALS	Y / N [✓ NA]
RECEIVED INTACT	yes
[✓ BLUE ICE]/ICE	4.0°c

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒

CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER

METHANOL PRESERVATION ☐

COMMENTS: FIXED FEE ☐

RELINQUISHED BY: 1.

Signature: Cindy Hurtado Time: 235P
Printed Name: Cindy Hurtado Date: 3-14-02
Company:
See reverse side (Force Majeure)

RECEIVED BY: 1.

Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.

Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.

Signature: Time: 0940
Printed Name: Date: 3/15/02
Pinnacle Laboratories Inc.

Enviro-Test Laboratories LLC.

Chemical Analysis Report

PINNACLE LABORATORIES, INC
Attn: PROJECT MANAGER
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

Date: 16 JAN 2002

Lab Work Order #: L4438

Project P.O. #:

Project Reference: GIANT REFINERY

Comments:

Date Received: 15 JAN 2002

PRELIMINARY REPORT

APPROVED BY: ______________________________

Project Manager

420 West 1st Street Casper, Wyoming 82601
Phone: (307) 235-5741 Fax:(307) 266-1676
Toll Free 1(800)666-030(

Date: January 16, 2002
Client: Pinnacle Laboratories, Inc.
Job Number: L4438

SAMPLE DELIVERY GROUP NARRATIVE

The following information is relevant to the interpretation of the data for the above job:

8260 Volatiles:

The above sample was originally analyzed 1/16/02 after a failed CCV (1,1,2,2-Tetrachloroethene response was low). A new calibration curve is being prepared; the sample will be reanalyzed 1/17/02. Results are not expected to vary significantly from the enclosed data.

PRELIMINARY REPORT

Paul Reeks
Organics Lab Supervisor

Chemical Analysis Report

PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

ATTN: PROJECT MANAGER

Project: GIANT REFINERY
Purchase Order:

PRELIMINARY REPORT

Page: 2 of 4
Report Date: 16-JAN-02
Work Order: L4438
Lab Sample ID: L4438-1
Client Sample ID: IP#22
Date Collected: 14-JAN-02
Sampled By: CLIENT
Date Received: 15-JAN-02
Matrix: WATER

Parameter	Result	Qualifier	MDL	PQL	Units	DF	Run ID	Analyzed	By
Misc									
Volatiles By SW-846 8260B									
Dichlorodifluoromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Chloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Vinyl Chloride	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Bromomethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Chloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Trichlorofluoromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1-Dichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Carbon Disulfide	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1,2-Trichlorotrifluoroethane	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Iodomethane	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Acrolein	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Methylene Chloride	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Acetone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
trans-1,2-Dichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Methyl-tert-Butyl Ether	15		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1-Dichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Acrylonitrile	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Vinyl Acetate	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
cis-1,2-Dichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
2,2-Dichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Bromochloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Chloroform	20		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Carbon Tetrachloride	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1,1-Trichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
2-Butanone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1-Dichloropropene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Benzene	350		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,2-Dichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Trichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Dibromomethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,2-Dichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Bromodichloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
2-Chloroethyl Vinyl Ether	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
cis-1,3-Dichloropropene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Toluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
4-Methyl-2-pentanone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
trans-1,3-Dichloropropene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Tetrachloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1,2-Trichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Dibromochloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,3-Dichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR

Chemical Analysis Report

PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

ATTN: PROJECT MANAGER

Project: GIANT REFINERY
Purchase Order:

Page: 3 of 4
Report Date: 16-JAN-02
Work Order: L4436
Lab Sample ID: L4436-1
Client Sample ID: IP#22
Date Collected: 14-JAN-02
Sampled By: CLIENT
Date Received: 15-JAN-02
Matrix: WATER

PRELIMINARY REPORT

	Parameter	Result	Qualifier	MDL	PQL	Units	DF	Run ID	Analyzed	By
Misc										
Volatiles By SW-846 8260B										
	1,2-Dibromoethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	2-Hexanone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
	Ethyl Benzene	114		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Chlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,1,1,2-Tetrachloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	m+p-Xylenes	2300		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	o-Xylene	98		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Styrene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Bromoform	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Isopropylbenzene	37		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	n-Propylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,1,2,2-Tetrachloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Bromobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,3,5-Trimethylbenzene	125		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	trans-1,4-Dichloro-2-Butene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	2-Chlorotoluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,3-Trichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	4-Chlorotoluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	tert-Butylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,4-Trimethylbenzene	340		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Sec-Butylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	p-Isopropyltoluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,3-dichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,4-Dichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	n-Butylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2-Dichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2-Dibromo-3-chloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Hexachlorobutadiene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,4-Trichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Naphthalene	16		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,3-Trichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	2-Methylnaphthalene	<200		200	600	ug/L	10	R15485	16-JAN-02 00:00	PR
	1-Methylnaphthalene	<200		200	600	ug/L	10	R15485	16-JAN-02 00:00	PR
Surrogate:	Dibromofluoromethane (surr)	101		70-130		%		R15485	16-JAN-02 00:00	PR
Surrogate:	1,2-Dichloroethane-d4 (Surr)	108		70-130		%		R15485	16-JAN-02 00:00	PR
Surrogate:	Toluene-d8 (surr)	101		70-130		%		R15485	16-JAN-02 00:00	PR
Surrogate:	4-Bromofluorobenzene (surr)	104		70-130		%		R15485	16-JAN-02 00:00	PR

Reference Information

Page: 4 of 4
Report Date: 10-JAN-02
Work Order: L4438

The following is the Description of sample Qualifiers where applicable:

The following Preparation/Extraction Methods were performed:

ETL Test Code and Matrix		Test Description	Methodology Reference (Based On)
8260-PINNACLE-CA	Water	Volatiles By SW-846 8260B	

The following Analytical Methods were performed:

ETL Test Code and Matrix		Test Description	Methodology Reference (Based On)
8260-PINNACLE-CA	Water	Volatiles By SW-846 8260B	SW-846 Method 8260B

PRELIMINARY REPORT

nnacle Laboratories Inc.

CHA OF CUSTODY

DATE: 1/14/02 PAGE: 1 OF 1

PLI Accession #:

SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: B.C. Holman

COMPANY: Giant Refining Co.
ADDRESS: #50 CR 4990
Bloomfield NM 87413
PHONE: 505-632-4168
FAX: 505 632-3911

BILL TO: Same
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD 8015) Diesel/Direct Inject		(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline) MTBE	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics
TP#22 Hammond	1/14/02	1pm	H2O															X

SAMPLE ID	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081/8082)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310/8270-SIMS)	General Chemistry:		Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
TP#22 Hammond															2

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT INFORMATION

PROJ. NO. 021401
PROJ. NAME: Hammond Ditch
P.O. NO.:
SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	
CUSTODY SEALS	Y / N / NA
RECEIVED INTACT	
BLUE ICE/ICE	

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☒ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☐

CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER

METHANOL PRESERVATION ☐

COMMENTS: FIXED FEE ☐

RELINQUISHED BY: 1.
Signature: Time: 1pm
Printed Name: DARRY HOLMAN Date: 1/14/02
Company:
See reverse side (Force Majeure)

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: Tammie Schotz Time: 0945
Printed Name: Tammie Schotz Date: 1-15-02
Pinnacle Laboratories Inc.

11/10/98 PLI Inc.: Pinnacle Laboratories, Inc. • 2709-D Pan American Freeway, NE • Albuquerque, New Mexico 87107 • (505) 344-3777 • Fax (505) 344-4413 • E-mail: PIN_LAB@WORLDNET.ATT.NET

DISTRIBUTION: White - PLI, Canary - Originator

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

FAX TRANSMITTAL SHEET

DELIVER TO: Barry Holman **PHONE NUMBER:**

COMPANY: Giant Refining. **FAX NUMBER:**

NUMBER OF PAGES BEING SENT: 4 (INCLUDING THIS PAGE)

From:

Date: 1/17

Time: 9:42

- H. Mitchell Rubenstein, Ph.D., President/CEO
- Jacinta A. Tenorio, Project Manager
- X Francine J. Torivio, Sample Control
- Brian Pence, Senior Chemist

FAX NUMBER:
(505) 344-4413

COMMENTS: Preliminary Results for your Rush sample.

If you did not receive all page of this transmission or if you experience Fax Transmission problems.
Please call (505) 344-3777, as soon as possible.

Enviro-Test Laboratories LLC.

Chemical Analysis Report

PINNACLE LABORATORIES, INC
Attn: PROJECT MANAGER
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107

Date: 16 JAN 2002

Lab Work Order #: L4438

Date Received: 15 JAN 2002

Project P.O. #:

Project Reference: GIANT REFINERY

Comments:

PRELIMINARY REPORT

APPROVED BY: ______________________________

Project Manager

[illegible] West 1st Street Casper, Wyoming 82601
Phone: (307) 235-6741 Fax (307) 2[illegible]-1075
Toll Free 1(800)[illegible]

Chemical Analysis Report

PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107
ATTN: PROJECT MANAGER

Project: GIANT REFINERY
Purchase Order:

Page: 2 of 4
Report Date: 16-JAN-02
Work Order: L4436
Lab Sample ID: L4436-1
Client Sample ID: IP#22
Date Collected: 14-JAN-02
Sampled By: CLIENT
Date Received: 15-JAN-02
Matrix: WATER

Parameter	Result	Qualifier	MDL	PQL	Units	DF	Run ID	Analyzed	By
Misc									
Volatiles By SW-846 8260B									
Dichlorodifluoromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Chloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Vinyl Chloride	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Bromomethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Chloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Trichlorofluoromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1-Dichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Carbon Disulfide	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1,2-Trichlorotrifluoroethane	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Iodomethane	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Acrolein	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Methylene Chloride	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Acetone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
trans-1,2-Dichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Methyl-tert-Butyl Ether	15		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1-Dichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Acrylonitrile	<50		50	150	ug/L	10	R15485	16-JAN-02 00:00	PR
Vinyl Acetate	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
cis-1,2-Dichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
2,2-Dichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Bromochloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Chloroform	20		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Carbon Tetrachloride	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1,1-Trichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
2-Butanone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1-Dichloropropene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Benzene	350		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,2-Dichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Trichloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Dibromomethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,2-Dichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Bromodichloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
2-Chloroethyl Vinyl Ether	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
cis-1,3-Dichloropropene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Toluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
4-Methyl-2-pentanone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
trans-1,3-Dichloropropene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Tetrachloroethylene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,1,2-Trichloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
Dibromochloromethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
1,3-Dichloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR

Chemical Analysis Report

PINNACLE LABORATORIES, INC
2709D PAN AMERICAN FREEWAY NE
ALBUQUERQUE NM 87107
ATTN: PROJECT MANAGER

Project: GIANT REFINERY
Purchase Order:

Page: 3 of 4
Report Date: 16-JAN-02
Work Order: L4438
Lab Sample ID: L4438-1
Client Sample ID: IP#22
Date Collected: 14-JAN-02
Sampled By: CLIENT
Date Received: 15-JAN-02
Matrix: WATER

Parameter		Result	Qualifier	MDL	PQL	Units	DF	Run ID	Analyzed	By
Misc										
Volatiles By SW-846 8260B										
	1,2-Dibromoethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	2-Hexanone	<100		100	300	ug/L	10	R15485	16-JAN-02 00:00	PR
	Ethyl Benzene	114		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Chlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,1,1,2-Tetrachloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	m+p-Xylenes	2300		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	o-Xylene	96		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Styrene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Bromoform	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Isopropylbenzene	37		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	n-Propylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,1,2,2-Tetrachloroethane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Bromobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,3,5-Trimethylbenzene	125		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	trans-1,4-Dichloro-2-Butene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	2-Chlorotoluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,3-Trichloropropane	<10		10	80	ug/L	10	R15485	16-JAN-02 00:00	PR
	4-Chlorotoluene	<10		10	30	ug/L	10	R15486	16-JAN-02 00:00	PR
	tert-Butylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,4-Trimethylbenzene	340		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Sec-Butylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	p-Isopropyltoluene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,3-dichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,4-Dichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	n-Butylbenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2-Dichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2-Dibromo-3-chloropropane	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Hexachlorobutadiene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,4-Trichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	Naphthalene	18		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	1,2,3-Trichlorobenzene	<10		10	30	ug/L	10	R15485	16-JAN-02 00:00	PR
	2-Methylnaphthalene	<200		200	600	ug/L	10	R15485	16-JAN-02 00:00	PR
	1-Methylnaphthalene	<200		200	600	ug/L	10	R15485	16-JAN-02 00:00	PR
Surrogate:	Dibromofluoromethane (surr)	101		70-130		%		R15485	16-JAN-02 00:00	PR
Surrogate:	1,2-Dichloroethane-d4 (Surr)	108		70-130		%		R15486	16-JAN-02 00:00	PR
Surrogate:	Toluene-d8 (surr)	101		70-130		%		R15485	16-JAN-02 00:00	PR
Surrogate:	4-Bromofluorobenzene (surr)	104		70-130		%		R15485	16-JAN-02 00:00	PR

4.3.3

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED stated: New exposure pathways were the only pathways considered in the remedial options evaluation instead of all exposure pathways. The CMS cites the evaluation summarized in the 1995 Groundwater Technologies, Inc. risk assessment as the reason for not discussing exposure pathways and receptors beyond considering those associated with each remedial option. NMED requested that BRC provide an updated discussion of potential receptors and exposure pathways.

Response

The 2001 CMS references the 1995 *Human Health and Ecological Risk Assessment* [risk assessment]. This risk assessment identified media of concern (e.g., soil, water, and air), potential human and ecological receptors, and the potential risk associated with exposure to the constituents of primary concern (COPCs) found at the Refinery. The assessment included review of the RCRA Facility Investigation (RFI), the evaluation of the data for use in the assessment, identification of exposure parameters, a theoretical estimate of the risks posed by the chemicals used at the Refinery, an evaluation of the risk characterization, and cleanup goals if remediation was necessary.

In addition, the risk assessment considered in detail: biological resources; previous soil, groundwater, and stream and sediment investigations at the site; identification of chemicals of potential concern; exposure assessment; environmental fate and transport modeling; toxicity assessment; and finally risk characterization. The risk assessment also took into consideration and determined potential receptors at the BRC site.

The evaluation of data concluded that there are no potential ecological risks to receptors at the Refinery site and general vicinity. The data also suggest that there is no potential risk posed to the on site worker and to the off site resident.

The assessment followed human health assessment guidance detailed in the following documents.

- Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A (EPA, 1989a);
- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Supplemental Guidance, S*tandard Default Exposure Factors* (EPA, 1991);
- Exposure Factors Handbook (EPA 1989)
- Dermal Exposure Assessment: Principles and Applications (EPA 1992); and
- Supplemental Guidance to RAGS: Calculating the Concentration Term (EPA 1992)

The ecological risk assessment was conducted in accordance with the guidelines in:

- Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual (EPA 1989); and
- Framework for Ecological Rick Assessment (EPA 1992).

In addition to the 1995 risk assessment report, there is detailed information in the *RCRC Facility Investigation/Corrective Measures Study Report* (RFI – November 1994), the *Response to USEPA Comments on the Draft RFI/CMS Report*, April 1995, and in the *Corrective Measures Study Report* December 1995.

The typical exposure pathways by medium for industrial land uses is taken from NMED *Assessing Human Health Ricks Posed by Chemicals: Screening-level risk Assessment*, May 19, 1999 and are detailed below.

Medium	Land Use
Ground Water	Ingestion from drinking
	Inhalation of volatile chemicals
	Dermal absorption
Surface Water	Ingestion from drinking
	Inhalation of volatile chemicals
	Dermal absorption
Soil/Sediment	***Ingestion****
	Inhalation of particulates*
	Inhalation of volatile chemicals*
	Exposure to indoor air from soil gas
	Exposure to groundwater contaminated by soil leachate
	Inhalation of particulates from trucks and heavy equipment
	Dermal absorption

****Boldface italics*** indicate pathways considered in the screening-level human health risk assessment.

Specific information on exposure pathways, risks, and anticipated methods of exposure reduction, contamination containment and/or remediation has been submitted to the regulating agency and is maintained in the onsite library as a part of BRC's compliance management. The compliance library is maintained at the refinery and includes the documents outlining standard operating procedures. These documents include contingency plans, air monitoring, storm water prevention, emergency response and cooperative agreements with emergency management resources. These documents address exposure pathway information.

4.7.2

In Attachment A of NMED's *Request for Supplemental Information*, dated May 28, 2002, NMED stated: "Biodegradation is occurring at the site but its effectiveness is not directly measurable. The stable/shrinking plume described in the CMS is more likely the result of the continuing total fluids and product recovery and the containment caused by the formerly unlined Hammond ditch. A total fluids recovery system that is currently operating is likely an effective method for product recovery." NMED went on to request that "Giant Refining Company should collect site-wide dissolved oxygen and oxidation-reduction potential (ORP) measurements to determine whether biodegradation is occurring. In addition, dissolved iron and manganese, nitrate, sulfate, dissolved carbon dioxide, and methane concentrations could be measured to document the existence of some of the types of microbial activity occurring beneath the site. Background well measurements of biodegradation parameters must be obtained to determine whether biodegradation of hydrocarbons is occurring beneath the facility."

Response

The CMS outlines several methods, including in-situ bioremediation, to stabilize and/or shrink the plume. However, because of the lining of Hammond Ditch and the installation of the French Drain with a liquid recovery system beneath the ditch, BRC and NMED agreed on an alternative. A two-fold method is proposed for reducing the dissolved-phase contaminant distribution. A series of additional total fluids pumps will operate in tandem with natural attenuation to mitigate the contamination.

SJRC will verify natural attenuation activity along the primary groundwater flow path from MW-4 southwest to MW-37. The results will be compiled and evaluated to demonstrate that natural attenuation is occurring. This plan is detailed in Attachment 6.

OCD 1

In the OCD letter, dated July 17, 2002, the OCD included comments and requests for information regarding the Site Investigation Report and Abatement Plan. Most of the information the OCD requires to complete an evaluation of the…[CMS] has already been requested by the…NMED in their May 28, 2002 correspondence….In order to answer OCD's concerns and prevent duplicative information, Giant shall submit to the OCD a copy of their response to NMED's request of information.

Response

BRC has structured the response to the NMED RSI and the OCD letter so that it incorporates all of the information requested by both NMED and OCD. BRC is submitting this document, in its entirety, to both NMED and OCD.

OCD 2

In the OCD letter to Giant Refining Company dated July 17, 2002, OCD submitted the following comments and requests as Number 2: "The OCD still does not have complete information regarding seepage control actions for the San Juan River. On February 17, 1998 Giant submitted a remediation plan for the river bank contamination which included installation of a sheet piling system, installation of a recovery/monitor well and enhanced bioremediation of contaminated soils. This work plan was conditionally approved by the OCD on March 6, 1998. Giant submitted requested modifications to the sheet piling system work plan on May 27, 1999, June 21, 1999, and June 22, 1999. The OCD requested additional information on the proposed modifications on July 2, 1999. This information was never submitted and Giant implemented the proposed modifications in the summer of 1999 without OCD approval. To date the OCD has not received either the July 2, 1999 requested information nor any reports on the remediation and monitoring activities as required in the OCD's initial March 6, 1998 approval. In addition, the recommended abatement plan for the river bank area in Section 9 does not include some of the proposed remedial actions which were previously approved (i.e., remediation of contaminated soils and installation of a recovery well). In order to resolve this issue the OCD requires that Giant submit a report on all remedial actions conducted in the river bank area. The report shall provide a summary of all remediation and monitoring actions; information on how Giant has complied with the OCD's March 6, 1998 conditions of approval; maps and as built construction specifications for the items requested in OCD's July 2, 1999 correspondence ; and a recommendation remediation plan for the river bank areas.

Response

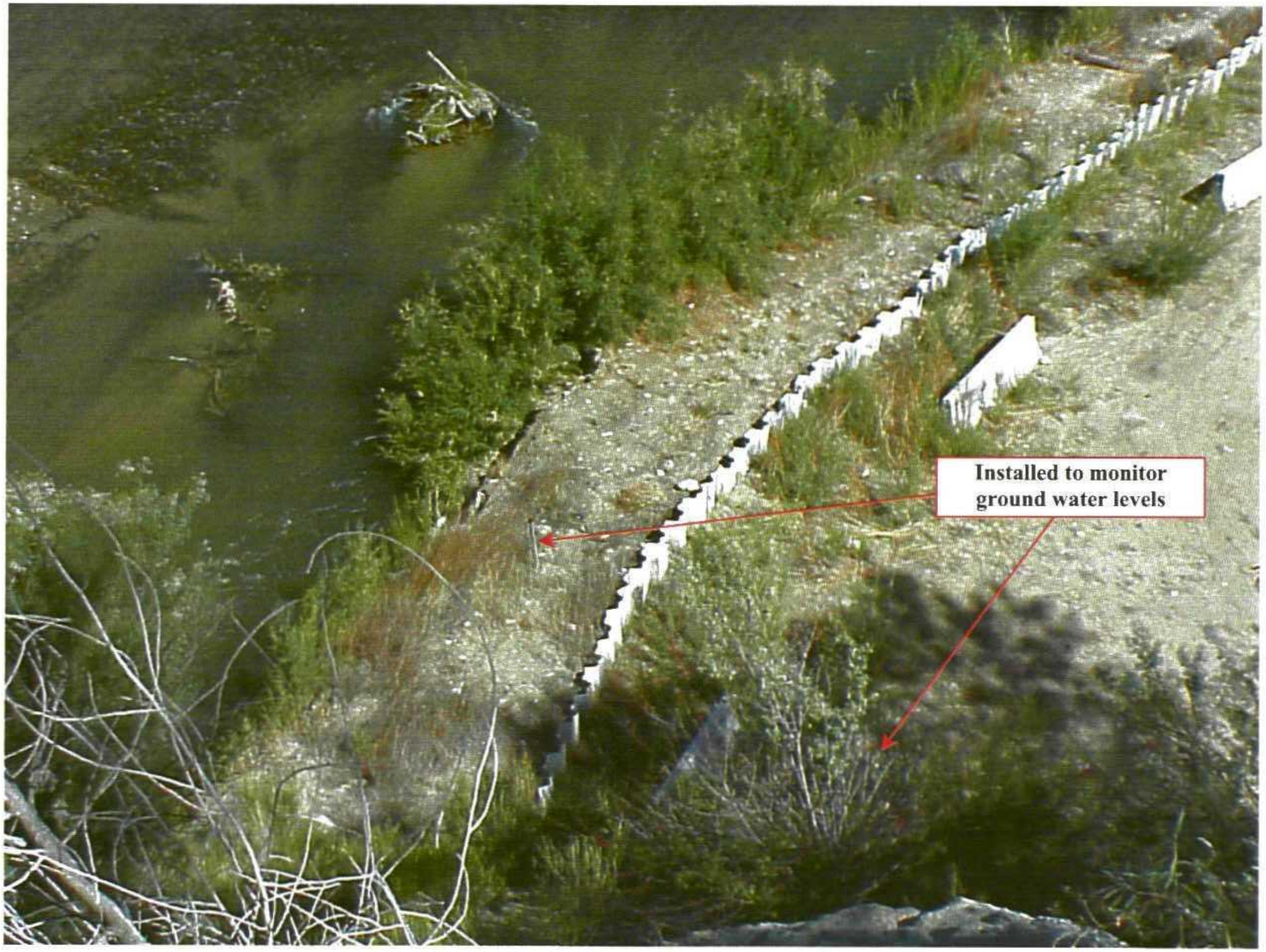
This attachment includes a chronology of the activities that have taken place at Hammond Ditch since the 1998 Remediation Plan was submitted, and a brief summary description of the activities depicted in the timeline; a copy of the *1998 Remediation Plan for the River Bank Contamination;* and a copy of the *San Juan River Unit, Hammond Project Portion, Final Planning Report / Environmental Assessment / Finding of No Significant Impact* by the United States Department of the Interior, December 1994. Soil characterization data for the area between Hammond Ditch and the San Juan River (both above and below the bluff) are included in Attachments 3.1.1 and 3.1.2.

This attachment also includes a copy of the correspondence with OCD in 1999, in which the sheet pilings and slurry wall at the San Juan River are outlined. A photograph of the sheet piling at the San Juan River is included to show what is in place at this time. Seep monitoring is outlined in the facility wide monitoring plan provided in Attachment 6

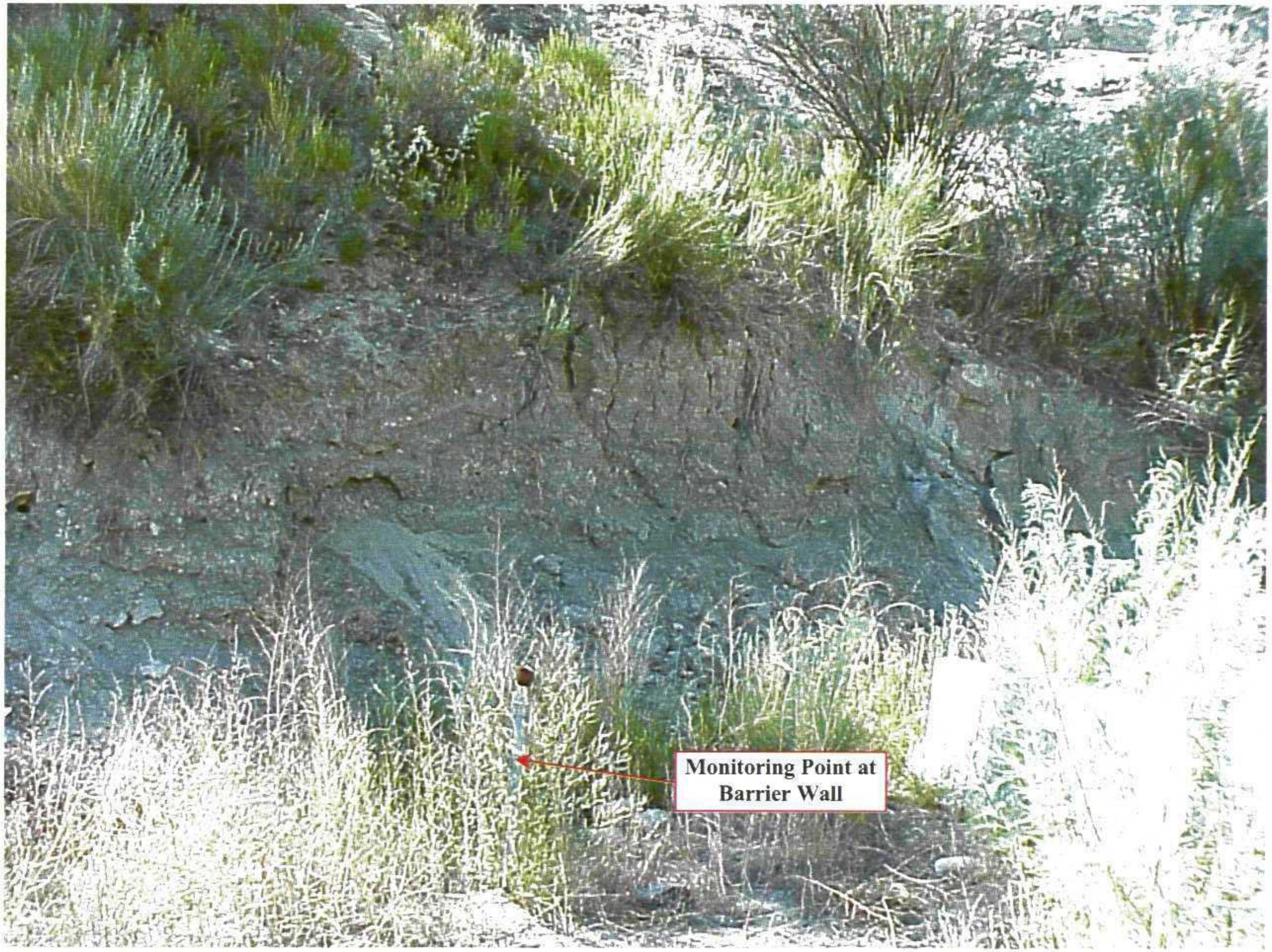
BRC will install a monitoring well between Hammond Ditch and the San Juan River. The facility wide monitoring plan (Attachment 6) calls for careful monitoring of this new well and the existing MW24, seeps, and the points at the sheet piling and for corrective actions if a condition should develop that poses a threat to the San Juan River.

Hammond Ditch Construction Chronology and Summary

Date	Description/Summary
9/07/99	Refinery receives notification from Hammond Conservancy District that a concrete liner will be installed in the Hammond Ditch along with a proposed construction contract for the work.
12/01/01	Lining of Hammond Ditch within the Refinery boundary by the Hammond Conservancy District contractor starts.
12/10/01	Hammond Conservancy District contractor encounters questionable soil beneath ditch and Refinery starts receiving excavated material from contractor for control within the Refinery's waste management operations.
12/20/01	Hammond Conservancy District contractor encounters saturated materials beneath Hammond Ditch. The Refinery takes over construction incorporating a French Drain and gravity flow piping to the recovery tank. Refinery incorporates excavated material from construction in the Refinery's waste management operation.
01/24/01	Refinery starts collecting fluids from the French Drain below the Hammond Ditch lining and includes the fluids in the existing API stream.
02/26/02	Refinery completes construction activities on the Hammond Ditch concrete lining effort and continues to collect the fluids from the French Drain and route them to the API separators.



San Juan River Sheet Piling and Slurry Wall with Monitoring Points



Close-up of Monitoring Point Adjacent to Sheet Piling

REMEDIATION PLAN

FOR THE

RIVER BANK CONTAMINATION

GIANT REFINING COMPANY
BLOOMFIELD
GW-001

PREPARED FOR:

NEW MEXICO OIL CONSERVATION DIVISION

PREPARED BY:

LYNN SHELTON
ENVIRONMENTAL MANAGER

FEBRUARY, 1998

GIANT
REFINING CO.

50 Road 4990
P.O. Box 159
Bloomfield, New Mexico 87413

505
632-8013

February 17, 1998

FEB 1998

Mr. Roger Anderson
Environmental Bureau Chief
New Mexico Oil Conservation Division
2040 south Pacheco
Santa Fe, New Mexico 87505

Re: River Bank Remediation Plan Giant Refining Company - Bloomfield
GW-001

Dear Mr. Anderson:

Giant Refining Company - Bloomfield submits the proposed remediation plan for the contamination discovered on the river bank area where Giant's property borders the San Juan River.

If you have any questions, please contact me at (505) 632 8013.

Sincerely:

Lynn Shelton

Lynn Shelton
Environmental Manager
Giant Refining Company - Bloomfield

TLS/tls

Enclosure

cc: John Stokes, Refinery Manager
Warren Arthur, USEPA, Region VI
Benito Garcia, NMED/HRMB
Denny Foust, NMOCD - Aztec

REMEDIATION PLAN
FOR THE
RIVER BANK CONTAMINATION

GIANT REFINING COMPANY - BLOOMFIELD

FEBRUARY, 1998

GENERAL:

As described in the June, 1997 **RIVER BANK INVESTIGATION** report, an area of hydrocarbon contamination was discovered on the river bank of the San Juan River (the river) at this facility. A complete characterization program was performed to document the extent of the hydrocarbon contamination. Mitigation activities have continued at the site and have included: recovery of separate phase hydrocarbon (SPH), bi-weekly monitoring (for BTEX constituents) of the river in the area behind the containment boom, and recovery of separate phase hydrocarbon within the area of the refining facility in order to prevent additional contamination from migrating to the river bank.

Recovery of SPH at the river bank continued through March, 1997. In February, 1997, the flow rate of the river was returned to ~ 500+ cubic feet per second (cfs) from the low flow test in which the river was limited to 250 cfs for a period of four months. It is assumed that the low flow will not occur again as a test, although low flow can occur as a result of long term drought conditions. As a result of the return to normal flow of the river (~500cfs), SPH was no longer observed in the collection gallery installed near the river. Although recovery equipment has been left in place, no SPH has been seen or recovered since March, 1997.

As stated in the **RIVER BANK INVESTIGATION** report, the low flow conditions appeared to have lowered the hydraulic barrier of the river sufficiently to allow SPH, that was held as bank storage, to migrate west to the river and create the sheen.

Several remediation techniques have been explored in order to determine the most effective remediation program for protection of the river. To be successful, any remediation activity must be performed in concert with the recovery and management of the SPH plume located on top of the bluff and immediately below part of the Giant facility.

SITE SPECIFIC PROPOSAL:

Phase I

The first part (or phase) of a remedial program must be to create an impermeable barrier between the contaminated area and the river. Although the migration of the SPH seems to be inhibited by the normal flow of the river, it is always possible that the low flow condition (<300 cfs) may occur due to additional flow tests or as the result of long term drought conditions. Should low flow conditions exist for an extended period of time, it is likely that, if SPH is still present and until the hydrocarbon contamination is mitigated, additional migration of SPH may occur.

Giant proposes to install an impermeable wall using sheet pilings. Specifically, an impermeable wall of high density polyethylene from Materials International (4501 Circle 75 Parkway, Atlanta, Georgia), brand name Shore Guard SG500, will be installed. A special sealant will be applied to interlocking seams to assure impermeability. The sheet pilings will be installed 5-10 feet from the edge of the river to minimize or eliminate impact to the river during installation.

The sheet piles will be ~22 feet long and will be driven into place with a crane mounted, hydraulically driven vibratory hammer. The plastic sheets will be supported during installation by a hardened steel mandrel. The sheets will be driven through the fluvials into the Nacimiento Formation. As the sheets are interlocking, an impermeable barrier will be created to prevent horizontal migration and the Nacimiento Formation is a natural barrier to vertical migration.

The sheet piling will be installed around the perimeter of the river bank to the outlet of the water make-up ponds, then south along the west edge of the make-up pond and then east to the east edge of the makeup pond. This will surround the contaminated soil and effectively prevent any migration of contaminants to the river. As the surface of the Nacimiento Formation dips to the north-northwest, this, again, provides adequate protection for the river from migration of contaminants.

A site drawing as well as a detail of the river bank are included as Attachment I and the extent of the sheet piling is marked for your reference.

The sheet piling, at ~22 feet, is of sufficient length to tie into the Nacimiento Formation and will be finished in heighth above the ground surface to allow a level surface across the entire river bank area.

Phase II

Because the installation of the sheet piling will provide an impermeable barrier that will prevent migration of contamination of the river and due to the fact that no SPH had been observed or recovered since March, 1997, Giant proposes to use in-situ remediation, with stimulated bio-remediation to enhance bio-degradation and subsequent cleanup of the hydrocarbon contaminated soil.

After installation of the impermeable barrier, Giant will backfill the low areas on the western part of the river bank with clean soil to establish a level grade across the river bank area. Giant will then plow or disc the hydrocarbon contaminated area and apply nitrogen/ phosphorus rich fertilizer to the affected area. Fertilizer applications will be transported down to the contamination by percolation. Giant will then plow or disc the affected area monthly to provide additional oxygen and to control vegetation growth. Giant plans to apply fertilizer twice annually during the warm months between April and October. Additions of nitrogen/phosphorus rich fertilizer will serve as a stimulant for bacterial growth. Applications of the fertilizer will not affect the river because of the impermeable barrier.

Additionally, a monitor well will be installed as close to the current recovery culvert* as is safely possible, allowing room for sloughing or sliding of the talus slope to occur without damage to the well (see detail map for wellsite). This well will be monitored monthly with an interface probe to determine if SPH is present. Although Giant believes that most of the SPH has been recovered, if SPH is observed, collection of SPH will commence through the monitor well. If sufficient SPH is present, a collection gallery may need to be installed to recover the SPH. The need for this could be discussed between Giant and the OCD if a considerable volume of SPH is determined to be present. If no SPH is detected for one year, or after SPH recovery is abandoned, Giant will monitor the water in the monitor well for BTEX constituents quarterly until those constituents diminish to below WQCC standards. Quarterly progress reports will be submitted to OCD at that time to inform the OCD of the progress being made by the remediation efforts. When BTEX levels fall below WQCC standards, the river bank area will be considered clean and remediation and sampling activities will cease at that time.

In addition to the remediation activities on the river bank, Giant will continue to maximize product recovery from the plume beneath part of the refinery on top of the bluff. Upon approval of the Corrective Measures Study, an enhanced recovery system will be installed in order to expedite recovery of the SPH plume and cleanup of the Jackson Lake Terrace Formation. As this plume is considered to be the source of the contamination on the river bank, recovery activities will preclude the possibility of additional SPH from migrating to the river bank.

INSTALLATION:

Giant proposes to install the impermeable barrier, assuming approval of this remediation plan by OCD, in June or July 1998. Immediately after completion of the impermeable barrier, the river bank area will be backfilled as needed, leveled and then plowed or disced. The monitor well will be installed at that time.

This timetable provides the quickest assurance that no contamination can reach the river and provides the best assurance that the environment and human health are protected.

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*The existing collection culverts will be removed because sloughing of the talus slope threatens to cover them up.

ATTACHMENT I

NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

March 6, 1998

CERTIFIED MAIL
RETURN RECEIPT NO. P-288-259-041

Mr. Lynn Shelton
Environmental Manager
Giant Refining Co.
P.O. Box 159
Bloomfield, NM 87413

RE: Remediation Plan for the River Bank Contamination
Bloomfield Refinery (GW-001)
San Juan County, New Mexico

Dear Mr. Shelton:

The New Mexico Oil Conservation Division (OCD) has completed a review of the Giant Refining Co. (Giant) "Remediation Plan for the River Bank Contamination" dated February 17, 1998. This plan contains Giant's proposal to install an impermeable barrier to prevent migration of contaminants to the San Juan River, installation of a monitor well in place of the current recovery culvert, and in-situ remediation of hydrocarbon contaminated soils. Based on the information provided, Giant's plan is hereby approved with the following conditions:

1. The monitor well will be constructed with:
    a. A minimum of ten feet of well screen, with at least one foot of well screen above the water table and nine feet of well screen below the water table.
    b. An appropriately sized gravel pack will be set around the well screen from the bottom of the hole to 2-3 feet above the top of the well screen.
    c. A 2-3 foot bentonite plug will be placed above the gravel pack.
    d. The remainder of the hole will be grouted to the surface with cement containing 5% bentonite.
    e. A 2 foot by 2 foot cement pad will be installed around the wellbore at the surface.
2. After completion of the monitor well, ground water will be sampled and analyzed for concentrations of BTEX on a quarterly basis. Quarterly reports will be sent to the OCD Santa Fe Division Office, and copies to the OCD Aztec District Office. Quarterly analysis

of the ground water will continue until BTEX levels fall below Water Quality Control Commission (WQCC) levels. At that time Giant may make a request to the OCD to modify this remediation plan. The modification will include recommendations for future actions based on the results of ground water sampling, and may include proposals for sampling intervals.

3. All separate phase hydrocarbons (SPH) will be recovered from the monitor well. Monthly SPH monitoring will continue one year beyond the last detected SPH. When one year without SPH detection has been reached, Giant may make a request to the OCD to modify this remediation plan. The modification will include recommendations for future actions based on the results of ground water sampling.

4. Applications of fertilizer and oxidizers should be directly to contaminated soils where ever possible.

5. The hydrocarbon contaminated soils will be sampled annually until BTEX levels fall below WQCC levels. At that time Giant may make a request to the OCD to modify this remediation plan. The modification will include recommendations for future actions based on the results of ground water sampling.

6. The recovery culvert will be plugged using materials consistent with the surrounding river bank.

7. Giant will submit a report on remediation activities to the OCD by August 1, 1998. The report will include a description of the actions performed and the results of the most recent sampling activities.

8. Giant will notify the OCD Aztec District Office at least 72 hours in advance of all activities.

9. All original documents will be submitted to the OCD Santa Fe Office with copies provided to the OCD Aztec District Office.

Please note that a potential for hydraulic head behind the sheet piling installation does exist.

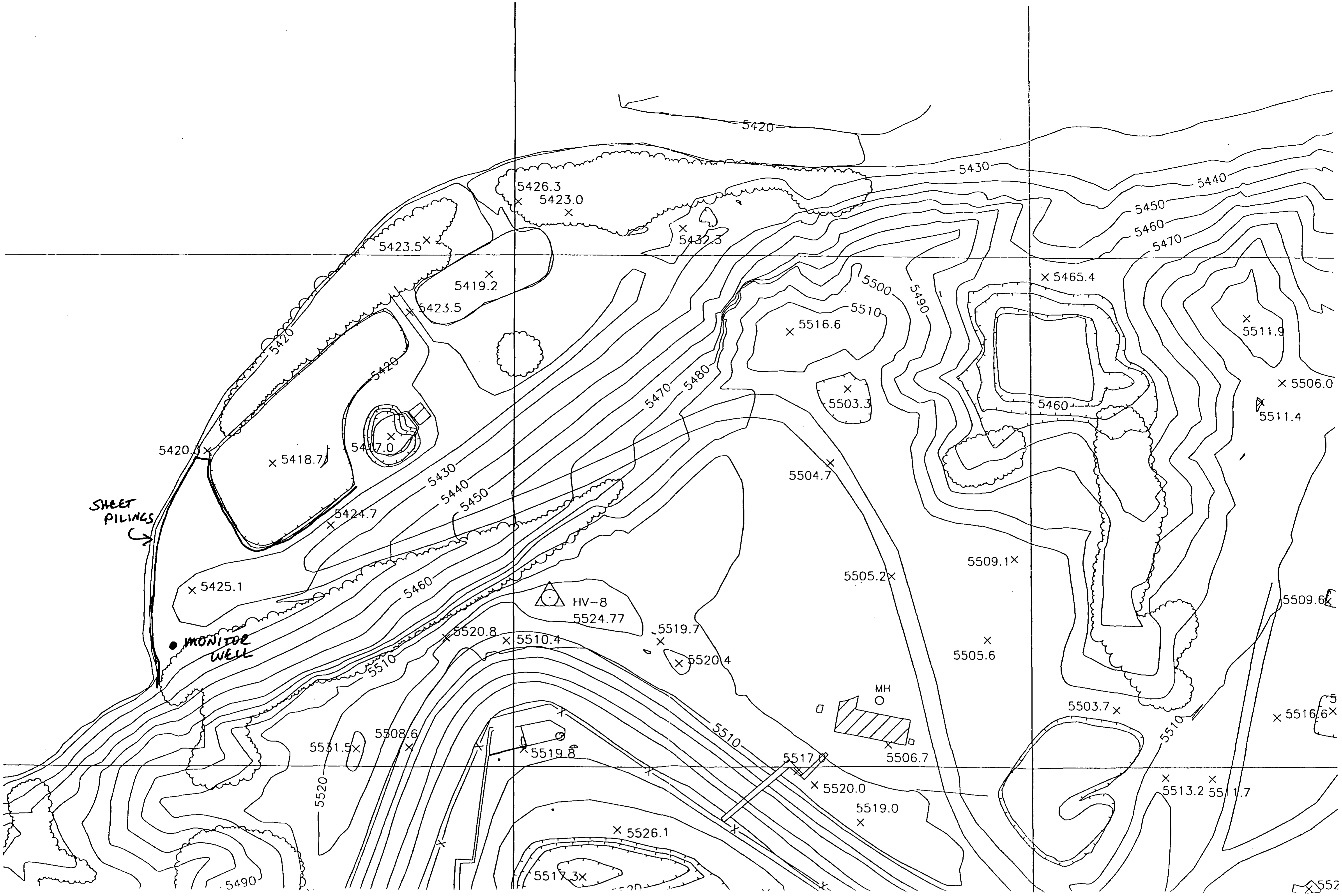
Please be advised that OCD approval does not relieve Giant of liability if contamination exists which is beyond the scope of this remediation plan or if the activities fail to adequately determine the extent of contamination related to Giant's activities. In addition, OCD approval does not relieve Giant of responsibility for compliance with any other federal, state or local laws and/or regulations.

If you have any questions, please call me at (505) 827-7155.

Sincerely,

Mark Ashley
Geologist

xc: OCD Aztec Office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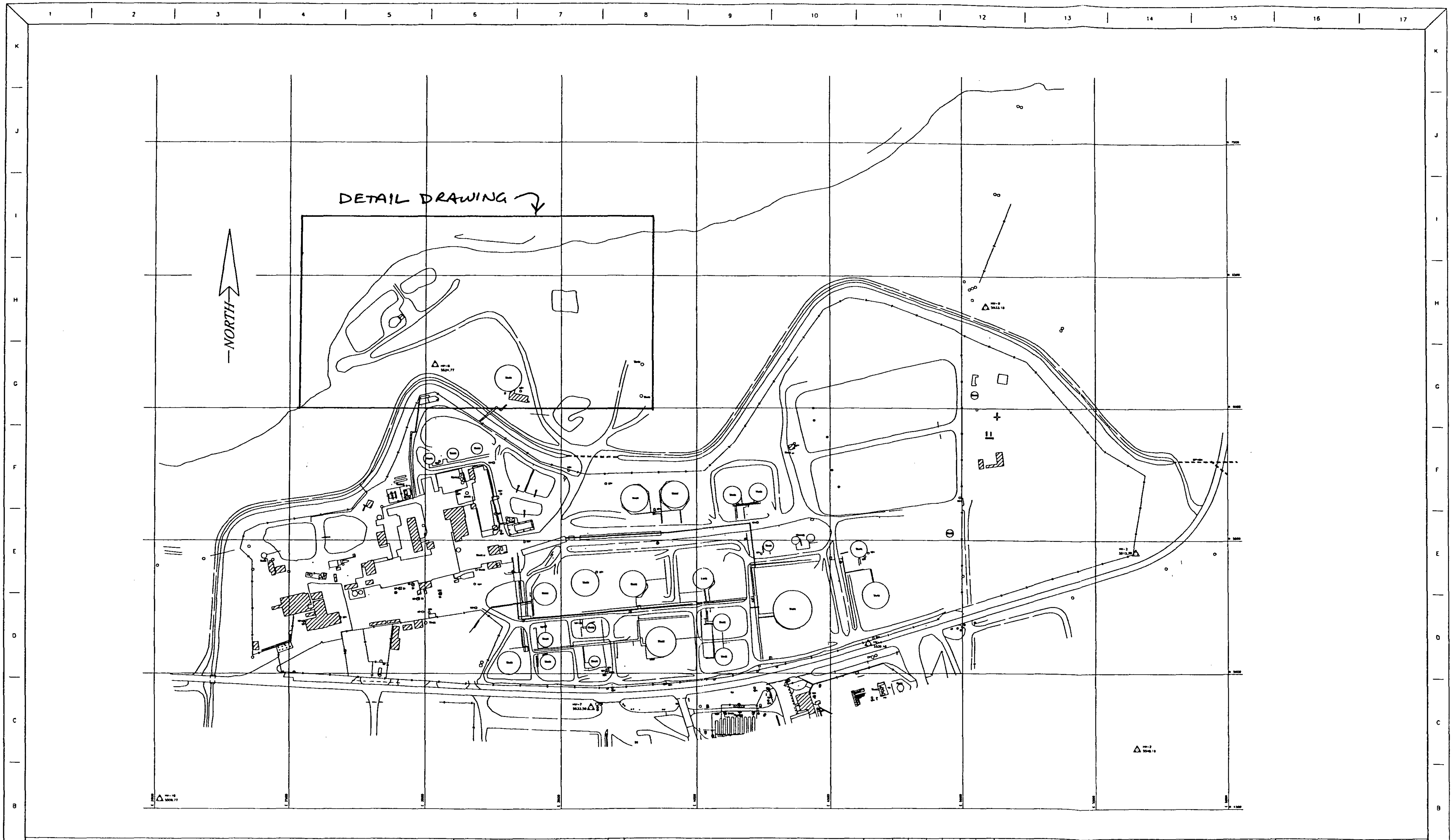
SHEET PILINGS
MONITOR WELL



NOTES

REFERENCE DWGS.	NO.	REVISION	JOB No.

BY	DATE	BY	DATE	BY	DATE
DRAWN		CHECKED		APPROVED	

SCALE 1/16 =1'-0" DATE
DRAWN BY LDB 7/15/97
INITIAL CHK.
FINAL CHK.
ENGR.
APPR. BY
AFE/WO No.

GIANT # 1

GIANT
REFINING CO.

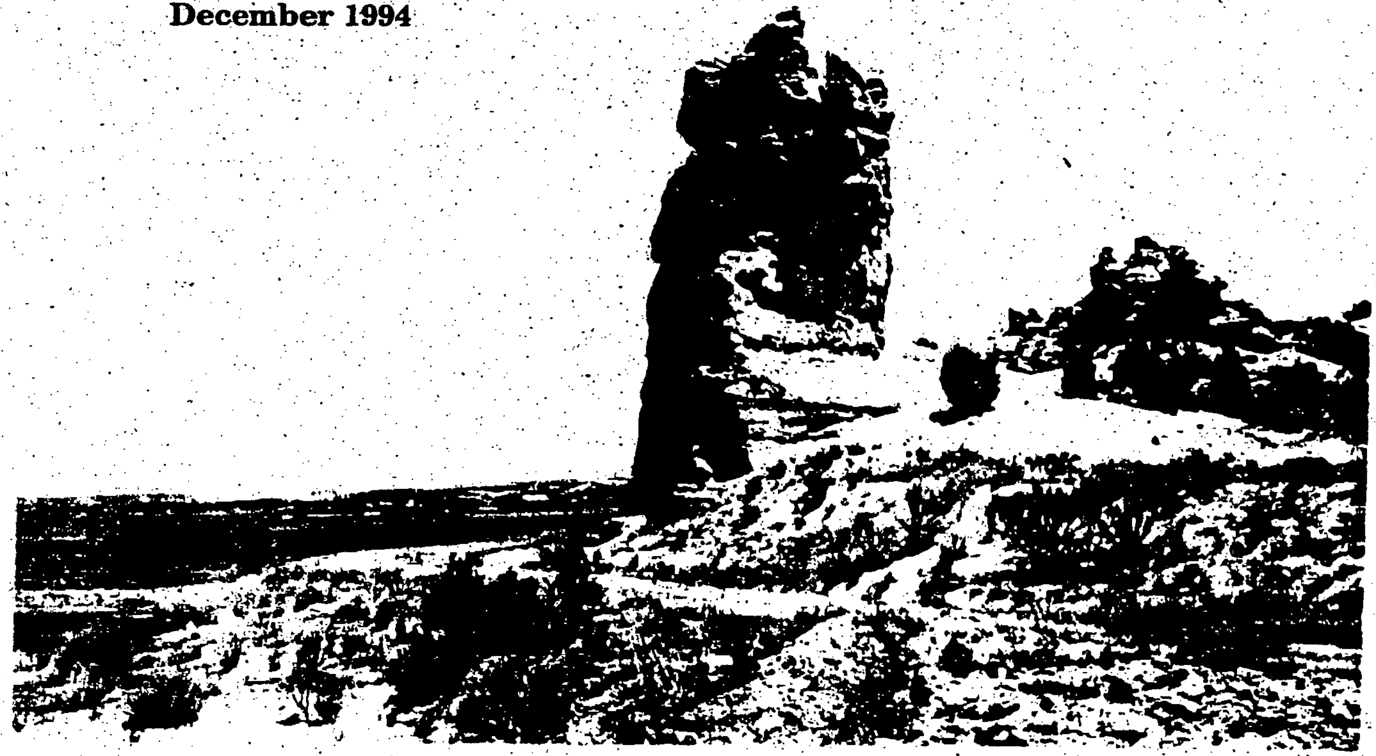
BLOOMFIELD REFINERY
BLOOMFIELD NEW MEXICO

DWG. NO. **D-000-900-XXX**
REV. **0**

SAN JUAN RIVER UNIT—
HAMMOND PROJECT PORTION, NEW MEXICO
(Colorado River Water Quality Improvement Program)

FINAL PLANNING REPORT / ENVIRONMENTAL ASSESSMENT / FINDING OF NO SIGNIFICANT IMPACT
(PR / EA / FONSI)

December 1994



UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

MISSION STATEMENTS

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. Administration.

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.

ENVIRONMENTAL ASSESSMENT: The purpose of this chapter is to comply with the procedural requirements of the National Environmental Policy Act (NEPA), to disclose the environmental consequences of the proposed action and alternatives to it, and to determine if an environmental impact statement is needed.

CHAPTER VI

ENVIRONMENTAL ASSESSMENT

PURPOSE OF AND NEED FOR THE PROJECT

BACKGROUND

The purpose of the salinity control alternatives is to reduce salt loading to the Colorado River, as discussed in chapter I. Both salt loading and salt concentration occur on the Hammond Project, which was originally designed as a system of earth-lined irrigation canals. After the Hammond Project was completed in the early 1960's, several sections of the system were concrete lined to reduce canal water loss (seepage) and for operation and maintenance (O&M) reasons. Sections that have not been lined show significant deterioration of the canal prism. Following the original construction of earth-lined sections, some of the lining was unintentionally removed during O&M activities. Conveyance and operation losses currently average approximately 50 percent of the diversions into the Hammond distribution system, and canal seepage is a substantial part of this loss. Salt pickup results from canal seepage water and excess irrigation deep percolation flowing through the underlying shales high in salt content and returning to the river. The Bureau of Reclamation (Reclamation) estimates that the Hammond Project contributes up to 31,650 tons of salt per year to the Colorado River, as noted in chapter II.

SCOPE OF PROJECT

The scope of this discussion will be to address a reduction of salt loading and concentration from the Hammond Project, the rehabilitation of the Project conveyance system, and the relevant environmental issues related to it. This environmental assessment (EA) incorporates by reference the detailed Project information contained in the planning report (PR) (chapters I through V of this document). This chapter summarizes or references information in the PR to reduce duplication.

PROPOSED ACTION AND ALTERNATIVES

ALTERNATIVES CONSIDERED IN DETAIL

Alternative 1 (No Action)

No action would be taken by Reclamation or the Hammond Conservancy District (District) to rehabilitate the Project to reduce salt loading to the Colorado River. Evaluation of the No Action Alternative is required by NEPA.

Alternative 2 (The Proposed Action - Line Canals, as described in chapter IV)

Unlined portions of the Main Gravity Canal and three principal laterals (East and West Highline and Gravity Extension) would be lined with concrete, clay, or other impermeable membrane or layer. The portions of the Main Canal adjacent to or potentially affected by the Bloomfield Refinery (Refinery) would be lined after remediation of contamination has been completed by the Refinery (chapter I).

Alternative 3 (Low-Pressure Pipeline - Upper Section Only, chapter IV)

The existing Main Canal would be replaced with a 30- to 42-inch-diameter pipeline from Muñoz Canyon to 2 miles east of State Highway 44 (see figure VI-1). The pipeline would be installed in the existing alignment. A 2,430-kilowatt (kW) pumping plant would be built near the beginning of the pipeline to develop 234 feet of initial head. Existing siphons would be used, but all other structures (including existing laterals) would be abandoned. Water would be delivered into 13 new pipe laterals with at least 10 feet of pressure at the end of each lateral. These pipe laterals would follow new rights-of-way. The remainder of the Project (lower section) would be operated by the present system.

Alternative 4 (High-Pressure Pipeline - Upper Section Only, chapter IV)

This alternative is similar to Alternative 3, except that it would provide 100 feet of pressure at the end of the pipe laterals. A 3,370-kW pumping plant would develop 324 feet of initial head.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Gravity-Pressurized Pipeline

This alternative would place the Hammond system into a pipeline pressurized by gravity, delivering water to farm turnouts along the Main Canal. The alternative failed the efficiency test because of the high cost of the pipeline required.

Retire Project Lands

Hammond Project lands would be selectively retired from irrigated agriculture based on how much salinity they contribute to the San Juan River. This could result in up to the full 3,933 acres of Hammond Project land being removed from service. This alternative was eliminated because it: (1) would result in a significant economic loss to the local economy, (2) was not acceptable to the State of New Mexico (which does not want irrigated land removed from production), and (3) because the irrigators/ water users would object to it.

Low-Pressure Pipeline (Both Upper and Lower Sections)

All but about 4.9 miles of the Main Canal would be replaced by pressurized pipe. Pressure in the main pipeline would be produced by pumping and would be sufficient to distribute Project water into 41 piped laterals to provide at least 10 feet of head. Individual irrigators would be required to provide the necessary additional pressure to their own farms. This alternative was eliminated because of the high cost per ton of salt removed.

High-Pressure Pipeline (Both Upper and Lower Sections)

This alternative is the same in concept as the Low-Pressure Alternative, except that 100 feet of pressure would be provided at the end of each lateral. While the first increment was viable, the second increment failed the efficiency test.

Low-Pressure Pipeline, Muñoz Canyon

Project water would be delivered by a pipeline from the Navajo Indian Irrigation Project (NIIP) Canal, which is 400 to 500 feet above the Project lands. This alternative was eliminated because of potential problems in acquiring rights from the Navajo Nation to carry Project water in the NIIP Canal. The NIIP is still under development, and it is unlikely that the NIIP Canal could deliver the additional volume of water to the Project.

ENVIRONMENTAL CONSIDERATIONS AND ANALYSIS ASSUMPTIONS

The alternatives considered in detail incorporate construction considerations and analysis assumptions to avoid or minimize the potential environmental impacts noted in the subsequent "Environmental Mitigation Commitments" section.

The predicted impacts of the proposed action and alternatives are summarized and displayed in table VI-1.

Table VI-1.—Summary of impacts

	Alternative			
Resource/issue	No Action	Canal Lining	Low-Pressure Pipeline	High-Pressure Pipeline
Water quality				
Salinity reduction (tons/year)	0	27,700	18,400	18,400
Seepage reduction (acre-feet/year)	0	4,900	2,840	2,840
Wetlands and riparian areas				
Wetland/riparian loss				
Inside canal structure	0	0	0	0
Outside canal structure	No effect	Seepage from canal would be reduced or eliminated; 25 acres of irrigation-produced wetland/riparian vegetation would be potentially adversely affected.		
Mitigation	None	Mitigation would be implemented to replace the ecological value of 25 acres lost outside the canal structure at a 2:1 ratio. Destroyed cottonwood trees would be replaced at a 2:1 ratio.		
Threatened/endangered species				
Colorado squawfish	Awaiting final biological opinion from the U.S. Fish and Wildlife Service.			
Razorback sucker	Awaiting final biological opinion from the U.S. Fish and Wildlife Service.			
Other listed/candidate species	*No effect*	*No effect*	*No effect*	*No effect*
Fish and wildlife habitat		Losses of habitat for small animals and for songbirds and raptors both inside and outside the canal structure. Improved water quality for San Juan River aquatic resources due to salinity reduction.		
Soils and vegetation				
Total surface disturbance	0	234 acres	234 acres	234 acres
Volume of spoil material	0	Unknown	Unknown	Unknown
Borrow sources (if any)	0	Borrow sources have not been identified.		
Vegetation type	0	25 acres wetland/riparian; 170 acres desert shrubland.		
Bloomfield Refinery				
Soil/water/ground-water contamination	*Remediation of contamination by the Refinery would be undertaken prior to any action by Reclamation on portions of canal and laterals that may be affected by such contamination.*			
Cultural resources	None	Cultural resources surveys would be conducted when areas of surface disturbance are identified where existing cultural resources data are insufficient.		
Indian trust assets	None	No adverse impacts are anticipated as a result of these alternatives. As this project enters construction, consultation will continue.		
Cost ($)				
Annual cost				
Cost/ton salt removed (1 ton salt removed)	0	41.65	88.75	107.36
Construction cost (million)	0	1.15	1.63	1.98
O&M cost ($) (additional)	0	6,000	400,000	540,000

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the affected environment and discloses the potential environmental consequences of the alternatives described in chapter II. This chapter provides the scientific and analytical basis for a comparison of the alternatives. The chapter follows the sequence of environmental issues and resources listed at the end of chapter III.

WATER QUALITY

Affected Environment

The San Juan River, a tributary of the Colorado River, is located north of the Project canals. The canals are located from about one-fourth to nearly 2 mile(s) south of the river (see figure VI-1). The soils in the Project area are derived from the San Juan River alluvium and alluvial fan deposits derived from the sandstones, siltstones, and shales of the Nacimiento and Ojo Alamo sandstones. Early investigations in 1986 and 1987 indicated the Hammond Project could be contributing significant amounts of salt to the San Juan River. Hammond Project operation results in salt loading to the San Juan River due to deep percolation of irrigation return flow and canal seepage. Recent Hammond Project water conveyance and operational losses have been averaging about 50 percent. A discussion of water rights and diversions is included in chapter I in the "Operation of the Hammond Project Irrigation System" section.

Environmental Consequences of All Alternatives

Reductions of salt load are estimated to be: Alternative 1—0 ton; Alternative 2—27,700 tons; Alternative 3—18,400 tons; and Alternative 4—18,400 tons. For Alternative 2, reaches that were already concrete lined were not considered in the evaluation.

WETLAND AND RIPARIAN VEGETATION

Affected Environment

Reclamation identified areas of wetland or riparian vegetation within the Project area, and those areas are shown on preceding figure VI-1. They are typically characterized as low-lying areas in close proximity to the San Juan River with cattails, willows, rushes, and sedges. Higher-elevation wetlands in the Project area are dominated by tamarisk and willow and are classified as scrub-shrub wetlands (Cowardin, 1979). These wetlands are principally supported by surface water and ground water associated with the adjacent

San Juan River. Reclamation estimates that the ground water in the Project area comes from canal and lateral seepage during the irrigation season, as noted in reports listed in chapter I.

The primary resource issues related to the proposed Project are potential impacts to areas of wetland/riparian vegetation that have become established as a result of seepage from the Project canals/laterals and historic lack of adequate O&M activities by the District. This wetland/riparian vegetation is found in two locations: (1) within the structure or right-of-way of the canal and laterals or (2) outside or adjacent to the canal structure or right-of-way. This vegetation is directly and indirectly supported by water from within the canal or by seepage from the canal and laterals. It is referred to as "irrigation-produced" wetlands. These areas are not defined as the "waters of the United States" (using the procedures in the 1987 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*). However, they do possess minimal functional values of naturally occurring wetland/riparian areas and similar wildlife habitats under provisions of the Fish and Wildlife Coordination Act.

The irrigation-produced wetland within the canal is removed periodically during routine canal O&M activities (i.e., spraying, cutting, mowing, burning, dredging, and livestock grazing). These activities affect both the short-term and long-term ecological value of irrigation-produced wetlands. Periodic removal of this vegetation reduces its wildlife habitat and ecological value (Reclamation, 1993). Reclamation is responsible for assuring that O&M activities are performed at regular intervals by the District (for instance, vegetation control is to be conducted annually) to protect the Federal investment in the Hammond Project and maintain the structural integrity and accurate water deliveries to irrigators. Routine O&M activities for the Hammond Main Canal are conducted by the District. However, inadequate O&M activities by the District prior to 1991 led to the presence of irrigation-produced wetland within the canal and right-of-way. The field vegetation surveys were conducted in 1990.

Irrigation-produced wetlands within the canal structure or right-of-way were identified and evaluated in 1990 by Reclamation, the U.S. Fish and Wildlife Service (Service), and the Environmental Protection Agency (EPA). Approximately 14 acres of irrigation-produced wetland were identified. The 14 acres consisted of 8 acres of willow-dominated wetland or "palustrine scrub-shrub broad-leaved deciduous" (Cowardin, 1979) and 6 acres of sedge/rush wetland or "palustrine emergent persistent" (Cowardin, 1979).[1] The irrigation-produced wetland was again evaluated by Reclamation and the Service in 1991. Significantly less than the previously estimated 14 acres of wetland/riparian vegetation were identified due to improved O&M

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[1] Reclamation evaluated the ecological value of the estimated 14 acres of irrigation-produced wetland within the canal structure or right-of-way (Reclamation, 1991). That analysis indicated a value of 2.6 habitat units for that area.

activities conducted by the District and private landowners since the 1990 field surveys. Another field survey was conducted in June 1993, and it showed further reduction of the irrigation-produced wetland areas because of the ongoing O&M activities by the District. The 8 acres of willow-dominated and most of the 6 acres of sedge/rush irrigation-produced wetlands had been removed by the District's O&M activities.

Fifty acres of irrigation-produced wetlands outside or adjacent to the canal structure or right-of-way were also identified during field surveys in 1990. However, Reclamation estimates that approximately 25 of these acres are adjacent to the Refinery and are supported, or became established, by remedial activities of the Refinery. Approximately 200 cottonwood trees (larger than 2 inches in diameter) were identified by Reclamation and the Service either within the canal structure or in areas outside the canal structure determined to be influenced by seepage from the Main Canal.

Environmental Consequences

Alternative 1 (No Action)

Operation of the Hammond Project would continue as in the past. The present O&M program would be continued by the District to achieve effective control of deep-rooted and other vegetation within the canal and lateral structures and rights-of-way. This program would continue to result in the direct loss of the irrigation-produced wetlands, including cottonwood trees, within the canal and lateral structures on an annual basis. The habitat value of these areas would be transitory and would likely vary from year to year depending on the intensity of the District's O&M activities. The 25 acres of irrigation-produced wetland outside the canal structure or right-of-way associated with the activities of the Refinery would not be affected.

Alternatives 2 (Proposed Action), 3, and 4

Construction activities associated with lining the canals or placing pipelines would remove irrigation-produced wetland remaining within the existing canals and rights-of-way. Approximately 25 acres of irrigation-produced wetland outside or adjacent to the canal structure and right-of-way could be indirectly impacted because seepage and deep infiltration from the canals would be reduced or eliminated due to canal lining or pipeline installation. Cottonwood trees within the canal structure would be destroyed as a direct impact of lining or pipeline installation. Cottonwood trees outside the canal structure or right-of-way could die because the canal lining or pipeline installation would eliminate all or a portion of the water source supporting those trees.

Mitigation

Alternative 1 (No Action)

No mitigation is proposed.

Alternatives 2 (Proposed Action), 3, and 4

Reclamation proposes to mitigate the loss of wildlife habitat value of irrigation-produced wetland outside the canal structures and right-of-way. The intent of the mitigation measure(s) would be to accomplish inkind replacement of wildlife habitat function and values through enhancement of existing or degraded wetland/riparian areas in the Project area. Reclamation would implement measures to replace the functional value of 25 acres of irrigation-produced wetland outside the canal structure and right-of-way at the 2:1 ratio (2 acres enhanced for every acre impacted) recommended by the Service. Reclamation would consider the measures recommended by the Service in its September 28, 1990, Planning Aid Memorandum (PAM) (Service, 1990), or other mutually agreeable measures, to replace that lost wildlife habitat value for the 25 acres of irrigation-produced wetland outside the canal structure and right-of-way.

Alternative mitigation measures could include, but are not necessarily limited to: (1) planting of cottonwood/willow along the San Juan River downstream from Navajo Dam in areas where natural cottonwood regeneration is presently inadequate or not occurring, (2) clearing areas of existing tamarisk or cattail-dominated wetland and creating irregularly shaped openings/ponds surrounded by willow and sedge/rush wetlands, (3) enhancement of existing wetlands on Reclamation-owned lands downstream from Navajo Dam or State-owned lands upstream from the Hammond Diversion Dam on the San Juan River, (4) cooperative wetland enhancement/ development with other landowners or interested parties (such as Ducks Unlimited) on areas adjacent to the San Juan River (such as Tom Bolack's Box B Ranch) or, (5) development of abandoned gravel pits adjacent to the San Juan River as wetlands.

The Service recommended mitigation measures for loss of the 14 acres of irrigation-produced wetlands within the canal structure or right-of-way in its PAM (Service, 1990). Reclamation has considered those recommendations and other recent mitigation recommendations (Service, 1993). However, Reclamation believes that acre-for-acre replacement of the irrigation-produced wetland within the canal structure or right-of-way is not reasonable, justified, or cost effective for this Project. The irrigation-produced wetland within the canal structure has limited value as wildlife habitat due to the District's O&M activities.

This position is consistent with Reclamation's memorandum regarding irrigation-produced wetlands (Reclamation, 1993, attachment E). A comparison of the future value of this resource *with* and *without* the proposed action (salinity control) indicates the same environmental impact (i.e., removal of the irrigation-produced wetland within the canal structure). The Service's 1990 PAM identified the most extensive habitat type in the Project area as agricultural lands. The PAM explained that ". . . agricultural practices (burning, mowing, pesticides) limit the habitat value of these lands." The District's O&M activities for the canal structures are the same as, or in some cases more severe than, the vegetation control practices used for adjacent agricultural lands and also limit the habitat value of irrigation-produced wetland.

Reclamation would prepare and implement a detailed mitigation plan for losses of irrigation-produced wetland outside the canal structure or right-of-way, in coordination with the Service, New Mexico Game and Fish Department, New Mexico Environment Department, and EPA, prior to completion of the proposed Project. The use of water for such mitigation would be subject to State water law. Mitigation measures would be implemented concurrent with construction activities. Mitigation measures would also include monitoring of irrigation-produced wetland/riparian vegetation outside the canal structure or right-of-way after construction of the Project is completed and additional replacement of actual wildlife habitat value losses, if warranted. Reclamation would avoid disturbing areas adjacent to the canal structure during construction activities to the extent practicable.

Reclamation would plant cottonwood trees (at a 2:1 ratio) at alternative locations to replace trees lost as direct and indirect impacts from the Project. Specific locations and sizes of replacement trees would be identified in coordination with the Service and New Mexico Game and Fish Department.

THREATENED AND ENDANGERED SPECIES

Affected Environment

Reclamation and the Service initially entered into an Endangered Species Act—Section 7 consultation on endangered species in early 1990. At that time, the Service identified seven federally listed threatened or endangered species and four candidate species as potentially occurring within the Project area. The Service provided an updated list of species on March 15, 1994. The updated list includes the following species: bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), black-footed ferret (*Mustela nigripes*), Colorado squawfish (*Ptychocheilus lucius*), Mancos milk vetch (*Astragalus humillimus*), the Mesa Verde cactus (*Sclerocactus mesa-verde),* and the razorback sucker (*xyrauchen texanus*). The candidate species are: Beautiful gila (*Gila formosa*) and the San Juan milkweed (*Asclepias sanjuanensis*).

Reclamation removed the Mancos saltbush from consideration in the biological assessment and this planning report/environmental assessment (PR/EA) because it has been downgraded by the Service to category 3C, meaning it is more prevalent than previously thought and/or there is no identifiable threat to the species. In addition, the biological assessment addresses potential Project impacts to recently designated critical habitat for two endangered fish, the Colorado squawfish and razorback sucker.

Environmental Consequences of All Alternatives

Reclamation evaluated potential effects on the subject listed and candidate species and prepared a biological assessment (Reclamation, 1991) that described potential impacts on those species (attachment F). Reclamation determined that the proposed Project would have no effect on the listed or candidate species addressed in the 1991 biological assessment. The Service concurred with that determination (Service memorandum dated May 14, 1991) for the subject species, except the Colorado squawfish and razorback sucker.

The Service expressed a concern regarding water depletions associated with wetland mitigation for salinity control. The concern is that wetland mitigation could result in a new depletion of water from the San Juan River. The Service generally views such water depletions as adversely affecting endangered fish or their critical habitat. Reclamation has not identified a specific source of water for any proposed wetland mitigation measures described in this chapter. As previously stated, use of water for mitigation would be subject to State water law.

Reclamation believes that implementation of the proposed salinity control project would result in a long-term reduction of annual water depletions to the San Juan River from the Hammond Project. Reclamation estimates this reduction to be up to 4,900 acre-feet, a result of reducing seepage from the existing canals and laterals ("Evaluation of Salt Loading for Viable Alternatives" section of chapter IV). Reclamation believes this reduction, not including any water used for wetland mitigation, would result in a net reduction of historic water depletions from the Hammond Project and a net gain in riverflows.

Reclamation has prepared a revised biological assessment to address the updated species list and the unresolved issue regarding water used for wetland mitigation. The Service will render an opinion on the effects of the Project on the species addressed in the revised biological assessment. The parties (except the Navajo Nation and State of Utah) to the San Juan Recovery Implementation Program have agreed to protect water that flows through critical habitat for endangered fish in the San Juan River to its confluence with Lake Powell.

FISH AND WILDLIFE HABITAT

Affected Environment

Fish habitat is generally available in the open canals of the Project only during the irrigation season. Incidental numbers of fish enter the canal system from the San Juan River at the Hammond Diversion Dam and survive until the canals are dewatered in the fall. The San Juan River flows adjacent to the Project for the entire length of the Project. Wildlife habitat within the Project area is generally limited to field edges and undisturbed areas (such as Project drains), the margins of the existing canals and laterals, and areas of vegetation outside the canal structures supported by seepage from the canals. Some of the fields do provide temporary habitat for some upland game species such as ringneck pheasant; but, as mentioned earlier, the routine harvesting of hay and other crops reduces the habitat value. Waste water areas and return channels provide some areas of enhanced wildlife habitat, but the value is reduced in some areas because of the buildup of salts on the soil surface and the resultant reduction in vegetative cover. Some cottonwood trees that have become established within and along conveyance facilities and in fence rows provide structural diversity and enhanced habitat for some species.

Environmental Consequences of Alternative 1 (No Action)

The habitat within the canal structure would continue to be removed by the O&M program of vegetation control by the District. No other changes to fish and wildlife habitat would be expected. Effects on fish and wildlife habitat could result from future individual landowner or District actions.

Environmental Consequences of Alternatives 2 (Proposed Action), 3, and 4

Alternatives 2, 3, and 4 would result in an improvement in the aquatic resources in the San Juan River due to reduced salinity loading from the project lands. Alternatives 3 and 4 would result in the loss of 79 acres of seasonal aquatic habitat associated with open canals. Alternatives 2, 3, and 4 would also have a short-term adverse effect on 170 acres of other vegetation due to construction activities. This impact would be reduced over time by restoration and revegetation of construction-disturbed areas. Reclamation would investigate methods to allow easy exit for all sizes of wildlife, including consideration of a step-sided design.

SOILS AND VEGETATION

Affected Environment

The Project area is composed of eight major vegetation types that total almost 8,100 acres (see table VI-2).

Table VI-2.—Hammond Project habitat types

Habitat type	Acres
Agricultural	3,933
Wetland or marsh	481
Riparian woodland	65
Phreatophytic shrubland or mixed riparian shrubland	1,336
Riparian wash	719
Riparian grassland	70
Desert shrubland	1,392
Aquatic (ponds and canals)	96
Total	8,092

Environmental Consequences of Alternative 1 (No Action)

The No Action Alternative would result in adverse effects on the vegetation within the canal structure due to maintenance and management activities by the District. The exact extent of this effect would vary somewhat from year to year depending upon the nature of the activities performed annually. However, a long-term adverse effect on this vegetation would occur.

Alternative 2 (Proposed Action)

All construction-disturbed areas, not needed for long-term operation of the Project, would be restored and revegetated.

Alternatives 3 and 4

These alternatives would result in the existing open canals being placed in pipelines. Areas formerly occupied by open canals would be restored to natural ground surfaces and fields. Approximately 234 acres would be temporarily disturbed by construction activities. A pumping plant would be constructed to pressurize the pipeline. All construction-disturbed areas not needed for long-term operation of the Project would be restored and revegetated.

BLOOMFIELD REFINERY

Affected Environment

The Refinery near Bloomfield, New Mexico, has been identified by the State of New Mexico as the source of hydrocarbon contamination beneath and adjacent to the Refinery and as being responsible for cleanup of the refinery-generated contamination. This includes portions of the Main Canal adjacent to the Refinery. The Refinery has initiated remedial cleanup actions. At present, the Main Canal is shut down when water deliveries are completed in the late fall of each year, and water seeps/drains from the Refinery site into the canal. A small detention berm is constructed in the canal to retain the drainage water that accumulates during the winter shutdown period. Prior to water deliveries being made in the spring, the berm and accumulated water are removed. When water deliveries are being made from the Main Canal, seepage from the canal moves underneath the Refinery, flushing the underlying soils, cleansing the soils, and further aiding ground-water movement and leaching of the contaminated soils. Reclamation is concerned that by undertaking construction activities to rehabilitate the Main Canal, it may incur some joint responsibility for cleanup of the contaminated soils under provisions of the Resource Conservation and Recovery Act. This would not be acceptable to Reclamation. Reclamation has initiated coordination with Refinery officials to define remediation responsibility and to seek absolution from any such responsibility. (See attachment D.)

Environmental Consequences of Alternative 1 (No Action)

The Refinery would continue its remedial actions to remove contamination. Irrigation water from the Main Canal would continue to seep underneath the Refinery, and seepage from the Refinery would continue to seep into the canal during the nonirrigation season. It would be anticipated that remediation of the contaminated soils would be completed in the future.

Alternatives 2 (Proposed Action), 3, and 4

Reclamation would monitor the progress of the remedial actions undertaken by the Refinery and assess the effects on the Main Canal. Any construction of rehabilitation features for the reach of the Main Canal adjacent to the Refinery would be delayed until the remedial actions are completed and determined to have no effect on the Project.

CULTURAL RESOURCES

Affected Environment

The Project area was occupied for thousands of years by prehistoric groups prior to European incursion into the area. Aztec Ruins National Monument, about 9 miles north of the Project area, preserves some evidence of the prehistoric culture. The Project area was surveyed at the time of the construction of the Hammond Project in the early 1960's. Further consultations with the New Mexico State Historic Preservation Office (SHPO) and Advisory Council would be conducted as required by 36 CFR 800. Current trends would be expected to continue under Alternative 1 (no action).

Environmental Consequences of Alternatives 2 (Proposed Action), 3, and 4

Cultural resources surveys would be conducted in all Project areas where there is no existing inventory or where the information requires clarification. These areas would include borrow and spoil areas, road realignments, excavation areas, contractor work areas, and other areas of surface disturbance. Data recovery would be conducted for significant sites which could not be avoided. Reclamation would avoid significant sites to the extent practicable. If evidence of prehistoric or historic cultural resources should be discovered during construction activities, work would immediately cease at the location until Reclamation coordinated with the SHPO to determine the significance of the discovery.

INDIAN TRUST ASSETS

Policy

Indian Trust Assets are legal interests in property held in trust by the United States for Indian tribes or individuals. The Secretary of the Interior (Secretary) is the trustee for the United States on behalf of Indian tribes. All Department of the Interior agencies, including Reclamation, share the Secretary's duty to act responsibly to protect and maintain Indian Trust Assets reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and executive orders. These rights are sometimes further interpreted through court decisions and regulations. Examples of trust assets are lands, minerals, hunting and fishing rights, and water rights. Reclamation will carry out its activities in a manner which protects trust assets and avoids adverse impacts, when possible. When Reclamation could not avoid adverse impacts, it would provide appropriate mitigation or compensation.

Adversely Impacted Assets

In accordance with this policy, Reclamation has maintained coordination with the Navajo Nation, other area tribes, and the Bureau of Indian Affairs (BIA) throughout the project planning phases. Sections of this document concerning the Navajo Unit, Navajo Indian Irrigation Project, Issues and Institutional Constraints, and the Consultation and Coordination document most considerations and coordination events. These same groups continue to be consulted as part of the project review process. No adverse impacts are anticipated to Indian Trust Assets as a result of the No Action Alternative or any of the viable alternatives considered in this project. As this project enters construction, consultation would continue.

PROJECT COST

Affected Environment

The estimated cost of the proposed Project is a key economic factor in evaluating its effectiveness. Project costs have been evaluated for the proposed Project, and alternatives to it, in terms of: (1) annual cost, (2) cost per ton of salt removed, (3) construction cost, and (4) annual O&M cost. Table VI-3 displays those costs.

Table VI-3.—Comparison of cost estimates for alternatives

	No Action	Canal Lining	Low-Pressure Pipeline	High-Pressure Pipeline
Annual cost ($ million)	0	1.15	1.63	1.98
Cost effectiveness ($/ton salt removed)	0	41.65	88.75	107.36
Investment cost ($ million)	0	13.6	14.7	17.1
Annual operation, maintenance, and replacement cost ($)	104,000	110,000	500,000	670,000

Environmental Consequences of All Alternatives

The Colorado River Water Quality Improvement Program uses a criterion of value of approximately $100 per ton of salt removed as the threshold for determining cost-effective increments for salinity control projects. The reasonable alternatives have been evaluated in terms of cost effectiveness, including cost per ton. Costs of the reasonable alternatives were estimated using January 1993 price levels with a project life of 50 years. The current economic value of power production was used—these values were estimated at $262 per kW per year for capacity and 19.5 mills per kilowatthour for energy.

CONSULTATION AND COORDINATION

PUBLIC INVOLVEMENT

This chapter, in conjunction with chapter V of the planning report, serves as the Public Involvement Summary Report on this phase of Project development.

Reclamation prepared and mailed a public scoping document (attachment C) in April 1986 to those individuals, organizations, and agencies interested in, or affected by, rehabilitation of the Hammond Irrigation Project. The purpose of the scoping document was to: (1) notify the public that Reclamation was preparing an EA for the proposed Project, (2) solicit public comment on potentially significant environmental issues that should be addressed in the EA, and (3) identify alternatives that the public believed Reclamation should consider. The EA was sent to those individuals, organizations, and agencies for a 30-day review and comment period. Reclamation responses to letters and comments are included in attachment A.

COORDINATION WITH OTHER AGENCIES

Reclamation is the lead agency for preparation of this EA. Reclamation used a team of interdisciplinary resource specialists to comply with the mandate of NEPA to utilize a ". . . systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking. . ." (40 CFR 1501.2 (a)). The principal Reclamation members of the team were: environmental protection specialist, archeologist, civil engineering technician, geologist, ecologist, and hydrologist.

In addition, other key State and Federal agencies were involved with the team. They provided resource expertise, technical assistance, and ongoing review and input to the environmental analysis during preparation of the EA. A more detailed list of preparers is appended to this PR/EA.

Reclamation consulted with the Service to assure compliance with the Endangered Species Act. Reclamation requested a list of potentially affected federally listed threatened and endangered species from the Service and prepared a biological assessment for the proposed Project. The Service concurred with Reclamation's determination of "no effect" for all the subject species, except Colorado squawfish and razorback sucker. The Service expressed a concern regarding water depletions associated with wetland mitigation. Reclamation also coordinated with the Service in compliance with the Fish and Wildlife Coordination Act and will request additional coordination. The Service prepared a PAM for the Project (see attachment E). Additional coordination and consultation has been and will be conducted with the SHPO regarding potential effects on significant prehistoric or historic cultural resources.

Consultation and coordination with the Navajo Nation, other area tribes, and BIA have constituted an ongoing aspect of project planning. These activities will continue in accordance with Reclamation's Indian Trust Assets (ITA) policy.

Reclamation has consulted with EPA regarding characterization and remediation actions for contamination caused by the Refinery. EPA has provided comments and input to this PR/EA. Reclamation will coordinate its proposed action for the Hammond Main Canal with EPA and the Refinery.

ENVIRONMENTAL MITIGATION COMMITMENTS

The following environmental mitigation commitments were identified as a result of the environmental analysis conducted for the EA. The commitments would be implemented by Reclamation through: (1) incorporation into construction specifications, (2) separate contracts by Reclamation or other agencies, or (3) Reclamation or other agency personnel. Commitments for preconstruction activities would generally be completed by Reclamation or by contract prior to construction specifications and activities. Environmental commitments to be implemented by another agency would also be identified. Some commitments, such as monitoring or additional studies (where needed), could continue beyond completion of the Project.

- Management practices would be employed during construction activities to minimize environmental effects and would be included in construction specifications. These specifications address public safety, dust abatement, air pollution, noise abatement, water pollution abatement, waste material disposal, erosion control, hazardous materials, archeological and historical resources, vegetation, and wildlife. An environmental commitment plan would be developed to insure implementation of environmental commitments and adherence to the management practices.

- Construction activities would be timed and coordinated with the District to minimize interruptions of Project water deliveries to the maximum extent practicable. Reclamation would make provisions to deliver Project water to downstream water users during construction activities, if needed.

- Contractor work areas and storage yards would be needed to support construction activities. Existing cleared areas would be used to the maximum extent possible. The intent is to minimize areas cleared/disturbed for work areas.

- All construction-disturbed areas would be restored and revegetated as nearly to their preconstruction condition as practicable. Suitable species would be used in all revegetation efforts.

- Reclamation proposes to mitigate the loss of wildlife habitat value of irrigation-produced wetland outside the canal structures and right-of-way. The intent of the mitigation measure(s) would be to accomplish inkind replacement of wildlife habitat function and values through enhancement of existing or degraded wetland/riparian areas in the Project area. Reclamation would implement measures to replace the loss of 25 acres of irrigation-produced wetland outside the canal structure and right-of-way at a 2:1 ratio (2 acres enhanced for every acre impacted). Reclamation would investigate and implement the measures recommended by the Service in its September 28, 1990, PAM (Service, 1990), or other mutually agreeable measures, to replace that lost wildlife habitat value for the 25 acres of irrigation-produced wetlands outside the canal structure and right-of-way.

- Alternative mitigation measures would include: (1) planting of cottonwood/willow along the San Juan River downstream from Navajo Dam in areas where natural cottonwood regeneration is presently inadequate or not occurring, (2) clearing areas of existing tamarisk or cattail-dominated wetland and creating irregularly shaped openings/ponds surrounded by willow and sedge/rush wetlands, (3) enhancement of existing wetlands on Reclamation-owned lands downstream from Navajo Dam or State-owned lands upstream from the Hammond Diversion Dam on the San Juan River, (4) cooperative wetland enhancement/development with other landowners or interested parties (such as Ducks Unlimited) on areas adjacent to the San Juan River (such as Tom Bolack's Box B Ranch), or (5) development of abandoned gravel pits adjacent to the San Juan River as wetlands.

- Reclamation would prepare and implement a detailed mitigation plan for losses of irrigation-produced wetland outside the canal structure or right-of-way, in coordination with the Service, New Mexico Game and Fish Department, New Mexico Environment Department, and EPA, prior to completion of the proposed Project. The use of water for such mitigation would be subject to State water law. Mitigation measures would be implemented concurrent with construction activities. Mitigation measures would also include monitoring of affected irrigation-produced wetland/riparian vegetation outside the canal structure or right-of-way after construction of the Project is completed and additional replacement of actual habitat value losses, if warranted. Reclamation would avoid disturbing areas adjacent to the canal structure during construction activities to the extent practicable.

- Reclamation would plant cottonwood trees (at a 2:1 ratio), as recommended by the Service, at alternative locations to replace trees lost as direct and indirect impacts from the Project. Specific locations of replacement trees would be identified in coordination with the Service and New Mexico Game and Fish Department.

- Cultural resources surveys would be conducted in all Project areas where there is no existing inventory or where the information requires clarification. These areas would include borrow and spoil areas, road realignments, excavation areas, contractor work areas, and other areas of surface disturbance. Data recovery would be conducted for significant sites which cannot be avoided. Reclamation would avoid significant sites to the extent practicable. If evidence of prehistoric or historic cultural resources should be discovered during construction activities, work would immediately cease at the location until Reclamation coordinated with the SHPO to determine the significance of the discovery.

- Reclamation would monitor the progress of the remedial actions undertaken by the Refinery and would assess the effects on the Main Canal. Any construction of salinity control features for the reach of the Main Canal adjacent to the Refinery would be delayed until the remedial actions were completed and were determined to have no effect on the Project.

- Reclamation will continue to consult with the Navajo Nation, other area tribes, and BIA to ensure proper consideration of ITA. An analysis of potential impacts and related mitigation would be prepared, if needed.

Finding of No Significant Impact
(FONSI)

FINDING OF NO SIGNIFICANT IMPACT

San Juan River Unit-Hammond Project Portion, New Mexico

Colorado River Water Quality Improvement Program

Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Salt Lake City, Utah

Recommended By: Regional Environmental Officer — 12-15-94 Date

Approved By: Regional Director — 12/16/94 Date

UC-FONSI-95-003
FONSI NUMBER

FINDING OF NO SIGNIFICANT IMPACT

San Juan River Unit-Hammond Project Portion, New Mexico

Colorado River Water Quality Improvement Program

The Bureau of Reclamation (Reclamation) has prepared a Planning Report/Environmental Assessment (PR/EA) for the San Juan River Unit-Hammond Project Portion, a part of the Colorado River Water Quality Improvement Program. The proposed action involves implementing actions to reduce salt loading to the Colorado River from the existing Hammond Project. The existing Hammond Project provides a full-service irrigation water supply to over 3,900 acres of land south of Bloomfield, New Mexico south of the San Juan River.

The PR/EA evaluated in detail four alternative courses of action:

1. No Action - meaning no action would be taken by Reclamation or the Hammond Conservancy District to rehabilitate the project to reduce salt loading to the Colorado River.

2. Line Canals (the proposed action) - Presently unlined portions of the existing Main Canal and three principal lateral canals (East and West Highline and the Gravity Extension) would be lined with concrete, clay, or other impermeable membrane or layer.

3. Construct Low-Pressure Pipeline, Upper Section Only - The existing Main Canal would be replaced with a 30 to 42-inch diameter buried pipeline from Munoz Canyon to two miles east of State Highway 44. A 2,340 kilowatt pumping plant would be constructed in the existing Main Canal alignment. Water would be delivered into 13 new buried pipe laterals with at least 10 feet of pressure at the end of each lateral. The remainder of the existing project (lower section) would be served by the present water delivery system.

4. Construct High-Pressure Pipeline, Upper Section Only - This alternative is similar to No. 3, except that it would provide 100 feet of pressure at the end of the pipe laterals.

Alternatives considered but eliminated from consideration included: constructing a gravity-pressurized buried pipeline; retiring project lands; constructing a low-pressure or high-pressure buried pipeline to both the upper and lower section project lands and; constructing a low-pressure pipeline from the Navajo Indian Irrigation Project Canal at Munoz Canyon.

Reclamation has decided to select and implement Alternative 2 (the proposed action), including all the prescribed measures to mitigate adverse environmental impacts described in Chapter VI of the PR/EA. Based on the environmental analysis in the PR/EA, Reclamation has determined that the federal action proposed to be undertaken (Alternative 2) would not significantly affect the quality of the human environment. Therefore, an environmental impact statement will not be prepared.

A summary of the environmental analysis leading to the Finding of No Significant Impact is as follows:

1. Indian trust assets have been identified and considered. There would be no adverse effect form the proposed action on those assets. Consultation with potentially affected American Indian tribes and entities has been conducted, including their review and comment of the PR/EA. Consultation with the tribes regarding effects on trust assets will continue as the proposed action is implemented.

2. Adverse effects on irrigation-produced wetland and riparian areas have been considered. The proposed action would result in a loss of up to 25 acres of this habitat outside the canal right-of-way. Mitigation will be implemented to replace this habitat loss at a 2:1 ratio. The recommended wetland mitigation measures described in Chapter VI of the PR/EA will be implemented in close coordination with the U.S. Fish and Wildlife Service and the EPA. Cottonwood trees destroyed by the proposed action will be replaced at a 2:1 ratio.

3. The proposed action would not affect any federally-listed threatened or endangered species (see U.S. Fish and Wildlife Service's Section 7 Final Biological Opinion dated October 6, 1994). Potential effects of water depletions on Colorado squawfish and razorback sucker and their designated critical habitat have been evaluated and determined not to jeopardize the continued existence of those species.

4. The portion of the Main Canal adjacent to the Bloomfield Refinery near Bloomfield, New Mexico would not be lined until after the refinery has successfully completed all hazardous waste remedial actions required by the Environmental Protection Agency.

4. The proposed action would reduce salt loading to the Colorado River by an estimated 27,700 tons annually.

Reclamation has consulted and coordinated extensively with the U.S. Fish and Wildlife Service and Environmental Protection Agency regarding impacts on fish and wildlife resources and water quality issues related to the Bloomfield Refinery. The U.S. Fish and Wildlife Service concurs with Reclamation's proposed mitigation measures for fish and wildlife impacts.

List of Attachments

A. Public Comments and Reclamation Responses to Comments

B. Salt-Load Estimates for 1963 Through 1981

C. Public Involvement—April 1986 Newsletter

D. Letter of Intent—Bloomfield Refinery
EPA Factsheet

E. Planning Aid Memorandum
Other Correspondence Related to Wetland Mitigation

F. Biological Assessment and Related Correspondence

ATTACHMENT A

Public Comments and Reclamation Responses to Comments

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

FEB 24 1994

Ref: 8WM-WQ

File # 4779

Max J. Stodolski, Projects Manager
Bureau of Reclamation
P. O. Box 640
Durango, CO 81302-0640

Re: Hammond Project Draft Planning Report/EnvironmentalAssessment, New Mexico

Dear Mr. Stodolski:

The Environmental Protection Agency (EPA), Region VIII has completed its review of the referenced document. Our review has been coordinated with EPA Region VI since New Mexico is in that EPA Region. We support continued aggressive efforts to control salinity in the Colorado River basin. We appreciate the opportunities for EPA and other agencies to meet with the Bureau of Reclamation and discuss this project, including a field trip in 1990.

You will note from our enclosed comments that we primarily focused on wetland concerns. We agreed with your office on May 6, 1993, that we would not ask for a wetland mitigation plan in the environmental assessment (EA) for the Project provided we were in agreement on the wetland acreage ratios which would be applied. In this case, the ratios we agreed upon were two acres of created wetlands for every acre lost and one acre of mitigation in-place for every acre lost if the mitigation is in place prior to construction impacts. The ratios were assumed to provide adequate insurance that the wetland impacts would be replaced. However, the draft EA calls for wetland enhancement (rather than creation) at a 2:1 ratio as the means to mitigate wetland impacts (page A-4). We can agree with wetland enhancement measures provided they are done after opportunities for hydrologic restoration of degraded wetlands and creation of wetlands have been exhausted. The document should be revised accordingly. We also found the need to have the wetland impacts consistently described throughout the document and supported with additional information.

Please contact Sarah Fowler or Doug Lofstedt at 303/293-1575 or 1446 respectively if there are questions regarding our comments.

Sincerely,

Robert R. DeSpain

Robert R. DeSpain, Chief
Environmental Assessment Branch
Water Management Division

Enclosure

cc: Charles A. Calhoun, Bureau of Reclamation
Patty Schrader, U.S. Fish and Wildlife Service

DETAILED EPA COMMENTS ON DRAFT PLANNING REPORT/ ENVIRONMENTAL ASSESSMENT FOR THE HAMMOND SALINITY CONTROL PROJECT, NEW MEXICO

Wetlands

The wetland losses should be consistently described starting in Table S-3 and in Tables IV-9 and 17. The losses should be clarified by type, acreage, and location, e.g., in the prism of the canals, in other areas of the canal right-of-way, and outside the canal right-of-ways.

Pages IV-23 and 24 and elsewhere - We found the discussion of wetland impacts regarding the canal prism in Table IV-9 to be confusing. Under the no action alternative on page IV-24, there would be a permanent loss of "up to 14 acres of phreatophytic shrubland for 50-foot clearance zone along canals and laterals". Under the no action alternative on page IV-23 there would be "Up to 14 acres of vegetation adversely affected by O&M activities of District." On page IV-38 under the no action alternative there would be "some effect" on such wetlands from a "more rigorous O&M program". What is the actual impact? It is not clear that O&M in the future will create a permanent loss of in-prism wetlands. What is the "50 foot clearance zone"? Are the 14 acres of "phreatophytic shrubland" actually 14 acres of wetlands in the canal prism or all wetlands in the canal right-of-way?

We found confusing and unsupported statements in Table IV-9. For example, it is not clear that reducing "persistent wetlands by 10 to 25 percent" would have "No significant change" to furbearers and small game (page IV-22) and cause only "slight" impacts to birds (page IV-24).

Page A-6 - The wetland section of Table A-2 references a footnote that we were unable to find.

Page A-8 - The discussion in the second paragraph does not supply any rationale to conclude that the "artificial wetlands" are non-jurisdictional or "low value".

Pages A-4, A-9, A-10 and elsewhere - Reclamation proposes to mitigate the wetland losses by enhancing at a 2:1 ratio "existing or degraded wetland/riparian areas in the Project area" (page A-9). However, the agreement reached with Reclamation's Durango Projects Office on May 6, 1993 was a 2:1 ratio of created wetlands for every acre impacted, and one acre of mitigation in-place for every acre lost if the mitigation is in place prior to construction impacts. We can agree with wetland enhancement measures provided they are done after opportunities for 1) hydrologic restoration of degraded wetlands and 2) creation of wetlands, have been thoroughly exhausted. The draft EA should be revised accordingly. The agreement on mitigation ratios was done to prevent the need to have the mitigation plan in the EA. Also, it is not clear that enhancement of riparian areas actually means enhancement of wetlands.

The mitigation cost of "up to $143,000" (page A-18) may or may not be adequate. The cost should be determined once the mitigation plan has inter-agency agreement.

Page I-7 - Reclamation "is perfecting the water rights for the Project for additional amounts of water." Will this water or water saved as a result of the Project be used to irrigate new lands under Reclamation authorization? This concern relates to the ineligible land studies discussed on page I-8. Has Reclamation authorized additional lands to come under irrigation? If so, how much would it defeat the purpose of the salinity control project?

General Comments

Page S-3 - In the first full paragraph, it would be helpful to briefly describe the increases in salinity that are causing $311 million damages per year. Likewise, on page IV-3, the relationship of the 500 milligrams per liter of salinity to estimated damages of $311 million dollars should be clarified.

Page I-1 - We believe the issues as stated at the top of the page should be comprehensive rather than just the salinity contributions.

Page I-3 - We are unable to verify that accuracy of the statement near the middle of the page that the "Salinity control studies on the San Juan River Unit ... were authorized as part of ... the Federal Water Pollution Control Act Amendments of October 1972 ... as amended by the Clean Water Act of 1977." A similar statement is on page A-1. The specific sections and language from the statutes should be stated.

Likewise, the statement at the top of page IV-3 makes a statement that Public Law 92-500 (the Federal Water Pollution Control Act) uses "a criterion of least cost to the Federal Government (cost per ton of salt removed)" in order to set "forth a public policy of nondegradation of water quality." Here again, the specific section(s) and language from the statute needs to be stated.

Page I-5 and elsewhere - It would be helpful to locate the Bloomfield Refinery on the project maps.

Page IV-11 - How was the $183 per ton figure determined for the land retirement alternative? The cost should be at least the same as the cost for the preferred alternative.

Reclamation Responses to Environmental Protection Agency

Comment 1:

We can agree with wetland enhancement measures provided they are done after opportunities for hydrologic restoration of degraded wetlands and creation of wetlands have been exhausted. The document should be revised accordingly. We also found the need to have the wetland impacts consistently described throughout the document and supported with additional information.

Response 1:

The Bureau of Reclamation agrees to implement a 2:1 ratio for wetland enhancement to mitigate wetland impacts. This is consistent with the U.S. Fish and Wildlife Service recommendation in the 1990 Planning Aid Memorandum which called for a 2:1 ratio for inkind replacement of habitat values. The wetland mitigation measures described in chapter VI of the environmental assessment include both restoration of degraded wetlands and creation of new wetlands to mitigate the loss of habitat value.

Comment 2:

The wetland losses should be consistently described starting in Table S-3 and in Tables IV-9 and 17. The losses should be clarified by type, acreage, and location, e.g., in the prism of the canals, in other areas of the canal right-of-way, and outside the canal right-of-ways.

Response 2:

The discussion of wetland losses in chapter VI of the environmental assessment has been revised for clarity and consistency.

Comment 3:

Pages IV-23 and 24 and elsewhere - We found the discussion of wetland impacts regarding the canal prism in Table IV-9 to be confusing. Under the no action alternative on page IV-24, there would be a permanent loss of "up to 14 acres of phreatophytic shrubland for 50-foot clearance zone along canals and laterals". Under the no action alternative on page IV-23 there would be "Up to 14 acres of vegetation adversely affected by O&M activities of District." On page IV-38 under the no action alternative there would be "some effect" on such wetlands from a "more rigorous O&M program". What is the actual impact? It is not clear that O&M in the future will create a permanent loss of in-prism wetlands. What is the "50 foot clearance zone"? Are the 14 acres of "phreatophytic shrubland" actually 14 acres of wetlands in the canal prism or all wetlands in the canal right-of-way?

We found confusing and unsupported statements in Table IV-9. For example, it is not clear that reducing "persistent wetlands by 10 to 25 percent" would have "No significant change" to furbearers and small game (page IV-22) and cause only "slight" impacts to birds (page IV-24).

Response 3:

The discussion of wetland losses in chapter VI of the environmental assessment has been revised for clarity and consistency.

Comment 4:

Page A-6 - The wetland section of Table A-2 references a footnote that we were unable to find.

Response 4:

The footnote has been deleted from table VI-2.

Comment 5:

Page A-8 - The discussion in the second paragraph does not supply any rationale to conclude that the "artificial wetlands" are non-jurisdictional or "low value".

Response 5:

The discussion has been revised to include rationale for the conclusion that artificial wetlands are not waters of the United States.

Comment 6:

Pages A-4, A-9, A-10 and elsewhere - Reclamation proposes to mitigate the wetland losses by enhancing at a 2:1 ratio "existing or degraded wetland/riparian areas in the Project area" (page A-9). However, the agreement reached with Reclamation's Durango Projects Office on May 6, 1993 was a 2:1 ratio of <u>created</u> wetlands for every acre impacted, and one acre of mitigation in-place for every acre lost if the mitigation is in place prior to construction impacts. We can agree with wetland enhancement measures provided they are done after opportunities for 1) hydrologic restoration of degraded wetlands and 2) creation of wetlands have been thoroughly exhausted. The draft EA should be revised accordingly. The agreement on mitigation ratios was done to prevent the need to have the mitigation plan in the EA. Also, it is not clear that enhancement of riparian areas actually means enhancement of wetlands.

Response 6:

See response No. 1.

Comment 7:

The mitigation cost of "up to $143,000" (page A-18) may or may not be adequate. The cost should be determined once the mitigation plan has inter-agency agreement.

Response 7:

The subject reference to wetland mitigation cost has been deleted from chapter VI of the planning report/environmental assessment.

Comment 8:

Page I-7 - Reclamation "is perfecting the water rights for the Project for additional amounts of water." Will this water or water saved as a result of the Project be used to irrigate new lands under Reclamation authorization? This concern relates to the ineligible land studies discussed on page I-8. Has Reclamation authorized additional lands to come under irrigation? If so, how much would it defeat the purpose of the salinity control project?

Response 8:

The Bureau of Reclamation is not seeking additional water rights for the Hammond Project. The subject statement has been deleted from the planning report/environmental assessment. No new lands are, or will be, authorized by the Bureau of Reclamation to come under irrigation as a result of the Hammond Project.

Comment 9:

Page S-3 - In the first full paragraph, it would be helpful to briefly describe the increases in salinity that are causing $311 million damages per year. Likewise, on page IV-3, the relationship of the 500 milligrams per liter of salinity to estimated damages of $311 million dollars should be clarified.

Response 9:

The increases in salinity are due to a combination of agricultural, municipal, and natural salt sources such as salt deposits or saline springs in the Colorado basin. The text has been changed to reflect this explanation.

The material on page IV-3 needs some explanation: The $311 million are costs to consumers, public utilities, and water users, including irrigation due to salinity levels that exceed a baseline of 500 milligrams per liter. This information is included in the Bureau of Reclamation report *Estimating Economic Impacts of Salinity in the Colorado River* (Lohman, February 1988) which was cited in the text of the planning report/environmental assessment.

Comment 10:

Page I-1 - We believe the issues as stated at the top of the page should be comprehensive rather than just the salinity contributions.

Response 10:

The language has been revised to reflect this concern.

Comment 11:

Page I-3 - We are unable to verify that accuracy of the statement near the middle of the page that the "Salinity control studies on the San Juan River Unit . . . were authorized as part of . . . the Federal Water Pollution Control Act Amendments of October 1972 . . . as amended by the Clean Water Act of 1977." A similar statement is on page A-1. The specific sections and language from the statutes should be stated.

Response 11:

The narrative has been revised to accommodate this concern.

Comment 12:

Likewise, the statement at the top of page IV-3 makes a statement that Public Law 92-500 (the Federal Water Pollution Control Act) uses "a criterion of least cost to the Federal Government (cost per ton of salt removed)" in order to set "forth a public policy of nondegradation of water quality." Here again, the specific section(s) and language from the statute needs to be stated.

Response 12:

The document now includes specific section and statute language.

Comment 13:

Page I-5 and elsewhere - It would be helpful to locate the Bloomfield Refinery on the project maps.

Response 13:

The location has been added.

Comment 14:

Page IV-11 - How was the $183 ton figure determined for the land retirement alternative? The cost should be at least the same as the cost for the preferred alternative.

Response 14:

The cost-effective figure for land retirement in the report ($187) was incorrect. It should have been $87. This figure had not been updated since the plan was determined to be nonviable. The costs for all the nonviable alternatives have been updated to January 1993, which is the same time period as the viable alternatives. The updated figure is $100 per ton of salt removed. This is changed at relevant locations in the document.

Cost effectiveness for the land retirement alternative was determined by dividing total costs by the total tons of salt removed. The same method was used for all the alternatives. A low cost-effectiveness value indicates a lower cost of removing a ton of salt. The land retirement alternatives had a higher cost-effectiveness value and also failed the "acceptability" test (table IV-3).

The land retirement alternative could remove 34,350 tons of salt per year at a cost effectiveness of $100 per ton. This was determined by using an estimated cost of $8,000 per acre for the 3,933 acres. This cost, combined with the typical Bureau of Reclamation administrative costs (30 percent), results in a total cost of about $40.9 million. This amount amortizes to an annual cost of about $3.44 million, which results in the $100 per ton using 34,350 tons.

The detailed information has been included in the report.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Western Colorado Office
764 Horizon Drive, South Annex A
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:

ES/CO: BR-Hammond Project
MS 65412 GJ

March 15, 1994

Memorandum:

To: Acting Regional Director, Bureau of Reclamation, Upper Colorado Regional Office, Salt Lake City, Utah

From: Assistant Field Supervisor, U.S. Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Subject: Draft Planning Report/Environmental Assessment (PR/EA) for the Hammond Project Portion of the San Juan River Unit of the Colorado River Water Quality Improvement Program, San Juan County, New Mexico

The U.S. Fish and Wildlife Service (Service) has several comments on the subject documents. We noticed that the documents do not contain an updated list of species that may be impacted by project alternatives. A biological assessment for this project that addresses impacts to all the threatened, endangered, proposed, and candidate species that may occur in the project area would be appropriate. The biological assessment should address the entire water depletion caused by this project. A biological opinion addressing water depletion impacts to the endangered fishes in the San Juan River Basin and/or impacts to other species may need to be issued for this project. The EA lists seven federally listed species and three candidates that may occur in the project area. These are:

E	Bald eagle	Haliaeetus leucocephalus
E	Peregrine falcon	Falco peregrinus
E	Black-footed ferret	Mustela nigripes
E	Colorado squawfish	Ptychocheilus lucius
E	Razorback sucker	Xyrauchen texanus
E	Astragalus humillimus	Mancos milkvetch
T	Sclerocactus mesae-verdae	Mesa Verde cactus
3C	Proatriplex pleiantha	Mancos saltbush
C2	Gilia formosa	Beautiful gilia
C2	Asclepias sanjuanensis	San Juan milkweed

The Mancos saltbush has been downgraded to a category 3C which means it is more prevalent than previously thought and/or there is no identifiable threat to the species. The Bureau of Reclamation (BR) can remove this species from consideration in the final PR/EA. In addition to the above species there are other species that may occur in the project area and BR should address impacts to these species in a biological assessment. The additional species are:

E	Pediocactus knowltonii	Knowlton's cactus
P	Southwestern willow flycatcher	Empidomax traillii extimus
C1	Mountain plover	Charadrius montanus
C2	Ferruginous hawk	Buteo regalis
C2	Apache northern goshawk	Accipiter gentilis apache
C2	White-faced ibis	Plegadis chihi
C2	Spotted bat	Euderma maculatum
C2	Roundtail chub	Gila robusta
C2	Flannelmouth sucker	Catostomus latipinnis

The Service would prefer wetland creation (over wetland enhancement) at a 2:1 replacement ratio but we are willing to accept enhancement if no options exist for creating wetlands. A combination of wetland creation and enhancement would also be acceptable. The Service will continue to cooperate with BR on wetland mitigation issues.

Page III-3, paragraph 2 of the PR states that water used for fish and wildlife purposes is a beneficial use of water. Similarly, page A-7 of the EA mentions recreation as a beneficial use of water. Recreation could include fishing or bird watching and hence water used to enhance fish habitat or bird habitat would be a beneficial use. It logically follows then, that water used for creation or enhancement of wetlands, which may improve both fish and wildlife habitat, is a justifiable use of the water and BR should be able to acquire water saved by the Hammond Project and apply it to wetland creation or enhancement. Even if "salvaged" water does not automatically go to the current water user BR should be able to purchase water for wetland creation and fish and wildlife purposes.

In Table IV-9, page IV-26, there is a statement that claims "no effect" to the endangered species from either the canal lining or pipeline options. Currently, the project pumps an excess 9,500 acre-feet of water to offset losses due to evaporation and leaks in the canal. It would be beneficial to the endangered fishes if BR would ensure that the 9,500 acre-feet of "saved" water is protected throughout the length of the San Juan River. This may result in a small beneficial effect to the endangered fishes but overall there is still a negative impact to the endangered fishes since the rest of the water used by this project is more than 9,500 acre-feet.

Page IV-27, states that canal lining is the alternative that removes the most salt. This may not be totally accurate. A combination of canal lining and land retirement would reduce salinity more than just canal lining. The Service recommends that the BR further explore options for retiring lands under irrigation if current landowners are willing.

The PR/EA indicate that lining the canal would reduce salt input to the San Juan River more than putting the water in a pipeline. The Service would like a further explanation of this statement.

The Service would also like clarification on whether the "lower" section of the canal is going to be lined or not. The PR/EA does not address this clearly.

If the Service can be of further assistance, please contact Terry Ireland at the letterhead address or (303) 243-2778.

Keith L. Rose

pc: FWS/ES, Golden
FWS/ES, Albuquerque FO
BR, Durango Projects Office, (Attn: Dan Fritz)

TIreland:HammPREA.mem:031594

Reclamation Responses to the U.S. Fish and Wildlife Service
(March 15, 1994)

Comment 1:

The U.S. Fish and Wildlife Service (Service) has several comments on the subject documents. We noticed that the documents do not contain an updated list of species that may be impacted by project alternatives. A biological assessment for this project that addresses impacts to all the threatened, endangered, proposed, and candidate species that may occur in the project area would be appropriate. The biological assessment should address the entire water depletion caused by this project. A biological opinion addressing water depletion impacts to the endangered fishes in the San Juan River Basin and/or impacts to other species may need to be issued for this project. The EA lists seven federally listed species and three candidates that may occur in the project area. These are:

E	Bald eagle	Haliaeetus leucocephalus
E	Peregrine falcon	Falco peregrinus
E	Black-footed ferret	Mustela nigripes
E	Colorado squawfish	Ptychocheilus lucius
E	Razorback sucker	Xyrauchen texanus
E	Astragalus humillimus	Mancos milk vetch
T	Sclerocactus mesae-verdae	Mesa verde cactus
?	Proatriplex pleiantha	Mancos saltbush
?	Gilia formosa	Beautiful gilia
C2	Asclepias sanjuanensis	San Juan milkweed

Response 1:

The Bureau of Reclamation has prepared a revised biological assessment to address the updated list of species that may be impacted by the Hammond Project and will complete the Endangered Species Act—Section 7 consultation with the U.S. Fish and Wildlife Service.

Comment 2:

The Mancos saltbush has been downgraded to a category 3C which means it is more prevalent than previously thought and/or there is no identifiable threat to the species. The Bureau of Reclamation (BR) can remove this species from consideration in the final PR/EA. In addition to the above species there are other species that may occur in the project area and BR should address impacts to these species in a biological assessment. The additional species are:

E	Pediocactus knowltonii	Knowlton's cactus
P	Southwestern willow flycatcher	Epidomax trailii extimus
C1	Mountain plover	Charadrius montanus
C2	Ferruginous hawk	Buteo regalis
C2	Apache Northern goshawk	Accipiter gentilis apache
C2	White-faced ibis	Plegadis chihi
C2	Spotted bat	Euderma maculatum
C2	Roundtail chub	Gila robusta
C2	Flannelmouth sucker	Catostomus latipinnis

The Service would prefer wetland creation (over wetland enhancement) at a 2:1 replacement ratio but we are willing to accept enhancement if no options exist for creating wetlands. A combination of wetland creation and enhancement would also be acceptable. The Service will continue to cooperate with BR on wetland mitigation issues.

Response 2:

The Bureau of Reclamation has removed this species from consideration in the biological assessment and the planning report/environmental assessment.

Comment 3:

Page III-3, paragraph 2 of the PR states that water used for fish and wildlife purposes is a beneficial use of water. Similarly, page A-7 of the EA mentions recreation as a beneficial use of water. Recreation could include fishing or bird watching and hence water used to enhance fish habitat or bird habitat would be a beneficial use. It logically follows then, that water used for creation or enhancement of wetlands, which may improve both fish and wildlife habitat, is a justifiable use of the water and BR should be able to acquire water saved by the Hammond Project and apply it to wetland creation or enhancement. Even if "salvaged" water does not automatically go to the current water user BR should be able to purchase water for wetland creation and fish and wildlife purposes.

Response 3:

The document will be changed in accordance with the State of New Mexico's water right allocation laws. There seems to be some confusion about beneficial uses, which are associated with specified uses required to perfect a water right with the State Engineer's Office, and the designated uses used in classifying stream under the Clean Water Act. Many of the "uses" cited are designated uses, not beneficial uses used in water rights determination. The Bureau of Reclamation or any other entity could file a water rights application for the "saved" water from the Hammond Project, but it would be junior to prior and existing applications filed with the State Engineer's Office. The State Engineer in New Mexico, not the Bureau of Reclamation, controls water rights appropriation.

Comment 4:

In Table IV-9, page IV-26, there is a statement that claims "no effect" to the endangered species from either the canal lining or pipeline options. Currently, the project pumps an excess 9,500 acre-feet of water to offset losses due to evaporation and leaks in the canal. It would be beneficial to the endangered fishes if BR would ensure that the 9,500 acre-feet of "saved" water is protected throughout the length of the San Juan River. This may result in a small beneficial effect to the endangered fishes but overall there is still a negative impact to the endangered fishes since the rest of the water used by this project is more than 9,500 acre-feet.

Response 4:

The Bureau of Reclamation's revised biological assessment addresses the effects of the salinity project on the historic water depletions of the Hammond Project. In addition, the threatened and endangered species discussion in chapter VI of the planning report/environmental assessment has been revised to include reference to the agreement made by the parties to the San Juan River Recovery Implementation Program to protect flows through endangered fish habitat of the San Juan River.

Comment 5:

Page IV-27, states that canal lining is the alternative that removes the most salt. This may not be totally accurate. A combination of canal lining and land retirement would reduce salinity more than just canal lining. The Service recommends that the BR further explore options for retiring lands under irrigation if current landowners are willing.

Response 5:

Only a few of those receiving Hammond Project benefits are full-time farmers who would be less likely to be willing sellers. One of the full-time farmers least likely to sell is at the end of the Main Canal; accordingly, in order to derive full Hammond Project benefits, it would not be feasible to retire some lands along the canal. The seepage losses that would occur in reaches along the retired lands would reduce the benefits attributable to the cessation of farming operations. The discussion regarding retiring of Hammond Project lands has been expanded in chapter IV of the planning report.

Comment 6:

The PR/EA indicate that lining the canal would reduce salt input to the San Juan River more than putting the water in a pipeline. The Service would like a further explanation of this statement.

Response 6:

In the Canal Lining Alternative, all unlined portions (19.52 miles) of the 26.95 miles of Main Canal and the unlined portions (7.21 miles) of the 10.25 miles of laterals would be lined, whereas in the two viable pipeline alternatives, only the upper section (6.59 miles) of the Main Canal comprising component reaches 8 through 16 (tables IV-2 and IV-13) would be placed in pipeline. The rest of the canal would remain as it now is. The existing laterals (Gravity Extension, East Highline, and West Highline) would be abandoned, thereby eliminating salt contributions from those sources. The total annual salt-load reduction by these measures is estimated to be 18,400 tons.

Included in the final draft is this additional information on the portions of canal to be placed in pipeline under the viable alternatives (tables S-3 and IV-17), which should help to clarify the question raised.

Comment 7:

The Service would also like clarification on whether the "lower" section of the canal is going to be lined or not. The PR/EA does not address this clearly.

Response 7:

Under Alternative 2 (the proposed action), the lower section of the canal would be lined.

TE OF NEW MEXICO
MENT DEPARTMENT

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Ron Curry
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February 14, 1994

Max J. Stodolski
Projects Manager
Bureau of Reclamation
P.O. Box 640
Durango CO 81302-0640

RE: DRAFT PLANNING REPORT/ENVIRONMENTAL ASSESSMENT (PR/EA), PROPOSED SAN JUAN RIVER UNIT, HAMMOND PROJECT, COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM, SAN JUAN COUNTY, NEW MEXICO

Dear Mr. Stodolski:

The following comments are made in reference to the subject project. The intent of the project is to line irrigation canals to prevent seepage of irrigation water into underlying sediment and bedrock, where the water will dissolve salts, carrying them back into the San Juan River. While this seems to be a good idea conceptually, the Draft PR/EA fails to document the same mechanism taking place on farmlands.

There is a potential for reduction of wetlands from the project. The document addresses mitigation measures to compensate for the loss. Wetlands are recognized as "waters of the State" by the New Mexico Water Quality Control Commission; the New Mexico Water Quality Act will apply to the potential loss of these critical areas. Accordingly, it is important that the Surface Water Quality Bureau of the New Mexico Environment Department be contacted by the Bureau of Reclamation to participate in the determination of mitigation measures and locations.

Thank you for the opportunity to comment; please let me know if you have any questions on the above.

Sincerely,

Gedi Cibas, Ph.D.
Environmental Impact Review Coordinator

cc: NMED File No.782

Reclamation Responses to State of New Mexico Environment Department

Comment 1:

The following comments are made in reference to the subject project. The intent of the project is to line irrigation canals to prevent seepage of irrigation water into underlying sediment and bedrock, where the water will dissolve salts, carrying them back into the San Juan River. While this seems to be a good idea conceptually, the Draft PR/EA fails to document the same mechanism taking place on farmlands.

Response 1:

On page II-2 of the December 1993 report, the last sentence of the paragraph under "Salt-Loading Mechanism" shows recognition of contributions to the San Juan River of saline water from irrigation deep percolation. However, the scope of our work does not cover this contributing factor. The scope of our work and this report address the contribution of salt loading from canal seepage and alternative methods to reduce this contribution by lining the canals and laterals or putting portions of the canal and laterals in pipeline. The onfarm contributions are being handled by the Soil Conservation Service, with whom we cooperate in all of these types of projects. It is anticipated that this contribution will be reduced as efficiency in irrigation applications increases.

Comment 2:

There is a potential for reduction of wetlands from the project. The document addresses mitigation measures to compensate for the loss. Wetlands are recognized as "waters of the State" by the New Mexico Water Quality Control Commission; the New Mexico Water Quality Act will apply to the potential loss of these critical areas. Accordingly, it is important that the Surface Water Quality Bureau of the New Mexico Environment Department be contacted by the Bureau of Reclamation to participate in the determination of mitigation measures and locations.

Response 2:

The Bureau of Reclamation agrees to include the New Mexico Environment Department in preparation and implementation of wetland mitigation measures. Planning report/environmental assessment references to the coordination process have been revised to include the New Mexico Environment Department.

NEW MEXICO INTERSTATE STREAM COMMISSION

BATAAN MEMORIAL BUILDING, ROOM 101
STATE CAPITOL
POST OFFICE BOX 25102
SANTA FE, NEW MEXICO 87504-5102
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April 11, 1994

Max J. Stodolski, Projects Manager
Bureau of Reclamation
Post Office Box 640
Durango, Colorado 81302-0640

Dear Mr. Stodolski:

The New Mexico Interstate Stream Commission staff offers the following comments on the Bureau of Reclamation's December 1993 Draft Planning Report/Environmental Assessment for the San Juan River Unit, Hammond Project, Colorado River Water Quality Improvement Program (Report).

Page S-8, Table S-3: The pipeline options exhibit less expected salt load reductions than the reduction expected by canal lining. This is because the pipeline options would install pipe for only a portion of the project; whereas, the canal lining would be installed for the entire project. For that portion of the project where pipe installation is not viable, the Report indicates that canal lining is viable. The Report should consider a combination pipeline and canal lining option, which should result in a greater expected salt load reduction than the reduction expected by canal lining alone. This assumes a small seepage loss rate for lined canals and a negligible pipeline leakage rate as is assumed elsewhere in the Report.

Page I-7, first complete paragraph: The first and third sentences indicate that Reclamation is knowingly making unpermitted and illegal diversions.

Page I-8, first paragraph, seventh sentence: With full development, 508,000 acre-feet of water will be diverted from Navajo Reservoir for use on the Navajo Indian Irrigation Project. Less water will actually be delivered to the irrigated acreage due to diversion and irrigation system conveyance losses.

Page II-5, first sentence: Based on the data at page I-7, first complete paragraph, that 36,300 acre-feet of water are diverted annually by the Hammond Project, canal losses of 5,600 acre-feet per year would yield an average canal loss of about 15%. Also, the Report at page III-2, first complete paragraph, uses a 50% historic canal system conveyance loss, which could then only occur with an average canal system operational waste of 35%, or one-third of the water diverted. The Report should discuss or provide data which might be available to substantiate conclusions regarding conveyance losses.

Page III-1, last incomplete paragraph, first sentence: It is not explained nor clear how a crop irrigation requirement of 3 acre-feet per acre was derived for the Hammond Project. Because the Report applies a farm irrigation efficiency to the crop irrigation requirement to determine the farm delivery requirements, the crop irrigation requirement would in this case be synonymous with the consumptive irrigation requirement or CIR. The New Mexico State University Agricultural Experiment Station Bulletin 531 at page 41 indicates that the CIR in the Bloomfield vicinity averages about 1.8 acre-feet per acre. New Mexico State Engineer Technical Report 32, Consumptive Use and Water Requirements in New Mexico, by Harry F. Blaney and Eldon G. Hanson (1965) indicates a crop irrigation requirement of 2.15 acre-feet per acre for alfalfa near Bloomfield, New Mexico. It is suggested that the assumed crop irrigation requirement be carefully reviewed.

Page III-1, last incomplete sentence: It is not clear why a conveyance efficiency of 80% is used in the derivation of a diversion requirement. The Report should indicate what the 80% conveyance efficiency represents and how it was determined. We cannot determine from the data given in the Report which scenario might be associated with a 20% conveyance loss.

Page III-2, first complete sentence: Based on the crop irrigation requirement and sprinkler efficiency given at page III-1, last incomplete paragraph, a fully piped system would have a diversion requirement of 4.3 acre-feet per acre irrigated. The Report should explain the basis for a diversion requirement of 4.0 acre-feet per acre.

Page III-2, first complete paragraph: The Report uses historic diversion data to indicate what the consumptive irrigation requirement might be for the Hammond Project. The generally accepted method for computing consumptive irrigation requirements uses data on crop types grown and meteorologic data.[1]

Page III-2, second complete paragraph: The information presented in this paragraph directly conflicts with the information presented in the two paragraphs which precede it. For example, this paragraph suggests that the farm delivery requirement for the Hammond Project is 3.01 acre-feet per acre, as compared to the farm delivery requirement of 4.42 acre-feet per acre given at page III-1, last complete sentence. This paragraph further suggests that there is no justification for actual diversions being nearly twice as large as are necessary to irrigate the lands within the Hammond Project.

Page III-3, second complete paragraph. No discussion of water salvage is contained in the Hammond Project water supply section, nor is there any indication that project implementation will result in water salvage. Absent a discussion on the nature and amount of water salvaged, the second and third paragraphs of this page should be deleted.

Page IV-2, first complete paragraph under the heading "cost effectiveness". In the last line, insert "construction" before "cost".

The following comments are offered on the Draft Environmental Assessment, Attachment A.

Page A-4. The last complete paragraph discusses the intent to mitigate the loss of wildlife habitat (artificial wetlands) through in-kind replacement. The first complete paragraph of page A-5 lists proposed alternative mitigation measures apparently being considered by Reclamation. Some of the mitigation measures proposed by Reclamation, such as the development of open ponds or planting of vegetation along the river channel, are not the same as vegetation that relied on a water supply that was provided only during the irrigation season. It is requested that Reclamation develop additional mitigation measures that could actually be considered more "in-kind". Actual "in-kind" mitigation should also alleviate the concerns expressed by the Fish and Wildlife Service regarding increased depletions associated with wetlands mitigation and the impact this increased depletion may have on the Colorado squawfish and the razorback sucker.

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[1] Blaney, Harry F., Hanson, Eldon G., and Litz, G. Marvin, 1950; Consumptive Use and Irrigation Water Requirements of Crops in New Mexico. U.S. Department of Agriculture, Soil Conservation Service.

Page A-7, fourth complete paragraph. The second sentence of this paragraph should be rewritten to indicate that the list of beneficial uses should not be considered all-inclusive. In addition, it is not clear how salinity control as contemplated for the Hammond Project could be designated as a beneficial use, when no consumption of water is involved.

Page A-11, fifth complete paragraph. This is the first place in this document that Reclamation quantifies the volume of water currently lost through seepage. Because seepage losses are the source of saline contributions to the river by leaching in situ salts from underlying formations, additional discussion should be included to state how this value was arrived at and was determined to be actually lost, and not returned to the system.

Thank you for the opportunity to review and comment on the Report. Please call me if you feel that further discussion of these matters might be helpful.

Sincerely,

William J. Miller

William J. Miller
Interstate Stream Engineer

WJM:rav

cc: Jack Barnett
Tim Henley

\rav\colorado\stodolsk.fnl

Reclamation Responses to the New Mexico Interstate Stream Commission

Comment 1:

Page S-8, Table S-3: The pipeline options exhibit less expected salt load reductions than the reduction expected by canal lining. This is because the pipeline options would install pipe for only a portion of the project; whereas, the canal lining would be installed for the entire project. For that portion of the project where pipe installation is not viable, the Report indicates that canal lining is viable. The Report should consider a combination pipeline and canal lining option, which should result in a greater expected salt load reduction than the reduction expected by canal lining alone. This assumes a small seepage loss rate for lined canals and a negligible pipeline leakage rate as is assumed elsewhere in the Report.

Response 1:

Combining a low-pressure pipe system for the upper portion with a new canal lining on the lower portion of the Hammond Project would save approximately 27,700 tons of salt per year at a cost of about $80 per ton. Because pipe is expensive, the preferred Hammond Project is more economical and is the first choice of all alternatives at this time. The existing alternatives represent a complete range of viable options.

Comment 2:

Page I-7, first complete paragraph: The first and third sentences indicate that Reclamation is knowingly making unpermitted and illegal diversions.

Response 2:

The December 1993 draft report lists an annual diversion of 36,200 acre-feet per year (fourth line of paragraph). The source of this value is not given. Diversion records for the 10-year period (1977-86) show an average diversion of 31,240 acre-feet per year with a high of 34,937 acre-feet for 1977 and a low of 28,139 acre-feet for 1980. These data are from annual crop survey records, and the figure 36,200 has been changed to 31,240 in the final draft. However, this is still more, by approximately 4,535 acre-feet per year, than for the listed water rights (listed as 26,700 on page I-7 and 26,704.6 on page III-2). As further discussed on those pages, some of this excess diversion is required by the Hammond Conservancy District for operation of a poorly efficient hydraulic turbine pump to pump water to upper levels, and the Bureau of Reclamation does not have the authority or responsibility to enforce reduced diversions.

It is noted, however, that much of this excess water spills back into waste-ways and finds its way back to the river, some of it very quickly. It is further noted that only that water which is consumptively used by the growing crops or by phreatophytes or which is lost by surface evaporation is actually lost from the system. Based on a consumptive use of 3.00 acre-feet per acre per year, this would be 11,800 acre-feet per year for 3,933 project acres for the growing of crops plus whatever is lost to surface evaporation or use by phreatophytes, estimated not to exceed 2,000 acre-feet per year. The remainder, over 50 percent, will return to the river, some of it within hours and the rest within days or weeks.

Comment 3:

Page I-8, first paragraph, seventh sentence: With full development, 508,000 acre-feet of water will be diverted from Navajo Reservoir for use on the Navajo Indian Irrigation Project. Less water will actually be delivered to the irrigated acreage due to diversion and irrigation system conveyance losses.

Response 3:

The Bureau of Reclamation appreciates the comment. "Delivered" has been changed to "diverted" in the final draft.

Comment 4:

Page II-5, first sentence: Based on the data at page I-7, first complete paragraph, that 36,300 acre-feet of water are diverted annually by the Hammond Project, canal losses of 5,600 acre-feet per year would yield an average canal loss of about 15%. Also, the Report at page III-2, first complete paragraph, uses a 50% historic canal system conveyance loss, which could then only occur with an average canal system operational waste of 35%, or one-third of the water diverted. The Report should discuss or provide data which might be available to substantiate conclusions regarding conveyance losses.

Response 4:

As stated in the response to previous comment No. 2, the 10-year period (1977-86) shows an average annual diversion of 31,240 acre-feet, and the Bureau of Reclamation has elected to go with that figure. No data exist to substantiate the diversion of 36,200 acre-feet per year, and it is further believed that an annual diversion of that amount would exceed the capacity of the canal. The figure 31,240 may have been rounded to 31,200 and mistakenly written as 36,200. The above-stated 10 years of data show operational spills of 9,352 acre-feet per year, or 30 percent of the

31,240 acre-feet diversion and conveyance losses of 6,283 acre-feet per year, or 20 percent of the 31,240 acre-feet diversion. The 5,600 acre-feet per year, as determined from the seepage estimates, would be about 18 percent of the 10-year historic diversion. These data from two different sources are believed to be close enough to be considered consistent.

It is further noted that the "50 percent" refers to both operational spills (30 percent) and conveyance losses (20 percent), as explained in the final draft.

Comment 5:

Page III-1, last incomplete paragraph, first sentence: It is not explained nor clear how a crop irrigation requirement of 3 acre-feet per acre was derived for the Hammond Project. Because the Report applies a farm irrigation efficiency to the crop irrigation requirement to determine the farm delivery requirements, the crop irrigation requirement would in this case be synonymous with the consumptive irrigation requirement or CIR. The New Mexico State University Agricultural Experiment Station Bulletin 531 at page 41 indicates that the CIR in the Bloomfield vicinity averages about 1.8 acre-feet per acre. New Mexico State Engineer Technical Report 32, <u>Consumptive Use and Water Requirements in New Mexico</u>, by Harry F. Blaney and Eldon G. Hanson (1965) indicates a crop irrigation requirement of 2.15 acre-feet per acre for alfalfa near Bloomfield, New Mexico. It is suggested that the assumed crop irrigation requirement be carefully reviewed.

Response 5:

The crop irrigation requirement of 3.00 acre-feet per acre per year is based on research data gathered over a 3-year period (1980 to 1982 inclusive) at the nearby Navajo Indian Irrigation Project. These data, as given in the Bureau of Reclamation/Bureau of Indian Affairs joint report *Consumptive Use on the Navajo Indian Irrigation Project* (September 1983, page 60), shows a consumptive use requirement for alfalfa (3 to 4 cuttings per year) of 3.33 acre-feet (40 inches) per acre per year with effective precipitation of 0.33 acre-foot (4 inches) per year, leaving a net annual crop irrigation requirement of 3.00 acre-feet per acre. This amount is considered to be a reliable estimate of what the crop irrigation requirement would be. A footnote of the above-listed reference to these data will be added to the report. It is noted that a crop irrigation requirement of 3.00 acre-feet per acre per year for 3,933 acres amounts to an annual total of 11,800 acre-feet. The Bureau of Reclamation's experience indicates that the 2.15 acre-feet per year gross crop irrigation requirement given by the 1965 Blaney-Hansen report referenced in your comment would be insufficient to meet the needs of 3 to 4 cuttings of alfalfa.

Comment 6:

Page III-1, last incomplete sentence: It is not clear why a conveyance efficiency of 80% is used in the derivation of a diversion requirement. The Report should indicate what the 80% conveyance efficiency represents and how it was determined. We cannot determine from the data given in the Report which scenario might be associated with a 20% conveyance loss.

Response 6:

The 80-percent conveyance efficiency is based on the 10-year period (1977-86) of data gained from the crop survey records.

The combined operational spills and conveyance losses from this survey were approximately 50 percent, of which operational spills were estimated to be 30 percent and conveyance losses were estimated to be 20 percent.

Comment 7:

Page III-2, first complete sentence: Based on the crop irrigation requirement and sprinkler efficiency given at page III-1, last incomplete paragraph, a fully piped system would have a diversion requirement of 4.3 acre-feet per acre irrigated. The Report should explain the basis for a diversion requirement of 4.0 acre-feet per acre.

Response 7:

The 4.3 appears to have been obtained by dividing 3.00 by the sprinkler efficiency of 70 percent. However, the value of 2.79 acre-feet per acre (adjusted from 3.00 due to only 93 percent of the irrigable acres actually being irrigated, as noted in chapter III of the report) is the amount that should be divided by 0.70, which then yields 3.99 (rounded to 4.00) acre-feet per acre per year.

Comment 8:

Page III-2, first complete paragraph: The Report uses historic diversion data to indicate what the consumptive irrigation requirement might be for the Hammond Project. The generally accepted method for computing consumptive irrigation requirements uses data on crop types grown and meteorologic data.

Response 8:

The historic (1977-86) data giving a value of 3.07 acre-feet per acre per year were not used to establish the water needs in the study. This value is included in the report only to corroborate the 3.00 acre-feet per acre per year value used in the report, which value as discussed above in response to comment No. 5, is based on a lysimeter study (1979-82) conducted on the Navajo Indian Irrigation Project and in that study was compared with meteorological data.

Comment 9:

Page III-2, second complete paragraph: The information presented in this paragraph directly conflicts with the information presented in the two paragraphs which precede it. For example, this paragraph suggests that the farm delivery requirement for the Hammond Project is 3.01 acre-feet per acre, as compared to the farm delivery requirement of 4.42 acre-feet per acre given at page III-1, last complete sentence. This paragraph further suggests that there is no justification for actual diversions being nearly twice as large as are necessary to irrigate the lands within the Hammond Project.

Response 9:

This paragraph has been revised from the December 1993 draft. It is noted that the value of 3.01 should be 3.11 in that paragraph and the value of 4.82 should be 4.75. These changes have been made, and this paragraph has been reworded as follows for the final draft:

> *The March 1958 Definite Plan Report (DPR) for the Hammond Project was based on an annual farm delivery requirement of 3.11 acre-feet per acre and a diversion requirement of 4.75 acre-feet per acre for a Project area of 3,900 acres. This yields a total diversion requirement of 18,525 acre-feet of water per year (listed as 18,500 acre-feet per year in the DPR).*

This differs from the values given on page III-1 in that the estimated annual crop irrigation requirement has been increased from the 1.84 acre-feet per acre value given in the March 1958 Definite Plan Report to 3.00 acre-feet per acre for this report. This increases the diversion requirement from the 18,500 acre-feet per year as given in the 1958 Definite Plan Report to 21,750 acre-feet per year based on the combined sprinkler/gravity irrigation efficiencies of 63 percent used in the subject report. This is still less than the listed diversion of 36,200 acre-feet per year as given in the December 1993 draft or as stated previously, the value to which it has been corrected, 31,240 acre-feet per year. As noted in previous responses, the Bureau of Reclamation does not have the authority or responsibility to enforce reduced diversions. The Hammond Conservancy District still believes there is a need for some additional diversions above the 21,750 acre-feet per year figure given above for operation of a hydraulic turbine pump which is operating rather inefficiently. Again, it is only that water which is consumptively used (11,800 acre-feet per year based on a crop irrigation requirement of 3.00 acre-feet per year per acre for 3,933 acres plus the losses to surface evaporation from the canal and phreatophyte use, estimated to be less than 2,000 acre-feet per year) that will not return to the river through wasteways and seepage.

Comment 10:

Page III-3, second complete paragraph. No discussion of water salvage is contained in the Hammond Project water supply section, nor is there any indication that project implementation will result in water salvage. Absent a discussion on the nature and amount of water salvaged, the second and third paragraphs of this page should be deleted.

Response 10:

As discussed in previous comments and responses, that which is not evaporated or consumptively used eventually returns to the river. The second and third paragraphs are deleted from the final draft.

Comment 11:

Page IV-2, first complete paragraph under the heading "cost effectiveness". In the last line, insert "construction" before "cost".

Response 11:

Cost effectiveness not only includes construction costs but also interest during construction and operation, maintenance, and replacement costs. It would be incorrect to insert "construction" before "cost effectiveness"; this would give the connotation that only construction costs are used in determining cost effectiveness. The sentence is correct as written in the report.

Comment 12:

Page A-4. The last complete paragraph discusses the intent to mitigate the loss of wildlife habitat (artificial wetlands) through in-kind replacement. The first complete paragraph of page A-5 lists proposed alternative mitigation measures apparently being considered by Reclamation. Some of the mitigation measures proposed by Reclamation, such as the development of open ponds or planting of vegetation along the river channel, are not the same as vegetation that relied on a water supply that was provided only during the irrigation season. It is requested that Reclamation develop additional mitigation measures that could actually be considered more "in-kind". Actual "in-kind" mitigation should also alleviate the concerns expressed by the Fish and Wildlife Service regarding increased depletions associated with wetlands mitigation and the impact this increased depletion may have on the Colorado squawfish and the razorback sucker.

Response 12:

The Bureau of Reclamation will investigate and implement wetland mitigation measures consistent with the U.S. Fish and Wildlife Service's mitigation recommendation for "inkind" replacement of habitat values (see Environmental Protection Agency response No. 1). The list of alternative mitigation measures described in chapter VI of the planning report/ environmental assessment is not intended to be an inclusive list but rather a list of measures that may be considered and implemented. The biological assessment will address the issue of water depletions associated with wetland mitigation.

Comment 13:

Page A-7, fourth complete paragraph. The second sentence of this paragraph should be rewritten to indicate that the list of beneficial uses should not be considered all-inclusive. In addition, it is not clear how salinity control as contemplated for the Hammond Project could be designated as a beneficial use, when no consumption of water is involved.

Response 13:

The subject sentence is in a paragraph that has been eliminated from the document. A discussion of Hammond Project water rights is included in chapter III of the planning report/environmental assessment.

Comment 14:

Page A-11, fifth complete paragraph. This is the first place in this document that Reclamation quantifies the volume of water currently lost through seepage. Because seepage losses are the source of saline contributions to the river by leaching in situ salts from underlying formations, additional discussions should be included to state how this value was arrived at and was determined to be actually lost, and not returned to the system.

Response 14:

The volume of seepage is not lost to the system but returns back to the San Juan River in formations below the canals and laterals. The same value of estimated seepage was given in chapter IV, "Canal Lining Alternative" section and in table A-2. This estimated value was a result of a statistical analysis of data from seepage and ponding tests.

Bloomfield Refining
Company
A Gary Energy Corporation Subsidiary

February 28, 1994

Mr. Max J. Stodolski
Projects Manager
Bureau of Reclamation
P. O. Box 640
Durango, CO 81301-0640

Subject: Draft Planning Report/Environmental Assessment (PR/EA), Proposed Hammond Lining Project

Dear Mr. Stodolski:

Bloomfield Refining Company (BRC) has reviewed the subject draft dated December 1993 and has the following comments concerning BRC's relationship to the overall project.

1. BRC has been working with the New Mexico Oil Conservation Division in implementing procedures and installing equipment as part of a comprehensive discharge plan to minimize the environmental impacts of the refinery to surface or ground water. BRC has continued with a zero discharge policy in addition to careful water management aimed at minimized usage. BRC has completed the installation of two, five-acre, double-lined evaporation ponds and is in the process of removing from operation two clay-lined evaporation ponds and a spray evaporation area. The salty water from the evaporation ponds will be discharged into a recently permitted underground injection well thus eliminating the possibility of BRC operations contributing to the salt loading problem in the San Juan River.

2. BRC believes that the draft report overstates BRC's possible impact with the project to line the Hammond irrigation ditch. Only a small portion of the ditch adjacent to the refinery has the potential of hydrocarbon contamination (about 400 of 6,600 feet). All portions of the ditch not impacted, can certainly be included in the lining plans. The 400 feet or so in question may not require any soil removal, or very little as the underlying Nacimiento formation is very close to the bottom of the existing ditch. In fact, a visual examination of the ditch in this 400 feet section indicates that fill will be required here.

3. BRC would also like to point out that significant progress is being made to remediate the shallow ground water underlying the facility. By the time the project is underway, it is likely that soil contamination, if any, underlying Hammond ditch has been eliminated as any concern to the lining project.

In general, BRC has contributed substantially to the Bureau of Reclamation's goal of reducing the potential of salt loading to the San Juan River and remains committed to the obligations as stated in our Letter-of-Intent dated June 3, 1991. However, BRC does not expect any contamination at the refinery to be significant in the Bureau's lining effort and believes that this insignificance should be reflected in the final report. Please contact me at any time for any additional information.

Sincerely,

David Roderick

Dave Roderick
Refinery Manager

cc: Joe Warr
John Goodrich
Chris Hawley

Reclamation Responses to the Bloomfield Refining Company

Comment 1:

BRC believes that the draft report overstates BRC's possible impact with the project to line the Hammond irrigation ditch. Only a small portion of the ditch adjacent to the refinery has the potential of hydrocarbon contamination (about 400 to 6,600 feet). All portions of the ditch not impacted, can certainly be included in the lining plans. The 400 feet or so in question may not require any soil removal, or very little as the underlying Nacimiento formation is very close to the bottom of the existing ditch. In fact, a visual examination of the ditch in the 400 feet section indicates that fill will be required here.

Response 1:

Based on consultation with the Environmental Protection Agency, the full extent of the Hammond Ditch contamination has not been characterized and is not known. The site characterization work is scheduled to be completed in November 1994. The wording in this document has been coordinated with the Environmental Protection Agency.

ATTACHMENT B

Salt-Load Estimates for 1963 Through 1981

(U.S. Geological Survey Data)

ATTACHMENT B

SALT-LOAD ESTIMATES FOR 1963 THROUGH 1981 (U.S. GEOLOGICAL SURVEY DATA)

As an additional check on the reasonableness of the salt-load estimate for the main canal and lateral system, U.S. Geological Survey (USGS) data from 1963 through 1981 were used to recalculate the flows and salt loads at the following three stations: (1) San Juan River near Archuleta, New Mexico (Station No. 09355500), (2) Animas River at Farmington, New Mexico (Station No. 09364500), (3) San Juan River near Farmington, New Mexico (Station No. 09365000).

The river salt budget based on USGS data from 1963 through 1981 and the previous preliminary river salt budget by USGS based on the years 1978 through 1983 are presented in table B-1 for comparison:

Table B-1.—San Juan River salt budget
Archuleta to Farmington, 1978-83

Sources	1973-83 salt budget (tons/year)	1963-81 salt budget (tons/year)[1]
San Juan River near Farmington	527,000	461,927
San Juan River near Archuleta	199,000	181,339
Total salt pickup	328,000	280,588
Salt loading from known sources:		
Canyon Largo at mouth	17,000	not included
Animas River near Farmington	213,000	201,255
Total salt loading	230,000	201,255
Unaccounted salt loading from Archuleta to Farmington	98,000	79,333

[1] Bureau of Reclamation estimates.

The two data collection periods show little difference in salt-load estimates for the San Juan River near Archuleta and the Animas River near Farmington. However, a wide difference in salt loads is shown for the San Juan River near Farmington and a significant difference in the estimated salt pickup from Archuleta to Farmington—an average of 15.6 percent difference in salt loads—is shown by the two estimates.

Considering a salt-load contribution of 31,650 tons per year from the main canal and laterals in the unaccounted-for salt load of 79,333 tons per year between Archuleta and Farmington, the remaining salt load of 47,683 tons per year should have come from other significant sources, such as Hammond onfarm sources, Largo or Gallegos Canyon, the Bloomfield Irrigation Project, or the Gary Refinery near Bloomfield. Based on the *San Juan Salinity Study Reconnaissance and Preliminary Analysis Summary* (Bureau of Reclamation, Durango Projects Office, 1986), the salt-load contributions from Hammond onfarm sources, Largo Canyon, and Gallegos Canyon are [1]2,700, 17,000, and 4,000 tons per year, respectively, based on USGS data.[2] Salt-load contributions from the Bloomfield Irrigation Project and Gary Refinery are not available. Table B-2 shows the totals for these measured and estimated salt-load contributions, including the estimated salt loading of 31,650 tons per year from the main canal and laterals.

Table B-2.—Estimated salt-load contributions to the San Juan River between Archuleta and Farmington from significant sources

Sources	Salt load (tons/year)
Main Canal and laterals	31,650
Hammond onfarm sources	2,700
Largo Canyon	17,000
Gallegos Canyon	4,000
Total	55,350
Total incremental salt load at Farmington	79,333
(Unaccounted-for salt loading)	(23,983)

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[1] Communication from the Soil Conservation Service, Albuquerque, New Mexico.

[2] Salt loads of 17,000 tons per year from the Largo Canyon could be attributed to surface runoff from the Largo Canyon basin, in part from severe thunderstorms.

ATTACHMENT C

Public Involvement— April 1986 Newsletter

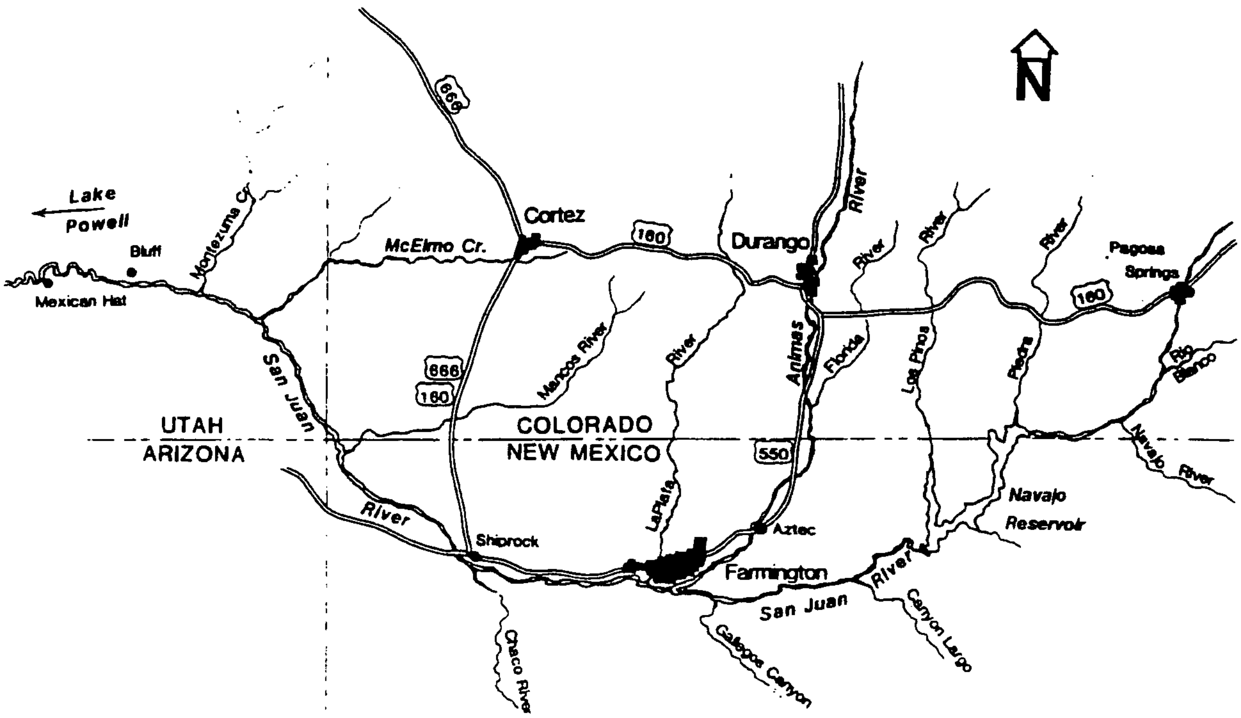
U.S. Department of the Interior
Bureau of Reclamation

Durango Projects Office
835 Second Avenue
P.O. Box 640
Durango, Colorado 81302

San Juan River Unit

April 1986

This newsletter, the first of several, describes the progress of Reclamation's salinity control investigation in the San Juan River Basin. This investigation is named the San Juan River Unit. The purpose of the four-year study will be to locate sources of salt discharged to the river by ground and surface water, such as shown in the picture, and to formulate control methods. The study area includes the entire San Juan River Drainage Basin from its headwaters in south-central Colorado to its mouth at Lake Powell (see map). The San Juan River Unit a part of the Colorado River Water Quality Improvement Program (CRWQIP), was authorized as part of the Colorado River Basin Salinity Control Act in 1972. Numerous areas located in the Colorado River Basin that contribute salt to the Colorado River are being investigated. In the Lower Colorado River Basin, high salinity adversely affects more than 18 million water users through increased water treatment cost and damages caused by saline water. One million acres of irrigated farm land in the United States are affected through reduced productivity.



ATTACHMENT D

Letter of Intent— Bloomfield Refinery

EPA Factsheet

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary

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OFFICIAL FILE COPY
[illegible] 05 '91

ACTION	TICKLER NUMBER

REPLY DATE

CODE	INITIALS	DATE	CYS
200	[illegible]	7/5	
200	[illegible]	6/5	
210	[illegible]	6/11	✓
400	[illegible]		
[illegible]			
[illegible]			
930	[illegible]	6/12	

CLASSIFICATION
PROJECT
CONTROL NO.
FOLDER I.D.

100 NJS 6/12
432 DGI 13 Jun
150 DF 6/19 ✓

June 3, 1991

Mr. Max J. Stodolski
United States Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Durango Project Office
835 East Second Avenue
P. O. Box 640
Durango, Colorado 81302-0640

RE: Salinity Control on the Hammond Project
Letter of Intent

Dear Mr. Stodolski:

Bloomfield Refining Company is committed to contributing to the reduction of indirect salt discharges into the Colorado River System. This commitment is reflected in a zero discharge policy and a program to eliminate salt leaching as a result of indirect discharges (groundwater). The program, under the oversight of the New Mexico Oil Conservation Division and the New Mexico State Engineer, has included the installation of two each, 5-acre, double-lined evaporation ponds and plans, for the near future, to eliminate the use of spray irrigation and to double-line or eliminate two existing evaporation ponds (about 5 acres, total) on our site.

At this time, we are actively remediating the perched water table underlying our facility for hydrocarbon contamination (the probable cause of some soil contamination near portions of the Hammond canal). We believe that the lining of Hammond Canal, as per your anticipated construction schedule, would fit well with our groundwater remediation program and our mutual desire to reduce salt leaching into the San Juan River.

We would be pleased to work with your office as necessary to include the section of the canal along our property in your lining plans. As a minimum, we will be responsible for the disposal and/or treatment of any excavated soil contaminated with hydrocarbons. We would also request that we be actively involved in evaluating the amount of excavation necessary along the section of canal bordering our property.

P.O. Box 159 • Bloomfield, New Mexico 87413 • 505/632-8013

Mr. Richard Traylor has retired as the Bloomfield Refining Company manager and I now hold that position. Please feel free to contact me or Chris Hawley for further development of a cooperative agreement between us.

Sincerely,

David Roderick

David Roderick
Refinery Manager

DR/jm

cc: Joe Warr
Chris Hawley
Gerald Collins
John Goodrich
Nick Ashcroft, President, Hammond Water Conservation District

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

BLOOMFIELD REFINING CO.
Bloomfield, New Mexico

BACKGROUND

The Bloomfield Refinery is located approximately one mile south of Bloomfield, New Mexico on Highway 44 and has been in operation since 1963. It consists of approximately 287 acres. The Refinery identified itself as a Treatment, Storage and Disposal facility in its Part A permit Application on November 19, 1980. The Facility illegally disposed of hazardous waste K051 at the facility in 1982 in an unlined pit. An RFA conducted at the Facility during 1987 identified thirteen Solid Waste Management Units (SWMU's).

CURRENT STATUS

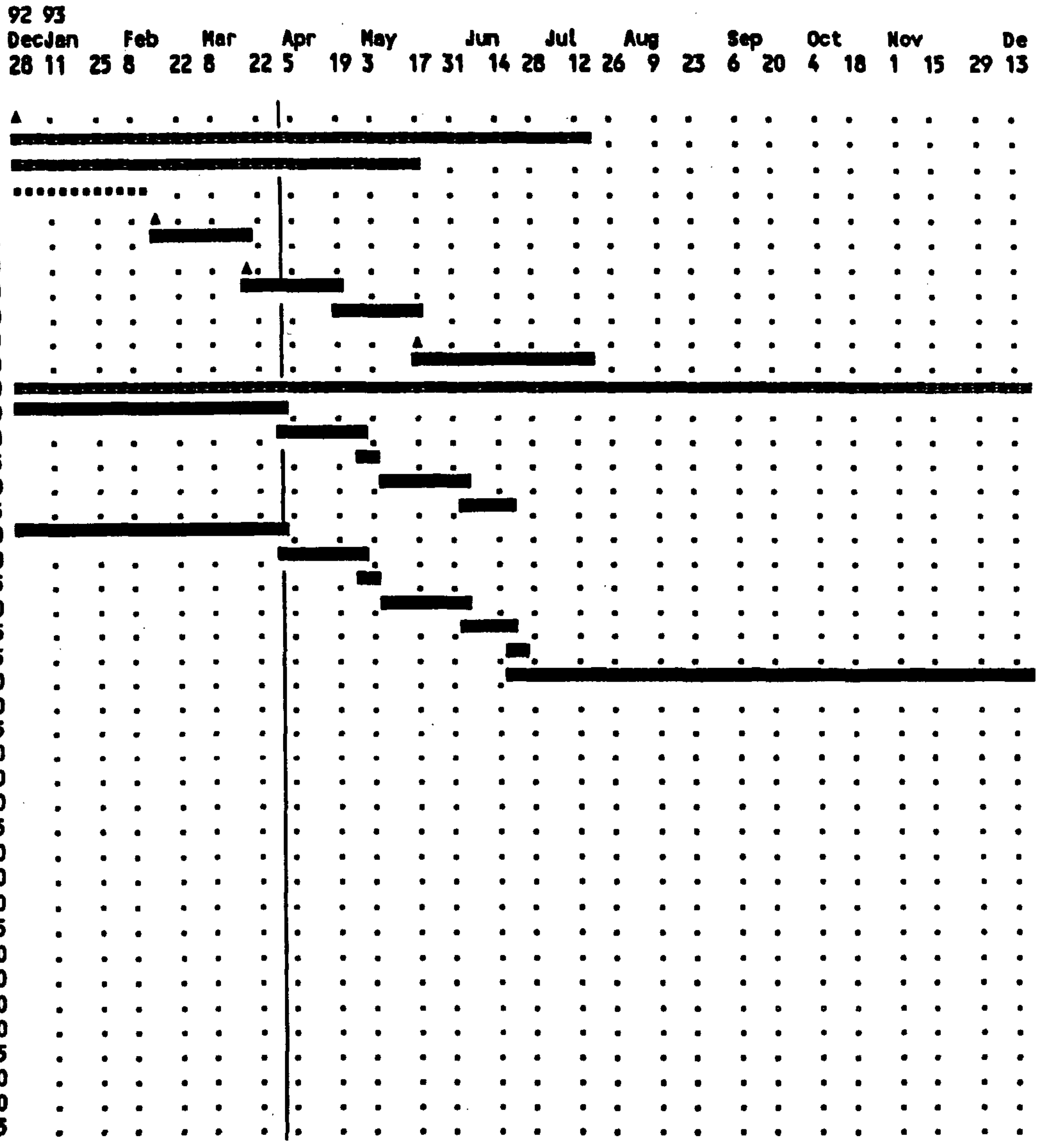
The Facility has released or caused to be released hazardous waste and hazardous waste constituents to the groundwater, surface water and soil at the facility. Surface water contamination consists of elevated levels of organics and inorganics. The Facility has an existing groundwater recovery system in place to recover LNAPL's.

3008 (h) ORDER

A RCRA § 3008(h) Administrative Order on Consent (Consent Order) was successfully negotiated with Bloomfield Refining Company (BRC) and U.S. EPA. The Order effective date is December 31, 1992. BRC has released or caused to be released hazardous waste and hazardous waste constituents to the groundwater, surface water (San Juan River) and soil. Surface water contamination consists of elevated levels of organics and inorganics. The Consent Order consists of Interim Measures, a RCRA Facility Investigation, and a Corrective Measures Study (IM/RFI/CMS). The entire facility and the surrounding property will be studied during the course of the RFI/CMS. All media (groundwater, surface water, soil, soil gas, and air) will be investigated. Interim Measures consisting of two additional rececovery wells were required to mitigate the potential for releases off-site to the San Juan River.

hedule [illegible] : GENERIC 3008(h) ORDER
esponsible :
-of Date : 30-Mar-93 Schedule File : BLMFBLM

ask Name	Start Date	End Date	Durat
3008(h) CONSENT ORDER SIGNED	31-Dec-92	31-Dec-92	0
INTERIM MEASURES	31-Dec-92	18-Jul-93	200.0
IM Workplan	31-Dec-92	19-May-93	140.0
Prepare workplan	31-Dec-92	13-Feb-93	45
Submission of Workplan	14-Feb-93	14-Feb-93	0
EPA Review	14-Feb-93	20-Mar-93	35
Comment Letter	21-Mar-93	21-Mar-93	0
Facility Revise Workplan	21-Mar-93	19-Apr-93	30
EPA Review	20-Apr-93	19-May-93	30
EPA Approval Letter	20-May-93	20-May-93	0
IM Completion Report	20-May-93	18-Jul-93	60
RCRA FACILITY INVESTIGATION	31-Dec-92	26-Oct-94	665.0
Prep Draft Curr Cond	31-Dec-92	30-Mar-93	90
EPA Rev Draft Curr Cond Report	31-Mar-93	29-Apr-93	30
Transmit Comments	30-Apr-93	4-May-93	5
Prep Current Cond Report	5-May-93	3-Jun-93	30
EPA Approve Current Cond Repor	4-Jun-93	18-Jun-93	15
Prep Draft RFI Workplan	31-Dec-92	30-Mar-93	90
EPA Review Draft RFI Workplan	31-Mar-93	29-Apr-93	30
Transmit Comments	30-Apr-93	4-May-93	5
Revise RFI Workplan	5-May-93	3-Jun-93	30
EPA Approve RFI Workplan	4-Jun-93	18-Jun-93	15
EPA Transmit Approval	19-Jun-93	23-Jun-93	5
Prep Draft RFI Report	19-Jun-93	18-Jun-94	365.0
EPA Review Draft RFI Report	19-Jun-94	18-Jul-94	30
Transmit Comments	19-Jul-94	23-Jul-94	5
Prep Final RFI Report	24-Jul-94	21-Sep-94	60
Prep Bench Scale Studies	24-Jul-94	21-Sep-94	60
EPA Approve RFI Report	22-Sep-94	21-Oct-94	30
Transmit Approval	22-Oct-94	26-Oct-94	5
CORRECTIVE MEASURES STUDY	27-Oct-94	25-Mar-95	150.0
Prep Draft CMS Report	27-Oct-94	25-Dec-94	60
EPA Review Draft CMS Report	26-Dec-94	24-Jan-95	30
Transmit Comments	25-Jan-95	29-Jan-95	5
Prep Final CMS Report	25-Jan-95	23-Feb-95	30
EPA Approve Final CMS Report	24-Feb-95	25-Mar-95	30
STATEMENT OF BASIS	26-Mar-95	12-Aug-95	140.0
Prepare Statement of Basis	26-Mar-95	24-Apr-95	30
Public Notice	25-Apr-95	8-Jun-95	45
Response to Comments	9-Jun-95	8-Jul-95	30
EPA Remedy Selection	9-Jul-95	7-Aug-95	30
Transmit Remedy Selection	8-Aug-95	12-Aug-95	5



Detail Task
(Progress)
(Slack)
Summary Task
(Progress)
(Slack)
••••• Baseline
▶▶▶ Conflict
Resource delay
▲ Milestone
Progress shows Percent Achieved on Actual
Scale: 4 days per character

ATTACHMENT E

Planning Aid Memorandum

Other Correspondence Related to Wetland Mitigation

wildlife habitats in the area are the wetlands and riparian zones of the San Juan River and its tributaries. Also of high wildlife value are the wetland habitats created by canals, ditches, drains, and irrigation practices.

The policy of the Fish and Wildlife Service (Service) is to preserve, protect, and enhance wetlands of the United States, in that they provide valuable habitat for migratory birds, fur bearers, and other wildlife species. Many natural wetlands in the project area occur at the terminus of larger washes and canyons. Irrigation induced wetlands have been created by seepage from canals and ditches of the Hammond Project. Also, agricultural drains have created or expanded existing wetland areas.

Riparian habitats in the project area consist of cottonwood bottoms along the San Juan River, tributary streams and washes. Some of these areas are wetlands, while other areas do not meet all wetland criteria. However, areas that do not meet wetland criteria still provide very valuable wildlife habitat. Riparian areas provide habitat for many species of migratory birds, fur bearers, and other wildlife.

The most extensive habitat type in the project area is agricultural lands. These areas provide habitat for a variety of game species (ring-neck pheasant, Gambel's quail, mourning dove, and waterfowl) and non-game species (raptors, song birds). However, agricultural practices (burning, mowing, pesticides) limit the habitat value of these lands.

Desert shrubland habitat in the project area is dominated by rabbit brush and salt brush. It provides habitat for some game and non-game wildlife species.

The San Juan River fishery in the project area is considered a warm-water fishery, characterized by high turbidity, with a sand and silt substrate. Common native fishes found in this area are the bluehead sucker, flannelmouth sucker, and speckled dace. Non-native fish found in this area include fathead minnow, red shiner, common carp, channel catfish, Rio Grande killifish, mosquito fish, brown trout, and mottled sculpin.

Threatened and Endangered Species

The following is a list of Federally listed endangered species which may be present within the area of project influence.

FEDERALLY LISTED SPECIES

Bald eagle	Haliaeetus leucocephalus
Black-footed ferret	Mustela nigripes
Colorado squawfish	Ptychocheilus lucius
*Razorback sucker	Xyrauchen texanus
Mancos milk-vetch	Astragalus humillimus
Mesa Verde cactus	Sclerocactus mesae-verde

* Proposed May 22, 1990

The bald eagle is a common winter resident to the San Juan River and Navajo Reservoir. Bald eagles utilize riparian habitat along the river for perching and roosting. Recently, bald eagles have attempted to nest in the project area.

Historically, the endangered black-footed ferret occurred in portions of southwestern Colorado and northwestern New Mexico. Although unconfirmed sightings of this mammal have occurred in northwestern Colorado, the only known population is in captivity. Literature documents a close association between prairie dogs and black-footed ferrets. The standard that is used for determining possible project effects to black-footed ferrets is the disturbance of currently occupied prairie dog habitat. Should any of the activities made possible by this project result in an impact to prairie dogs, black-footed ferret surveys may be necessary.

A small, reproducing population of Colorado squawfish exists in the San Juan River. In recent studies, adult and young-of-year Colorado squawfish have been captured in the San Juan River 163 river miles upstream of Lake Powell. The proposed project is upstream of occupied habitat; however, if the proposed project will cause a net depletion of water from the upper Colorado River Basin, or a change in water quality or flow regime, the Bureau should evaluate potential impacts to this species.

Our previous Planning Aid Memorandum (April 28, 1989) listed the razorback sucker (<u>Xyrauchen texanus</u>) as a candidate species. On May 22, 1990, this species was officially proposed for listing as endangered. The razorback sucker has been captured in the San Juan arm of Lake Powell and near Bluff, Utah. However, there are no recent or historic records of the razorback sucker in New Mexico. If the proposed project will cause a net depletion of water from the upper Colorado River basin, or a change in water quality or flow regime, the Bureau should evaluate potential impacts to this species. Endangered Species Act regulations (50 CFR Part 402.10) require the Bureau to confer with the Service on any action which is likely to jeopardize the continued existence of any proposed species.

The Mancos milk-vetch occurs on sandstone ledges and mesa tops at 5,000 to 5,600 feet in elevation in San Juan County, New Mexico and adjacent Colorado counties. The plant is often found in sandstone substrate or shallow pockets of sandy soil.

The Mesa Verde cactus occurs on dry, exposed hillsides of Mancos or Fruitland shales, in San Juan County, New Mexico and Montezuma County, Colorado. It is found in clay soils high in selenite from 4,880 to 5,500 feet in elevation.

We would also like to bring to your attention species which are candidates for official listing as threatened or endangered species (<u>Federal Register</u>, Vol. 54, No. 4, January 6, 1989, Vol. 50, No. 188, September 27, 1985). While these species presently have no legal protection under the Endangered Species Act (Act), it is within the spirit of the Act to consider project impacts to potentially sensitive candidate species. Additionally, we wish to make you aware of the presence of Federal candidates should any be proposed or listed prior to the time that all Federal actions related to the project are completed:

FEDERAL CANDIDATE SPECIES

San Juan milkweed	<u>Asclepias</u> <u>sanjuanensis</u>
Mancos saltbush	<u>Astriplex</u> <u>pleiantha</u>
Beautiful gilia	<u>Gilia</u> <u>formosa</u>

The San Juan milkweed is a new species known from San Juan County, New Mexico, between Bloomfield and Shiprock. It occurs on erosive, sandy soils in pinyon-juniper woodlands along slopes and floodplains of the San Juan River Valley.

The Mancos saltbush occurs in San Juan County, New Mexico, and Montezuma County, Colorado. It is found in barren, gray soil on mesa slopes at 5,000 feet in elevation.

The beautiful gilia's only known location is in San Juan County, New Mexico where it inhabits sandstone outcrops at approximately 5,800 feet in elevation.

Section 7(c) of the Act requires that the Federal agency proposing a major Federal action significantly affecting the quality of the human environment to conduct and submit to the Service a biological assessment to determine effects of the proposal on listed species. The biological assessment must be completed within 180 days after the date on which initiated or a time mutually agreed upon between the agency and the Service. The assessment must be completed before physical project modification/alteration begins. If the biological assessment is not begun within 90 days, the species list above should be verified prior to initiation of the assessment.

<u>Wetlands</u>

The Fish and Wildlife Service defines wetland as lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. We classify wetlands according to "Classification of Wetlands and Deep Water Habitats of the United States" (Cowardin et al 1979). For purposes of this classification wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes.; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

In January of 1989 the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands" was published. This document was an interagency cooperative effort by the Fish and Wildlife Service, the Environmental

Protection Agency, the Department of the Army, and the Soil Conservation Service. This manual provides criteria for identifying wetlands that are subject to jurisdiction under Section 404 of the Clean Water Act. The Service would classify all sites in the project area that meet one of the three criteria (vegetation, soils, hydrology) as wetlands, even though some areas may not meet all jurisdictional manual criteria. All wetlands provide valuable habitat for wildlife and need to be considered during environmental analysis.

The Soil Conservation Service (SCS) mapped the vegetation cover types in the project area using SCS terminology. Service and Bureau personnel refined and ground truthed these SCS maps so that they would be appropriate for quantifying project area wetlands. Table A converts the SCS terminology into the Cowardin Classification System.

Various wetlands types occur in the project area. Classified by the Cowardin system, the wetlands consist of : 1) palustrine emergent persistent wetlands with dominant vegetation cover types of sedge, rush, cattail, bulrush, salt grass, and common reed 2) palustrine scrub-shrub/forested broad leaved deciduous wetland with dominant vegetation cover types of willow, tamarisk, Russian olive, and cottonwood 3) riverine lower perennial streambed which consist of the San Juan River and unvegetated washes 4) lacustrine littoral open water would include all ponds in the project area. The wetland areas along the Hammond canal and it's laterals consist primarily of willow and sedge/rush. Wetland or riparian areas that occur near, but not immediately adjacent to, the canal consist primarily of cottonwood, Russian olive, and tamarisk. Wetlands associated with agricultural drains are primarily composed of cattails, bulrush, sedges and rushes.

Wetland plant indicator categories have been developed to estimate the probability of a species occurring in a wetland. Table B shows the regional indicators for dominant wetland plant species in the project area.

Project Impacts

The lining of the Hammond canal will essentially stop water leakage that supports wetlands adjacent to the canal. From observations of sections of canal that are currently lined, we conclude that all wetlands immediately adjacent to the canal would be lost. Also, it was evident that mature cottonwood trees would also be lost when canal seepage is stopped. Wetlands associated with small drainages perpendicular to the canal, that receive seepage water, would also be impacted.

The project area contains many wetlands that are not immediately adjacent to the canal. It is not easily determined if any of these would be impacted by canal lining. Most wetlands not in the immediate canal vicinity appear to be supported primarily by other water sources, such as the San Juan River and

TABLE A

SCS Terminology	Cowardin Classification
P - Common reed	PEM1 - Palustrine emergent persistent
g - saltgrass	PEM1 - Palustrine emergent persistent
3 - cattail/bulrush	PEM1 - Palustrine emergent persistent
B - perennial herb	upland
A - cropland	upland
S - sedge/rush	PEM1 - Palustrine emergent persistent
W - willow	PSS1 - Palustrine scrub-shrub broad leaved deciduous
O - Russian olive	PSS1 - Palustrine scrub-shrub broad leaved deciduous
C - cottonwood	PFO1 - Palustrine forested broad leaved deciduous
R - river influence	not applicable
I - irrigation influence	not applicable
AH - animal herb	upland
SS - shrub/scrub	upland
G - bare ground	upland
p&h - pasture & hayland	upland
dss - desert shrub/scrub	upland
ub - urban buildup	not applicable
oil - oil and gas	not applicable
pond - pond or water	L2OW - Lacustrine littoral open water
river - San Juan River	R2SB - riverine lower perennial streambed
canal - irrigation canal	R2SBr - riverine lower perennial streambed artificial
T - tamarix-salt cedar	PSS6 - Palustrine scrub-shrub deciduous
road - highway, etc.	upland
wash - without vegetation	R25B2 - riverine lower perennial steambed sand
orchard - woody cultivated	not applicable
CR - cultural resource	not applicable

TABLE 3

The National List Regional Indicators for dominant wetland plant species in the Project area.

COMMON NAME	SCIENTIFIC NAME	INDICATOR
Fremont's cottonwood	Populus fremontii	FACW
saltcedar	tamarix sp.	FACW
Russian olive	Elaeagnus angustifolia	FAC
willow	sp. Salix sp.	OBL
common reed	Phragmites australis	FACW+
cattail	sp. typha sp.	OBL
bulrush	sp. Scirpus sp.	OBL
sedge sp.	Carex sp.	OBL or FACW
salt grass	Distichlis spicata	FAC+
reed canary grass	Phalaris arundinacea	OBL
tall fescue	Festuca arundinacl	FACW-
equisetum	sp. Equisetum sp.	FACW

INDICATOR CATEGORIES:

OBL -	Obligate Wetland. Occur almost always (estimated probability >99%) under natural conditions in wetlands.
FACW -	Facultative Wetland. Usually occur in wetlands (estimated probability 67%-99%), but occasionally found in nonwetlands.
FAC -	Facultative. Equally likely to occur in wetlands or nonwetlands (estimated probability 34%-66%).
FACU -	Facultative Upland. Usually occur in nonwetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%).
UPL -	Obligate Upland. Occur in wetlands in another region, but occur almost always (estimated probability >99%) under natural conditions in nonwetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the National List.

agricultural practices. However, we could not determine if canal seepage contributes to these wetland areas.

Lining the Hammond canal would result in the loss of 8 acres of willow dominated wetland along the canal, and approximately 6 acres of sedge/rush wetland. Approximately 50 acres of other wetlands or riparian areas could be impacted by canal lining. These acreage figures are based on draft maps and may be subject to change. Mature cottonwood trees would also be lost along the canal. Because it is difficult to locate individual trees with the aerial photo interpretation that was used, an on the ground survey will be necessary to quantify the number of cottonwood trees lost.

The lining of the Hammond Canal would reduce the ability of various wildlife species to successfully exit the canal because of the smooth surface lining would create.

Mitigation

The first step in project mitigation planning is to avoid an anticipated impact. When efforts to avoid impacts have been exhausted, methods to minimize impacts should be considered. After avoidance and minimization efforts have been completed, and impacts are still anticipated, compensation plans should be developed. In the case of this project, lining the Hammond Canal would dry up approximately 14 acres of wetlands immediately adjacent to the canal. If lining of the canal takes place, it would not be possible to avoid or minimize these wetland impacts. Other wetlands and riparian areas, not immediately adjacent to the canal, but associated with seepage from the canal, consist of approximately 50 acres. Impacts to these wetlands could potentially be avoided by providing water to maintain these wetland areas.

In accordance with the Service's mitigation policy (FR Vol. 46, No. 15, January 23, 1981) we have classified the wetlands in the project area as Resource Category 2, which requires in-kind replacement of habitat values. Therefore a mitigation plan should be developed that provides in-kind replacement of habitat values lost by canal lining. Willow shrub-scrub wetland associated with open water and sedge\rush wetland associated with open water should be developed. This could be accomplished by clearing areas of existing tamarisk dominated wetland and replacing them with elongated, irregular shaped shallow ponds, surrounded by willow and sedge/rush wetlands. Discussions with the Bureau, EPA, and the Service determined that mitigation ratios appropriate for the proposed wetland enhancement would be 2:1 (two acres enhanced for every acre impacted). This ratio is based on the fact the wetland mitigation is proposed for an area of existing wetland, which currently has some wetland value. When a mitigation site is selected, it should be evaluated to determine existing wildlife values. The mitigation area should restrict vehicular traffic and grazing.

Impacts to large cottonwood trees should be avoided by providing water to keep them alive. For any areas where this is not possible, trees should be replaced on a 2:1 ratio.

The canal should be designed to provide an easy exit for all sizes of wildlife. A step sided design should be considered.

Information Sources

The following documents may be useful during the formulation of the mitigation plan.

Kerpez, Theodore A., and Norman S. Smith. 1987. Saltcedar control for wildlife habitat improvement in the Southwestern United States. U.S. Fish and Wildlife Service, Resource Publ. 169. 16pp.

Swenson, E. A. 1988. Progress in the Understanding of How to Reestablish Native Riparian Plants in New Mexico. Pages 144-150 in Restoration, Creation, and Management of Wetland and Riparian Ecosystems in the American West. A Symposium of the Rocky Mountain Chapter of the Society of Wetland Scientists. November 1988.

Carothers, S. W., G. S. Mills, and R. R. Johnson. 1989. The Creation and Restoration of Riparian Habitat in Southwest Arid and Semi-Arid Regions. Pages 359-376 in J. A. Kusler and M. E. Kentula (eds.), Wetland Creation and Restoration: The Status of the Science. EPA/600/3-89/038 Vol. I.

The Service looks forward to continued coordination on this project. If you have any questions or comments on the Planning Aid Memorandum, please contact Patty Schrader of our Grand Junction office at (303) 243-2778 or FTS 322-0351.

cc: BR, Denver
BR, Durango
EPA, Denver (Attn: Sarah Fowler)
FWS/FWE, Field Office, Albuquerque
FWS/FWE, R6, Denver
FWS/FWE, Grand Junction
FWS/FWE, Salt Lake City
New Mexico Dept. of Game & Fish (Attn: Chris Pease)

United States Department of the Interior

TAKE PRIDE IN AMERICA

BUREAU OF RECLAMATION
DENVER OFFICE
P.O. Box 25007
Building 67, Denver Federal Center
Denver, Colorado 80225-0007

IN REPLY REFER TO:
D-5110

AUG 23 1993

MEMORANDUM

To: Regional Director, Salt Lake City UT
Attention: UC-700

From: Anthony J. Cappellucci
ACTING Chief, Resource Investigations Policy and Oversight Division

Subject: Mitigation for Irrigation Produced Wetlands (Mitigation Fish and Wildlife)

We are responding to your memorandum of July 12, 1993, (copy enclosed) concerning the Bureau of Reclamation's (Reclamation) policy on mitigation for irrigation-induced wetlands.

1. Items 1-4. This memorandum affirms Reclamation policy regarding mitigation (including irrigation-induced wetlands), which is: "to attempt to compensate for adverse impacts to wildlife resource values where practical and to enhance wildlife resource values where the opportunities exist," when such compensation or enhancement is "reasonable and justified" [Reclamation Instructions (RI), Part 376.13.7D] as determined by Reclamation (RI Part 376.13.7A and the Reclamation NEPA Handbook, section 10-20). "Analysis of wildlife resource impacts should be based on professionally accepted methodologies and tailored to the significance of the resource..." (RI, Part 376.13.7C).

2. Impacts to wildlife resource values and appropriate mitigation must be determined on a case-by-case basis. Periodic removal of vegetation along a canal during routine operation, maintenance, and replacement activities reduces wildlife resource values and significance of irrigation-induced wetlands. "The evaluation of wildlife resource effects will include a comparison of the future resource conditions without a proposed action or alternative and those future conditions projected to occur with the alternative under consideration" (RI, Part 376.13.7C). Therefore, the results of past and future periodic removal of vegetation affects the need for and extent of mitigation, if permanent removal of the vegetation is proposed.

3. Coordination with appropriate resource and regulatory entities, including the Fish and Wildlife Service and other Federal, State, and tribal agencies, is integral to the impact analyses and mitigation determination processes. Reclamation must involve them and consider their recommendations concerning the action, including possible mitigation, but the final determination on the action and any associated mitigation remains with Reclamation's regional directors.

4. Item 5. In response to your request for guidance on Federal laws and Executive orders, we really need specific issues to give further guidance on these or other applicable legislative actions. However, we can offer the following information to you: for the Fish and Wildlife Coordination Act, see RI 376.13; for the Clean Water Act, see RI 376.7; for Executive Order 11990, see RI 376.5; and for the Salinity Control Act, we do not have RI's or guidance written for it.

If you have further questions, please call Bob Martinson at (303) 236-9336, extension 275.

Tony Cappelluci

Enclosure

cc: Assistant Commissioner - Program, Budget, and Liaison
Attention: W-6500 (Troast), W-6600
(w/encl to each)
Projects Manager, Durango CO, Attention: DUR-150, DUR-710
(w/o encl to each)

United States Department of the Interior
BUREAU OF RECLAMATION
UPPER COLORADO REGION
DURANGO PROJECTS OFFICE
835 E. SECOND AVENUE
P.O. BOX 640
DURANGO, COLORADO 81302-0640

DEC 19, 1994

IN REPLY
REFER TO:

DUR-710
ENV-7.00

MEMORANDUM

To: Regional Director, Salt Lake City UT
Attention: UC-700

From: Errol G. Jensen Ken Beck
Chief, Environmental & Planning Division

Subject: Draft Planning Report/Environmental Assessment (PR/EA), Hammond Project Portion, San Juan River Unit, CRWQIP, San Juan County, New Mexico

On December 13, 1994, Ken Beck called Jennifer Fowler-Propst, State Supervisor, Fish and Wildlife Service (Service), to confirm that the Service's position on mitigation measures for the Hammond Project salinity work had not changed from the March 15, 1994, memorandum on the subject. Mrs. Propst informed Ken that the Service's position remains as stated in that memorandum to Reclamation. She thanked him for the courtesy call and emphasized that the surrounding issues had been discussed at length. No additional work is needed. Ken told her that the report is being finalized and thanked her for the cooperation and assistance received from the Service in bringing the report to closure.

Attachment

ATTACHMENT F

Biological Assessment and Related Correspondence

San Juan River Unit
Hammond Project Portion, New Mexico
(Colorado River Water Quality Improvement Program)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

October 6, 1994

Memorandum

To: Regional Director, Bureau of Reclamation, Upper Colorado Regional Office, Salt Lake City, Utah

From: State Supervisor, New Mexico Ecological Services Office, Albuquerque, New Mexico

Subject: Biological Assessment for the San Juan River Unit, Hammond Project Portion, New Mexico, Colorado River Water Quality Improvement Program

Your August 25, 1994, Biological Assessment for the subject project was forwarded to this office for review by Colorado Ecological Services Field Supervisor Lee Carlson, and was received on October 4, 1994. Based on the information presented in the Biological Assessment, and on the assurance provided in that document that no further depletions of the flow of the San Juan River would arise from either the operation of the lined canal or the mitigation of wetlands lost, I concur with your findings concerning the project, as proposed and described, that are listed below:

Mancos milk vetch	No effect
Knowlton's cactus	No effect
Mesa Verde cactus	No effect
Spotted bat	No effect
White-faced ibis	No effect
Mountain plover	No effect
Ferruginous hawk	No effect
Apache northern goshawk	No effect
Southwestern willow flycatcher	Not likely to jeopardize
Colorado squawfish (and critical habitat)	No effect
Razorback sucker (and critical habitat)	No effect
Roundtail chub	No effect
Flannelmouth sucker	No effect

I would like to commend the Bureau of Reclamation for addressing not only listed and proposed species, but also candidate species in this assessment.

If we may be of further assistance, please contact this office at (505) 883-7877.

Jennifer Fowler-Propst

Jennifer Fowler-Propst

BIOLOGICAL ASSESSMENT

SAN JUAN RIVER UNIT

HAMMOND PROJECT PORTION, NEW MEXICO

(Colorado River Water Quality Improvement Program)

August 1994
Bureau of Reclamation
Upper Colorado Region

TABLE OF CONTENTS

SUMMARY

Mancos milk vetch	Endangered	No affect
Knowlton's cactus	Endangered	No affect
Mesa Verde cactus	Endangered	No affect
Spotted bat	Candidate	No affect
White-faced ibis	Candidate	No affect
Mountain plover	Candidate	No affect
Ferruginous hawk	Candidate	No affect
Apache Northern goshawk	Candidate	No affect
Southwestern willow flycatcher	Proposed	Not likely to jeopardize
Colorado squawfish	Endangered	No affect
Razorback sucker	Endangered	No affect
Roundtail chub	Candidate	No affect
Flannelmouth sucker	Candidate	No affect

I. PROJECT SETTING

A. Location

The San Juan River, a tributary of the Colorado River, originates in the San Juan Mountains in southwestern Colorado. The San Juan River drainage encompasses over 43,000 square miles upstream of Mexican Hat, Utah and ranges in elevation from 3,700 feet (high water elevation of Lake Powell) to 14,000 feet in the San Juan mountains. The river flows in a general west/southwest direction to Shiprock, New Mexico, where it changes direction, heading northwest to the Four Corners area. The river then flows generally westward, ultimately joining Lake Powell in Utah. Major contributors to the San Juan River include the Animas, La Plata, Navajo, Piedra, Los Pinos, Chaco and Mancos rivers and McElmo and Montezuma Creeks (San Juan River Unit-Hammond Project Portion, New Mexico, Draft Planning Report/Environmental Assessment, 1993 [Hammond Report]).

B. Project Description and Proposal

The San Juan River Unit was authorized as part of the Colorado River Basin Salinity Control Act on June 24, 1974 (Public Law [P.L.] 93-320, as amended by P.L. 98-569 on October 30, 1984) and the Federal Water Pollution Control Act Amendments of October 1972 (P.L. 92-500), as amended by the Clean Water Act of 1977 (P.L. 95-217).

The San Juan River contributes about 1 million tons of salt annually to the Colorado River. Since 1985, the San Juan River drainage has been studied to develop alternative courses of action to economically reduce salt loading. The Hammond Project extends along the southern bank of the San Juan River in a 20-mile strip south of Bloomfield, New Mexico. The Hammond Project system has 26.95 miles of canal and 10.25 miles of laterals. Approximately, 4.5 miles of canal and 2.8 miles of laterals have already been concrete-lined to conserve water.

The Hammond Project study considered a variety of alternatives of which three were deemed viable. Among these three, the Canal Lining Alternative was considered the preferred alternative. Implementation of this preferred alternative would result in lining all unlined portions of the Hammond Canal with either concrete or membrane lining ultimately resulting in the reduction of 27,700 tons of salt per year to the San Juan River. This alternative assumes all existing structured turnouts, wasteways and pumping plants would remain essentially unchanged. Water diverted from the San Juan River would never exceed 90 cfs based on the maximum carrying capacity of the canal. Since implementation of this alternative would essentially eliminate water lost through leakage in the system, there would be no additional loss in flow to the San Juan River.

C. Project Impacts

A temporary disturbance of upland vegetation growing within the 10-foot right-of-way would occur during construction. All phreatophytic vegetation associated with water leaking from the canal would be lost once the canal is lined. This area was previously impacted during initial construction of the Hammond Project in the early 1960's. Disturbance would be confined to the rights-of-way segments that are not currently lined, which include: approximately 19.5 miles of Main Canal; 3.9 miles of Gravity Extension Lateral; 2.3 miles of East Highline Lateral; and 1.0 miles of West Highline Lateral. Approximately 14 acres of palustrine emergent persistent seasonally flooded wetland habitat adjacent to the canal would be lost based on wetland classification system described by Cowardin, at al., 1979. A more detailed description of impacts is contained in the Fish and Wildlife Coordination Act Report/Planning Aid Memorandum (Fish and Wildlife Service, 1990) and the draft Hammond Report. Reclamation would implement measures to replace the functional value of 25 acres of irrigation-produced wetland outside the canal structure and right-of-way at the 2:1 ratio. Implementation of this mitigative measure would be done utilizing sources of water that are already being consumptively used from the San Juan River; therefore, there would be no additional depletion of water to the San Juan River.

II. THREATENED AND ENDANGERED SPECIES

A. Background

Under requirements of Section 7 of the Endangered Species Act (Act), Reclamation requested from the U.S. Fish and Wildlife Service (Service) a list of threatened and endangered species that may be present in areas affected by the proposed action. The Service identified the following federally-listed threatened or endangered species as well as species identified as either proposed or candidate for listing under the Act that may occur in the area affected by the proposed action in memorandums dated April 3 and September 12, 1990:

SPECIES	STATUS
Bald eagle (Haliaeetus leucocephalus)	Endangered
Peregrine falcon (Falco peregrinus)	Endangered
Black-footed ferret (Mustela nigripes)	Endangered
Colorado squawfish (Ptychocheilus lucius)	Endangered
Mancos milk vetch (Astragalus humillimus)	Endangered
Mesa verde cactus (Sclerocactus mesa-verd	Endangered
Razorback sucker (Xyrauchen texanus)	Candidate
Mancos saltbush (Atriplex pleiantha)	Candidate
Beautiful gilia (Gilia formosa)	Candidate
San Juan milkweed (Asclepias sanjuanensis)	Candidate

A Biological Assessment was prepared addressing these species and sent to the Service on April 4, 1991. This assessment concluded that there would be no affect on any of the species listed. The Service responded to this assessment in a memorandum dated May 14, 1991. This memorandum concurred with Reclamation's "no affect" conclusion on all species with the exception of the Colorado squawfish and the razorback sucker. At that time, the Service stated they did not have sufficient information regarding possible additional depletions to the San Juan River in association with the Project's wetland mitigation plan. The issue of additional water depletion to the San Juan River remained the only major concern on the part of the Service regarding an affect on the two listed fish species.

In March 1994, Reclamation requested the Service update the list of federally protected species occurring in the project area. Also, since 1990, the razorback sucker has been elevated from a candidate species to being formally protected as endangered. In addition to the species listed above, the Service also requested Reclamation address additional species listed below:

SPECIES	STATUS
Knowlton's cactus (*Pediocactus knowltoni*)	Endangered
Southwestern willow fly catcher (*Epidomax trailii extimus*)	Proposed
Spotted bat (*Euderma maculatum*)	Candidate
White-faced ibis (*Plegadis chici*)	Candidate
Ferruginous hawk (*Buteo regalis*)	Candidate
Mountain Plover (*Charadrius montanus*)	Candidate
Apache Northern goshawk (*Accipiter chihi*)	Candidate
Roundtail chub (*Gila robusta*)	Candidate
Flannelmouth sucker (*Catostomus latipinnis*)	Candidate

B. Species Accounts and Assessment

While the Act does not require federal agencies to address candidate species in a biological assessment, Reclamation recognizes the importance of addressing potentially threatened species to assist in preventing further decline of the species which might ultimately require formal protection under the Act. Reclamation does not believe the proposed action would affect any of these listed species. Described below is an updated species assessment, assessing the effect the project would have on species listed above. Species addressed in Reclamation's 1991 biological assessment are not discussed again below unless new information has become available.

Mancos Milk Vetch

The Mancos milk vetch was listed as an endangered species on June 27, 1985 (Service, 1985). A member of the pea family (Fabaceae/Leguminoseae), the plant is a small, perennial, herbaceous species. It is known to occur only in southwestern Colorado and northwestern New Mexico. This milk vetch occurs in association with Mesa Verde sandstone of Cretaceous origin, between 5,000 and 5,600 ft in elevation. It is found on ledges and mesa tops and often becomes established in small cracks in sandstone or pockets of sandy soil.

This species does occur within the general vicinity of the Hammond Project. In 1980, after nearly a hundred years of no documented occurrence, a population was rediscovered near Farmington. In 1986, populations were found in the Mancos Canyon area in southwestern Colorado. Populations have also been identified in the vicinity of Navajo Reservoir (Sivinski, 1990).

However, suitable habitat for the Mancos milk vetch does not occur within or adjacent to the area to be disturbed during construction of the Hammond Project. There are no sandstone ledges or mesa tops in close association to the Project. Based on this lack of suitable habitat, the Hammond Project would not impact existing individuals, populations, or potential habitats of the Mancos milk vetch.

Knowlton's Cactus

Knowlton's cactus was listed as a federally endangered species on October 29, 1979. It is a small, inconspicuous cactus that occurs on alluvial hills from 6,000 to 6,500 feet and is only known to occur in San Juan County, New Mexico. Popular among cactus collecting enthusiasts, this species has been reduced to near extinction in the wild because of persistent collecting over the past 30 years.

Although alluvial hills do occur in the vicinity, no suitable habitat occurs within or adjacent to the area to be disturbed by the project. There are no known populations of the cactus in the project area; therefore, the Hammond Project would not impact individuals, populations, or suitable habitat for Knowlton's cactus.

Mesa Verde Cactus

The Mesa Verde cactus was listed as threatened on October 30, 1979 (Service, 1979). It is a small, globe-shaped cactus that occurs in desert habitats from 4,800 to 5,500 feet elevation. This cactus is found in severe habitats on barren Mancos shale. In one case; however, populations were thriving on Fruitland badland formations. Because of the specific habitat requirements of this cactus, its distribution is limited to Montezuma County, Colorado and San Juan County, New, Mexico.

Suitable habitat for the Mesa Verde cactus does not occur within or adjacent to the Hammond Project. No barren Mancos shale or badland formations occur in the project area. In addition, no known populations of this species occur in the general vicinity of the project. Therefore, the Hammond Project would not impact existing individuals, populations, or potential habitats for the Mesa Verde cactus.

Spotted Bat

The range of the spotted bat encompasses much of the arid and semi-arid, interior regions of the western United States. Within this range, occurrence is quite patchy, apparently dependent on the presence of certain requisite habitat features. Individual spotted bats may be found in a variety habitat types, both wooded and non-wooded. Because many such records are of individuals, these instances may be the result of post-breeding wandering and migration. Only a few locales have been identified with viable resident breeding populations, and these seem to have certain habitat characteristics in common. Typical habitat features include substantial rock formations, offering an abundance of crevice habitat for roosting, and the presence of perennial or ephemeral (with persistent pools) water sources. Sites typically inhabited are remote rocky canyons, washes, and arroyos, or sites with extensive rocky cliff formations. Because these locales are typically arid to semi-arid, reliable water appears to be a key habitat feature.

There are few regional records of this species. The closest record is of a single specimen, collected 2 miles north of Aztec in September, 1958 (Rodeck, 1961). Suitable habitat for the species does, no doubt, exist in the general project area. However, key habitat features, i.e., rocky, crevice roosting habitat are not present within or adjacent to the project disturbance zone. Any use of the disturbance zone by this species would most likely occur during nightly foraging activity (largely for moths). Foraging no doubt occurs over fairly large areas, and there are no identifiable characteristics within the disturbance zone that would be expected to concentrate foraging activity. Its distance from suitable roost habitat may, if anything, reduce use of the disturbance sites. Consequently, the project should have no adverse effect on any local spotted bat populations which could be present, nor should there be an adverse effect on the species.

White-faced Ibis

The white-faced ibis is on the periphery of its breeding range in northwestern New Mexico and is a species closely associated with freshwater marshes. Nesting and juvenile rearing generally take place in marshes with large rush or reed communities. Although these birds may occasionally feed along canals, they are most likely to be found where freshwater marsh habitat is present. Much of the Hammond Canal is located on semi-arid upland grassland and shrubland. The canal itself likely provides poor foraging habitat, and little or no suitable nesting habitat for the species. Therefore, it is unlikely that the canal would receive anything but rare, incidental use. Consequently, the Hammond Project should have no effect on any white-faced ibis population (direct or indirect) which may be found in the area; nor should there be any adverse effect on the species.

Mountain Plover

The mountain plover is a ground-nesting bird of short-grass ecosystems. Due to drastic declines in populations throughout its range, it has been elevated to a category I species for listing under the Endangered Species Act. The majority of breeding now occurs only in two counties in Montana and Colorado (Knopf, 1991). While apparently suitable breeding habitat goes unoccupied over large areas of formerly-occupied range, concerns for the species decline have, in part, shifted to wintering grounds. Much wintering habitat apparently occurs in California. Historical wintering grounds in south Texas now appear unused. The degree to which mountain plovers may winter in Mexico seems unknown.

It seems unlikely that either breeding or wintering populations exist in the project area. More likely, any sitings of mountain plovers are migratory birds, or sporadic wandering. Primary habitat is heavily grazed short-grass ecosystems (including prairie dog towns) on flat upland tables. Taller vegetation and rolling or strongly sloped terrain are generally not used by these birds. Consequently, considering both range and habitat requirements, it seems very unlikely there is any significant use of the project corridor by this species. Therefore, adverse effects on mountain plovers, either locally or as a species, resulting from the project, are improbable.

Ferruginous Hawk

The ferruginous hawk is a species of open grasslands and shrublands. It is an uncommon resident in northwestern New Mexico, and could be found in the project vicinity. Nests tend to be very large and are most typically built in trees. Occasionally, nest sites may be on cliffs or on the ground. The selected site is typically somewhat remote, well away from sources of disturbance. Although ferruginous hawks will take a variety of prey, they show a decided predilection for rodents, especially prairie dogs and ground squirrels. Much foraging, is in or near active prairie dog or ground squirrel colonies.

While upland vegetation in the Hammond Canal corridor may support some prey base for any foraging ferruginous hawks, there is nothing unique about the corridor that would make it especially important to these hawks. Further, any disturbance to adjacent upland habitats would be temporary, with only short-term effects on native habitats and, therefore, resident rodent populations. The canal itself does not provide habitat for the hawk. Loss of seepage due to canal lining will, to some extent, reduce the robustness of adjacent vegetation, which is often enhanced by canal seepage losses. However, because ferruginous hawks typically forage in open habitats where rodents are accessible to them, this should have no affect on either the prey base or the foraging ability of any ferruginous hawks which may hunt in the area. Nor should project activity have any affect on nesting habitat of the species. No known ferruginous hawk nests are present within or adjacent to the project disturbance corridor. Therefore, it is unlikely that the project would adversely affect either local ferruginous hawk populations, or the species.

Apache Northern Goshawk

The northern goshawk is a species of mature, old-growth forest ecosystems. As these ecosystems have declined through extensive logging and development, the northern goshawk has sustained a concomitant decline in both range and numbers. The northern goshawk is still found regionally where significant old-growth ponderosa pine and spruce-fir forest habitat remains. However, because these habitats have declined dramatically, the species is becoming increasingly rare in the southwest. According to Johnson and Silver (1991), there are only 83 known breeding territories in the entire southwest.

The subspecies A. g. apache is found in old-growth habitats of southern New Mexico and Arizona, and probably does not occur in the project area. In any case, the old-growth, closed-canopy requirements of the northern goshawk precludes its presence in the open, semi-arid environment of the Hammond Canal. Therefore, the project will have no adverse effect on any populations of the northern goshawk, nor on the species or any of its subspecies.

Southwestern Willow Flycatcher

The U. S. Fish and Wildlife Service has proposed listing the southwestern willow flycatcher as an endangered species under provisions of the Endangered Species Act. It is currently classified as endangered by the State of New Mexico. This subspecies is known to breed in southern California, Arizona, and southwestern New Mexico. Critical habitat, comprising known breeding colonies, has been proposed for several southwestern New Mexico counties, including the closest documented breeding populations to the project area, in the Rio Grande drainage west of Albuquerque. Even closer, probable breeding populations may also exist in the San Juan and Colorado river drainages of southeastern Utah. The status of the subspecies in these areas is currently not well defined. However, the presence of the subspecies along the San Juan River does increase the potential they may occur in the project area.

The southwestern willow flycatcher typically nests in dense, even-aged, multi-layered riparian communities. Structural elements typically include trees and shrubs approximately 4-7 meters tall, with a high percentage of canopy cover, and a dense understory under 4 meters in height (U. S. Fish and Wildlife Service, 1993). Historically, these multi-layered communities were comprised of a dense willow mid-layer and cottonwood overstory. With widespread alteration of natural vegetation communities, some adaptation to the use of tamarisk and Russian olive thickets has been noted. Foraging may occur in narrower, less dense, and patchier riparian shrub communities.

The Hammond Canal diverts water directly from the San Juan River above Blanco, roughly paralleling (within a mile) it for some 23 miles. Suitable habitat for the southwestern willow flycatcher may exist within the San Juan River floodplain in the vicinity of the project. However, along the canal itself, relatively little woody riparian habitat is found. The only developed habitat along or near the Hammond Canal occurs within the San Juan River floodplain, below the diversion dam, between the Hammond Canal and the San Juan River. Along the rest of canal, woody riparian habitat occurs as very narrow, sporadic linear strips of willow. Cottonwoods occur only occasionally, often associated with discharge seepage downhill from the canal. Periodic herbicidal treatments and burning have reduced woody phreatophytic vegetation along the canals substantially. Consequently, habitat for the southwestern willow flycatcher along the Hammond Canal is quite poor. Any use of the canal right-of-way by the southwestern willow flycatcher is likely to be rare and incidental. Therefore, it is unlikely the project action will have any detrimental effects on possible local southwestern willow flycatcher populations, should any be present, or on the species.

Colorado Squawfish

Described below is an addendum to the species account provided in the 1991 Hammond Project Biological Assessment.

In 1991, a seven-year research effort was initiated on the San Juan River drainage to better define habitat requirements and to formulate recovery strategies for the endangered Colorado squawfish and razorback sucker populations (USFWS, 1991). Over the last three years, several adult squawfish have been collected from the San Juan River, all downstream of Shiprock, New Mexico. In addition, reproductive success has been verified by this species evidenced by the collections of young-of-the-year (YOY) squawfish in the lower San Juan River. Most notably, eleven YOY squawfish were collected from the extreme lower San Juan River in 1993, all within six river miles of Lake Powell (Lashmett, 1994).

In March 1994, the San Juan River downstream of Farmington, N.M was formally declared by the Service as "Critical Habitat" for the Colorado squawfish and razorback sucker.

Since implementation of this project would not cause any additional depletion to the San Juan River, there would be no affect on either this species or its downstream critical habitat. Implementation of the proposed action would reduce diversion from the river and would result in improvement of water quality by reducing the salt loading to the river from project lands.

The Service has designated the portion of the San Juan River from the Hogback Diversion to the mouth of Neskahai Canyon as critical habitat for the Colorado squawfish (Maddux, et al, 1993). This designated critical habitat exists well downstream from the Hammond Project and would not be affected by the proposed action.

Razorback Sucker

The 1991 Hammond Biological Assessment describes the status of the razorback sucker in the San Juan River. There exists no substantive new information about this species occurrence and distribution that needs to be addressed in this assessment. The only new information available is that the same portion of the San Juan River designated as critical habitat for Colorado Squawfish was also designated for this species in 1993 (Maddux, et al. 1993). However, as stated above, implementation of this project would not additionally reduce flow in the San Juan River and neither the species nor its designated critical habitat would be affected by this proposed project.

Roundtail Chub

Roundtail chub populations have declined significantly over the last several years, particularly in the San Juan River drainage. Within New Mexico, this species has been extirpated in the Zuni and San Francisco drainages. It was classified in 1975 by the State of New Mexico as State Endangered Group II. Further, it is believed the species population trend within New Mexico continues to decline. It is believed predation and competition with non-native fishes and loss and alteration of aquatic habitat are primarily responsible for its decline. Historically, in the San Juan River Basin downstream of Navajo Dam, the roundtail chub has been reported from the Animas, La Plata and Mancos rivers as well as from the mainstem San Juan River. In recent years, all collections of roundtail chubs have occurred downstream of the Animas/San Juan river confluence. It is not known if this species successfully reproduces in the San Juan River downstream of Navajo Dam.

As concluded above, since the Hammond Project proposed action would not cause any further depletion to the San Juan River, the project would not affect downstream populations of roundtail chubs.

Flannelmouth Sucker

Within New Mexico, the flannelmouth sucker is known to occur within its native range, the San Juan River drainage. This sucker is one of the most abundant native fishes found in the San Juan River downstream of Navajo Dam. Also, large populations of these fish are found in the Animas, La Plata and Mancos rivers as well as McElmo Creek. Successful natural reproduction by this species occurs in all of these tributaries and also within the San Juan River. Population trend of this species within the San Juan River is determined to be stable.

For the same reason described above for other native fishes inhabiting the San Juan River, implementation of the Hammond Project alternative would not affect this fish species.

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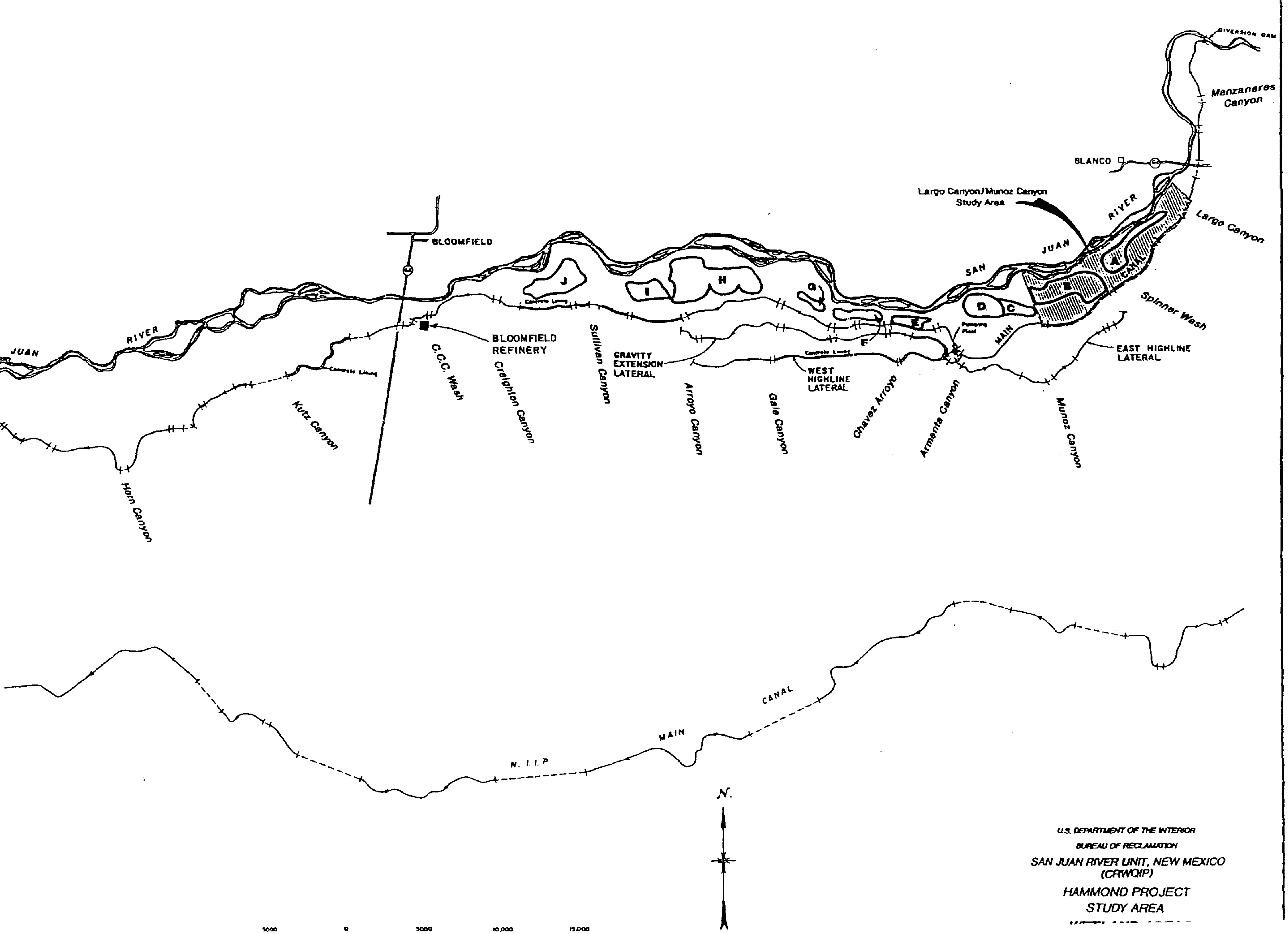

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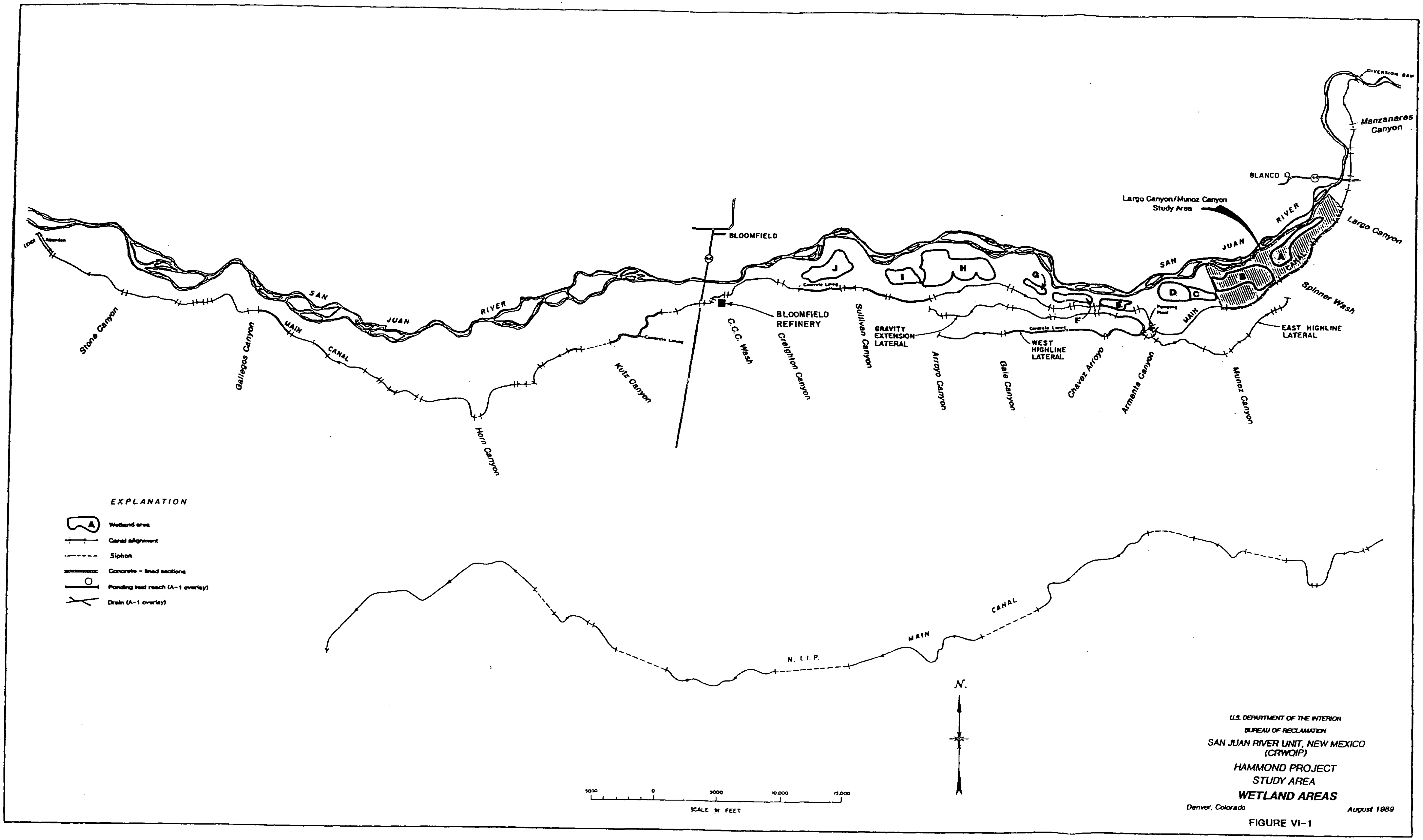
HAMMOND PROJECT
STUDY AREA



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(CRWQIP)
HAMMOND PROJECT
STUDY AREA
WETLAND AREAS
Denver, Colorado August 1989

FIGURE VI-1

Table II-1.—San Juan River salt-loading budget (Archuleta to Farmington, 1978-83)

Sources	1973-83 salt budget (tons/year)	1963-81 salt budget (tons/year)[1]
Salt pickup:		
San Juan River near Farmington	527,000	461,927
San Juan River near Archuleta	-199,000	-181,339
Total salt pickup	328,000	280,588
Salt loading from known sources:		
Largo Canyon at mouth	17,000	(not included)
Animas River near Farmington	213,000	201,255
Total salt loading	230,000	201,255
Unaccounted salt loading		
Archuleta to Farmington	98,000	79,333

[1] Reclamation estimates.

- A canal characterization study.
- Detailed ground-water and water quality investigations between Largo Canyon and Muñoz Canyon.
- Five additional wells, which were installed to bedrock near the river down from the canal alignment to obtain water quality information on ground water flowing along the bedrock interface.

Initial estimates of salt loading to the San Juan River attributable to canal and lateral system seepage were made using data and study results from previous Project investigations as well as results from San Juan salinity study investigations.

The canal and lateral system (Main Canal and Gravity Extension and West Highline and East Highline Laterals) were broken into reaches (as shown in figure I-1) to evaluate salt loading. Overall system salt loading was determined by combining reach estimates. Salt-tonnage reduction attributed to canal and lateral lining was estimated from expected reduced

SOILS

The soils in the irrigated areas developed in a complex alluvial, geomorphic environment and vary considerably in latitude and depth. The San Juan River has transported alluvial material from throughout the basin into the irrigated areas. Local weathering of the surrounding formations has also contributed considerable amounts of material to the area, building up a deep valley alluvium. On Project lands, the soils vary in texture from sands to clays and often occur in irregularly stratified layers of variable thickness. The valley fill material composing the Project lands ranges in depth from 10 to more than 100 feet.

PROBLEM QUANTIFICATION

Early reconnaissance in 1986 and 1987 indicated the Hammond Project could be contributing significant amounts of salt to the San Juan River from canal system seepage losses. These observations were based on measurements of quality and quantity of water from subsurface drains and investigations of canal seepage. The total salt load to the San Juan River along the 35-mile reach from Archuleta to Farmington, New Mexico, was quantified in a salt budget.

The salt-loading budget (1978-83) shown in table II-1 used U.S. Geological Survey data from the San Juan River at Archuleta, Largo Canyon at its mouth, the Animas River at its mouth, and the San Juan River at Farmington. The analyses indicate an average total salt pickup from Archuleta to Farmington of 328,000 tons per year.[2] The 98,000 tons of "unaccounted-for" salt loading includes the salt loading attributable to the Project.

HYDROSALINITY INVESTIGATIONS

During the course of salinity control investigations on the Hammond Project Portion of the San Juan River Unit, the Bureau of Reclamation (Reclamation) compiled diversion and canal operation records and data on cropping patterns and acreages. Additional site data were collected which included:

- Data on existing wells and agricultural drains, which were updated and monitored.

- Canal seepage investigations using transient ground-water and ponding tests.

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[2] Figure II-1 shows the Project drains, ponding test sites, and the Largo Canyon and Muñoz Canyon study area.

Table IV-3.—Tests of viability and other measures
(Action alternatives)

Alternatives	Completeness	Effectiveness	Efficiency	Acceptability	Salt removed	Cost effectiveness[1] ($ ton/removal)
Viable alternatives						
Canal Lining	Yes	Yes	Yes	Yes	27,700 tons	41.65
Low-Pressure Pipeline (upper section)	Yes	Yes	Yes	Yes (though less than canal lining)	18,400 tons	88.75
High-Pressure Pipeline (upper section)	Yes	Yes	Yes	Yes	18,400 tons	107.36
Nonviable alternatives						
Gravity-Pressurized Pipeline			Failed			Excessive
Land Retirement				Failed	34,350 tons	100
Low-Pressure Pipeline			Failed		25,560 tons	124
Lower section					7,160 tons	214
Upper section					18,400 tons	88.75
High-Pressure Pipeline			Failed		25,560 tons	145
Lower section					7,160 tons	241
Upper section					18,400 tons	107.36
Low-Pressure Pipeline, Muñoz Canyon	Failed	Yes	Yes	Failed (with Navajo Nation)	25,560 tons	125
Lower section					7,160 tons	216
Upper section					18,400 tons	88.75

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[1] Does not include cost for possible modifications to siphons.

High-Pressure Pipeline (Both Upper and Lower Sections)

The High-Pressure Pipeline Alternative is the same in concept as the Low-Pressure Pipeline Alternative, except that 100 feet of pressure would be provided by the Project at the end of each lateral. As with the Low-Pressure Pipeline Alternative, the upper section was found to be a viable alternative (see High-Pressure Pipeline Alternative), but the lower section failed the efficiency test with a cost effectiveness of $241 per ton of salt removed. The entire Project has a combined cost effectiveness of $145 per ton.

Low-Pressure Pipeline (Muñoz Canyon)

This alternative would be similar to the Low- and High-Pressure Pipeline (upper and lower sections) Alternatives described above, except that Project water would be carried in the existing NIIP Canal to a new pipeline to be constructed in Muñoz Canyon down to the Project. The pipeline would be sized to provide 10 feet of head at the ends of all new lateral pipes. The NIIP canal is approximately 400 to 500 feet higher in elevation than the Project lands.

This alternative was marginally cost effective, as it would reduce 25,560 tons of salt per year at an annual cost of $3.2 million. However, to implement the alternative, the rights for Project water to be carried in the NIIP Canal would have to be secured from the Navajo Nation. This is unlikely to occur as the NIIP, as mentioned earlier, is still under development and is currently encountering problems delivering enough water to NIIP lands during the peak irrigation season. As a result, the alternative fails the acceptability and completeness tests.

PLAN COMPARISON

As noted earlier, four accounts are used to display information on the effects of viable alternatives—the National Economic Development, the Regional Economic Development, the Social Effects, and the Environmental Quality accounts. Each account describes particular aspects of anticipated effects of the alternatives on the human environment. The NED account measures costs and benefits in monetary terms; the RED account measures impacts of the preferred alternative on the local economy in monetary and nonmonetary values; the SE account measures impacts on local residents of the study area, on their customs, and on their lifestyles; and the EQ account measures impacts on the environment in nonmonetary terms.

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

The objective of National Economic Development is to increase the Nation's output of goods and services and to improve national economic efficiency

(*Principles and Guidelines*, March 10, 1983). Impacts occur either directly to project users or indirectly as external effects, or as employment of underemployed and unemployed resources. The NED account analysis below identifies beneficial and adverse effects of the three viable action alternatives.

Beneficial Effects

Beneficial effects in the NED account are monetary increases in the economic value of the national output of goods and services from a plan, the value of output caused by the plan, and the value associated with the use of otherwise unemployed or underemployed labor resources.

Direct Users Benefits

Benefits from the Project would result from reducing the salt load in the Colorado River. Presently, the indexed annual value is $334.38 ($334) for each ton of salt removed. Derivation of the interim salinity value of $257 (1986 dollars) per ton is outlined in a Reclamation memo, "Interim Salinity Control Benefit Value (Salinity Control Coordination)," May 4, 1993. This figure, which is based on direct benefits only, was indexed to January 1993 dollars ($334) using the consumer price index.[5] The following assumptions and descriptions should be fully understood in evaluating the reliability of this figure.

The per unit benefit value for salt reduction is based on the assumption that the Salinity Control Program is fully implemented by the year 2010. This per unit value was determined by assuming the "with full program implementation" salinity level versus the "without program implementation" salinity level in the year 2010. The reduction in salinity damages was identified using the Colorado River Estimation Computer Program (February 1988). The total reduction in damages was divided by the amount of salinity (mg/L) reduced by the Salinity Control Program. This average value was then converted to a benefit per ton of salt removed.

External Economies

No external economies were identified for any of the three viable action alternatives (external economies are often referred to as "third-party effects," meaning the phenomena are byproduct effects on someone other than the parties directly involved in a production or consumption activity).

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[5] Since this is a value which does not occur until 2010 and is dependent on other salinity projects coming online, it is shown for display purposes only and will not be used in benefit/cost analysis for economic justification.

Unemployed and Underemployed Resources

San Juan County, New Mexico, has been designated a labor surplus area by the U.S. Department of Commerce's Economic Development Administration. Employers in the county may be given preference in bidding on Federal procurement contracts (Public Law 96-302, July 2, 1980). As a result, some of the construction labor is included in the NED account, based on this designation.

Adverse Effects

Adverse effects are the opportunity costs of resources used in implementing a plan and include costs for all Project features, including resources required to construct, manage, maintain, or replace Project features throughout the project life of 50 years.

Project Costs

Construction costs include all Project planning and construction costs, as shown in the construction cost estimate (table IV-12, as it appears later in this chapter). Interest during the 3-year design and 3-year construction period is based on the FY93 interest rate of 8-1/4 percent, and costs are annualized at the same interest rate based on a 50-year project life. Costs and tons of salt removed for the viable alternatives are shown in table IV-4.

As noted earlier, the Canal Lining Alternative is the most cost effective of the action alternatives and would reduce annual salt loading by 27,700 tons, whereas the pipeline alternatives would reduce annual salt loading by 18,400 tons.

Net Beneficial Effects

The NED account (see table IV-5) shows that the Canal Lining Alternative displays the greatest positive net benefits. Total beneficial effects exceed total adverse effects for the Canal Lining Alternative by about $8.249 million (in annual equivalent values).

Conditions Under No Action Alternative

Table IV-6 shows the projected salt-load reduction under the preferred alternative and the estimated direct benefits to users based on that removal. Effects of the Canal Lining Alternative are the monetary differences between the forecasted conditions with the plan and the

Table IV-4.—Cost effectiveness of alternatives

	No Action	Canal Lining	Low-Pressure Pipeline (10-foot head)	High-Pressure Pipeline (100-foot head)
Capital costs[1]				
Construction cost	$0	$11,697,000	$12,507,000	$14,599,000
Interest during construction	0	1,951,000	2,154,000	2,471,000
Capital investment	$0	$13,648,000	$14,661,000	$17,070,000
Annual investment	$0	$1,147,730	$1,232,980	$1,435,510
Annual operation, maintenance, replacement, and energy (increase)	0	6,000	400,000	540,000
Total annual cost	$0	$1,153,730	$1,632,980	$1,975,510
Tons of salt removed	0	27,700	18,400	18,400
Cost per ton	0	$41.65	$88.75	$107.36

[1] Preauthorization and archeological costs excluded.

forecasted conditions without the plan. Although an estimate of the No Action Alternative has not been quantified, existing conditions are expected to continue.

REGIONAL ECONOMIC DEVELOPMENT ACCOUNT

The RED account registers changes in the distribution of regional economic activity resulting from the viable alternatives. Two measures of the plan's effects on regional economies are used—regional income and regional employment. In this Project, the region is San Juan County, New Mexico; the adjacent region refers to the users of the Colorado River downstream from the region. The category termed rest of Nation consists of the rest of the State of New Mexico and all other states in the United States.

Income and employment are used in the RED analysis as measures of the effects of a plan on the regional economy. The positive effects on RED in terms of income and employment are equal to the incidence of NED benefits that accrue to the region plus the transfers of income and employment to the region. Because San Juan County has been designated as a labor

Table IV-5.—Beneficial and adverse effects of viable action alternatives on NED account (Units—$1,000, annual equivalent values)

	Action alternatives		
Component	Canal Lining	Low-Pressure Pipeline (10-foot head)	High-Pressure Pipeline (100-foot head)
Beneficial effects			
Direct user benefits[1] (salinity impacts)	$9,252	$6,146	$6,146
External economics	0	0	0
Unemployed and underemployed labor resources[2]	151	69	80
Total beneficial effects	$9,403	$6,215	$6,226
Adverse effects[3]			
Project costs			
Construction	$984	$1,052	$1,228
Interest during construction	164	181	208
Additional operation, maintenance, replacement, and energy	6	400	540
Subtotal	$1,154	$1,633	$1,976
External costs	0	0	0
Total adverse effects	$1,154	$1,633	$1,976
Net beneficial effects	$8,249	$4,582	$4,250

[1] The benefits are based on tons of salt removed and the January 1993 value of $334 per ton of salt removed.

[2] Eighty percent were assumed to be local labor.

[3] Project costs are shown in table IV-4.

Table IV-6.—Salt reduction benefits

	Present level	No Action Alternative	Canal Lining	Cumulative total
Tons of salt removed (annually)	0	0	27,700	27,700
Annual direct benefits to users[1] ($1,000)	0	0	9,252	9,252

[1] Based on January 1993 value of $334 per ton of salt removed annually.

surplus area, the employment and income influx is not viewed as a transfer from the rest of the Nation, but rather is considered a NED benefit. Due to the scale of the area's economy, the Project would have no significant effects on income and employment (tables IV-7 and IV-8).

SOCIAL EFFECTS ACCOUNT

None of the viable alternatives would have a significant impact on employment or other major social values of the county. Given the low level of influence on the county's problems and values, no detailed social analysis or SE account was considered necessary. The county accommodates impacts because of its experience with past boom-and-bust cycles, and no potential area of significant impact was identified.

Based on a study conducted by New Mexico State University for San Juan County, New Mexico, to analyze county problems (as perceived by the county residents in connection with the San Juan County Comprehensive Plan), the most pervasive concerns centered on the economy and regional unemployment followed by concern about alcoholism, with the latter receiving about half as much emphasis. These concerns were followed by those about the economic base, oil industry, race track, roads, parks and recreation, and drugs. Although the employment impacts of the various action alternatives have been presented earlier, their effect on the local conditions must be considered within the context of the local area. Within the county, the average number of persons employed in the construction industry was [6]2,117. The highest number of jobs created by any of the alternatives represents less than 3 percent of this number.

Among the alternatives, the canal lining plan uses construction that would create the most local jobs at the lowest expenditure. While this effect is

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[6] New Mexico State Economic Research and Analysis Bureau, Labor Area Unemployment Statistics Section (1988).

Table IV-7.—Regional Economic Development account
(Summary of impacts; three viable alternatives)
(Annual values: January 1993 dollars)

Category	Costs of Canal Lining Alternative (preferred alternative)	Costs of Low-Pressure Pipeline Alternative	Costs of High-Pressure Pipeline Alternative
Income (in $1,000)			
Beneficial	813	555	640
Adverse	0	0	0
Net effects	813	555	640
Employment (annual equivalent jobs)			
Beneficial	73	49	57
Adverse	0	0	0
Net effects	73	49	57
Population:			
Beneficial/ adverse	Project would not cause a long-term change in population; possible minimal change during construction period.		
Economic base and stability:			
Beneficial/ adverse	Project would not affect economic base.		

Table IV-8.—Regional Economic Development account
(Annual monetary impacts in annual equivalent employment)
(Units—work/years)

Category	Canal Lining Alternative		Low-Pressure Pipeline Alternative		High-Pressure Pipeline Alternative	
	Region	Rest of Nation[1]	Region	Rest of Nation	Region	Rest of Nation
Employment						
Beneficial effects						
Project construction	15	0	20	0	24	0
Unemployed and underemployed labor	55	0	26	0	30	0
Project operation, maintenance, replacement, and energy						
Permanent full-time	2	0	2	0	2	0
Permanent part-time	1	0	1	0	1	0
Part-time	0	0	0	0	0	0
Project output						
Indirect and induced	0	0	0	0	0	0
Adverse effects						
Displaced resources	0	0	0	0	0	0
Indirect and induced losses	0	0	0	0	0	0
Net employment gains or losses as a result of Project	[2]70	0	46	0	54	0
Duration of employment						
Long-term	3	0	3	0	3	0
Short-term	73	0	49	0	57	0
Population effects:						
Beneficial						
Population dispersal (not affected by canal lining)						
Urban/rural balance (not affected by canal lining)						
Adverse						
Concentration (Project will not affect population concentration)						
Population increase contrary to specified goals (Project will not increase long-term population)						
Economic base and stability:						
Beneficial						
Strengthening economic base through developing new basic industry sector (not affected by canal lining)						
Stabilizing seasonal employment fluctuations (not affected by canal lining)						
Adverse						
Concentration of economic base (not affected by canal lining)						
Aggravation of existing employment stability problem (not affected by canal lining)						

[1] Because the area has been designated a labor surplus area, use of unemployed and underemployed labor during construction is not viewed as taking away labor from the rest of the Nation.

[2] Three OMR&E employees are currently required for the existing Project; thus, no additional jobs are created by the salinity control project.

quite small, it is relatively better from a social perspective than the other two alternatives. The difference between the two pipeline alternatives was not significant enough to measure on the social indicators.

Since no changes in cropping patterns, markets, or water service are anticipated with this plan, no postconstruction phase impacts or effects are anticipated. No measurable impacts or effects will occur on the Navajo Reservation or to the NIIP resulting from any of the viable alternatives; therefore, no Native American subaccount is required.

ENVIRONMENTAL QUALITY ACCOUNT

The environmental consequences that would result from implementation of the No Action Alternative or the reasonable alternatives considered in detail are discussed in the environmental assessment (EA), which was prepared to comply with the procedural requirements of the National Environmental Policy Act. A summary of impacts is found in the EA and in table IV-9.

A team of resource specialists was assembled to prepare the EA, and a public involvement program was implemented. The District, Federal, and State agencies were involved in the analysis of impacts and development of mitigation measures. A complete discussion of consultation and coordination is included in the EA and in chapter V.

SELECTION OF THE PREFERRED ALTERNATIVE

Of the three viable alternatives, the Canal Lining Alternative is recommended by the study team as the preferred alternative for the following reasons:

- The program would satisfy the national goal of reducing salinity impacts within the Colorado River Basin.
- The cost effectiveness of canal lining is $41.65 per ton, making it the most cost effective of the viable construction alternatives.
- Canal lining is the alternative that reduces the most salt loading to the San Juan River (27,700 tons).
- Environmental impacts are least in this alternative.
- The social and regional economic effects of this alternative are minor but beneficial.

Table IV-9.—Environmental Quality account
(Impacts to be offset by mitigation)[1]

Environmental factor	Present quantity/quality	No Action Alternative	Canal Lining Alternative	Pressurized Pipeline Alternative (both high and low)
Ecological				
Mule deer	Small resident herd uses riparian corridor.	No significant change.	Concrete lining of 19.52 miles of canal and 7.21 miles of laterals would increase potential for deer and other wildlife drownings. Rough-textured concrete surface and/or shallow prism would provide adequate footing for large mammal escape. Membrane lining would not require escape devices because of footing provided by the canal walls.	No significant change.
Furbearers and small game	Good population of furbearers associated with wetland and riparian habitats. Fair populations of small game associated primarily with wetlands, riparian, and agricultural habitat types.	More rigorous O&M program would have slight impact on furbearers and small game species.	No significant change.	No significant change.

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[1] A list of environmental commitments is included in the EA, part 5.

Table IV-9.—Environmental Quality account (continued)

Environmental factor	Present quantity/quality	No Action Alternative	Canal Lining Alternative	Pressurized Pipeline Alternative (both high and low)
Wetlands	64 acres of persistent emergent and scrub-shrub supported by canal seepage.	Up to 14 acres of vegetation adversely affected by O&M activities of District.	64 acres of wetland. Reducing canal seepage could reduce persistent wetlands by 10 to 25 percent. Would convert some persistent wetlands to scrub-shrub wetlands with associated changes in wildlife values.	Same as Canal Lining Alternative.
Riparian vegetation	64 acres of phreatophytic (mixed riparian) shrubland.	Long-term loss of up to 14 acres of phreatophytic shrubland and riparian woodlands as result of O&M activities on all canals and laterals.	Same as No Action Alternative. Also, reduced seepage from conveyance system may affect 50 acres of phreatophytic shrubland and riparian woodland that are partially dependent on canal seepage for their water supply. Land may revert to desert shrubland with reduced wildlife values.	Up to 14 acres of phreatophytic shrubland and riparian woodland permanently lost in 30-foot pipeline ROW on old Hammond Canal alignment. Another 50 acres of phreatophytic shrubland may revert to desert shrubland and possibly agricultural land along abandoned canals and laterals.

Table IV-9.—Environmental Quality account (continued)

Environmental factor	Present quantity/quality	No Action Alternative	Canal Lining Alternative	Pressurized Pipeline Alternative (both high and low)
Birds	Excellent diversity; 148 known species with 105 breeding in general area.	Slight impact associated with small loss of cottonwood and Russian olive trees along canals and laterals with more rigorous O&M program. Permanent loss of up to 14 acres of phreatophytic shrubland for 50-foot clearance zone along canals and laterals may also have a slight impact on existing songbird populations.	Same O&M losses as No Action Alternative.	Impacts similar to No Action Alternative.
Raptors	Common along river corridor. Five species of owl, eight species of hawks, falcons (including peregrine), and eagles (including golden) breed in general area. Bald eagle and osprey are seasonal residents.	Slight impacts associated with more rigorous O&M program for canals and laterals. Small reduction could occur in prey base with loss of up to 14 acres of phreatophytic shrubland.	Same as No Action Alternative. Also, converting unquantified amount of phreatophytic shrubland and riparian woodland dependent on canal seepage to desert shrub could have slight impact on raptor populations.	Impacts similar to No Action Alternative.

Table IV-9.—Environmental Quality account (continued)

Environmental factor	Present quantity/quality	No Action Alternative	Canal Lining Alternative	Pressurized Pipeline Alternative (both high and low)
Waterfowl	Twelve species of ducks and the Canada goose use Project area seasonally and for breeding. Winter populations have increased dramatically with increased flow stability with Navajo Dam closure. Nesting in Project area wetlands moderate to low.	No significant change in nesting and brooding areas in riparian and wetlands habitats.	5- to 10-percent loss in persistent emergent wetland habitat.	Same as for the Canal Lining Alternative. Loss of seasonal aquatic habitat associated with open canals.
River fishery	Warm water, poor habitat quality, limited by excessive sedimentation. Fishing use low, and fishing access limited.	No significant change.	Improved water quality, reduced salinity concentration. No significant change to fishery.	Same as Canal Lining Alternative.

Table IV-9.—Environmental Quality account (continued)

Environmental factor	Present quantity/quality	No Action Alternative	Canal Lining Alternative	Pressurized Pipeline Alternative (both high and low)
Endangered species	San Juan milkweed (category 2), Mancos milkvetch (E), Mesa Verde cactus (T), Mancos saltbush (category 2), bald eagle (E), American peregrine falcon (E), black-footed ferret (E), Colorado squawfish (E), and razorback sucker (E).[2]	No significant change.	No effect.	No effect.
Cultural				
National Register sites	No National Register sites in Project area.	No change.	No change.	No change.
Visual				
Visual quality and diversity (number of elements present)	Open water and edge vegetation between cultivated fields (trees, fence rows, and ditch banks).	No change.	No change.	No change.

[2] E (endangered) refers to any species determined under the Endangered Species Act to be in danger of extinction throughout all or a significant portion of its range, while T (threatened) refers to those species likely to become so endangered within the foreseeable future. Category 2 species are under study for T or E status, but insufficient data exist at present to warrant an official listing.

PREFERRED PLAN

PROJECT FACILITIES AND OPERATIONS

The Hammond Project system has 26.95 miles of canal and 10.25 miles of laterals. Approximately 4.5 miles of canal and 2.8 miles of laterals have already been concrete lined to conserve water. The preferred plan would line all remaining sections of the Hammond Project system with either a concrete or membrane lining. Costs are similar for either of the two lining systems, and the final decision on which lining system is to be used would be determined in preconstruction activities.

The Canal Lining Alternative assumes that all existing structures, turnouts, wasteways, and pumping plants would remain. The operation of the system would remain essentially unchanged, but canal diversions would be strictly limited to a maximum of 90 ft^3/s based on the designed capacity of the canal at the diversion.

GEOLOGY AND CONSTRUCTION MATERIALS

All of the proposed canal and lateral lining construction would occur along the present alignment; therefore, additional geologic consideration would be negligible. The construction would consist of reshaping the canal prism, preparing the bedding, and installing lining. The reshaping of the existing prism would be done with common excavation methods. Minor amounts of material may be needed to reshape the prism, but they are assumed to be available near the canal right-of-way. Construction materials needed for bedding and lining would be obtained from local commercial sources in the area. Problems to be considered during design of the canal and laterals include high ground-water tables in some areas; soft, saturated soils; frost-susceptible soils; and soils with a high salt content.

RIGHTS-OF-WAY AND RELOCATION REQUIREMENTS

The canal lining activities would primarily be confined to the existing ROW for the Project waterways. Temporary ROW's may be needed for construction equipment and material staging and construction management facilities. These requirements are not significant and could be absorbed within the property controlled by the District.

PROJECT COSTS

CONSTRUCTION COST

Project cost estimates for alternatives are based on January 1993 prices and are shown in table IV-10. For plan selection, two lining methods were investigated—concrete and membrane. From these quantities and prices, costs per linear foot for concrete and membrane lining were developed for comparison. These are shown in table IV-11.

Table IV-10.—Comparison of cost estimates for alternatives

	No Action	Canal Lining	Low-Pressure Pipeline	High-Pressure Pipeline
Annual cost ($ million)	0	1.15	1.63	1.98
Cost effectiveness ($/ton salt removed)	0	41.65	88.75	107.36
Investment cost ($ million)	0	13.6	14.7	17.1
Annual operation, maintenance, replacement, and energy cost ($)	104,000	110,000	500,000	670,000

Table IV-11.—Costs for new canal lining[1]

	Cost of lining	
Size (ft^3/s)	Concrete ($/foot)	Membrane ($/foot)
90	128	98
55	90	83
45	74	72
35	64	65
25	55	58
15	41	49
10	36	48
5	32	45
3	29	41

[1] January 1993 prices.

The resulting cost for both lining systems is virtually the same. Concrete lining tended to cost less in reaches below a capacity of 35 ft^3/s, and membrane systems cost slightly less for capacities above 45 ft^3/s. For this report, it was considered redundant to continue to analyze two lining alternatives with the costs being so nearly equal; thus, the concrete-lined system and costs were selected for Project cost estimates in this report.

Table IV-12 was developed by applying the costs per linear foot to the 21 specific canal waterways in table IV-13. Cost estimates include 7- to 10-percent increases for related facilities, taking into account the following items. Costs for the related facilities were estimated in proportion to the waterway lining cost. Detailed work done before 1982 on the Lower Gunnison Basin Unit (Stage One, Colorado, CRWQIP) indicated that basic waterway costs should be increased 8 percent to relocate property (such as utilities and bridges), 1 percent for any new right-of-way obtainment, 3 percent for safety-related structures, 20 percent for waterway structures, and 0 to 80 percent for cross-drainage structures.

Overall construction costs are substantially lower when compared to similarly sized canals on some of the previous CRWQIP units studied because of the good condition of existing facilities.

Following plan selection, a more detailed cost estimate was developed for the preferred plan. These costs are summarized in table IV-12. The costs are based on January 1993 prices and also include allowances for miscellaneous structures, mobilization (5 percent), unlisted items (10 percent), mitigation, contingencies (20 percent), and noncontract costs (30 percent).

When specification designs are prepared, a decision will be made about the best lining material. Factors that will be considered in the designs include the demonstrated ability of irrigators to properly operate and maintain the membrane-lined systems on another Reclamation salinity control project (the Grand Valley Unit, Stage Two), a careful examination of existing concrete-lined sections, and an analysis of the underlying soils of the canal prism.

OPERATION, MAINTENANCE, AND REPLACEMENT COSTS

The concrete lining would reduce OM&R costs for canal sections with capacities greater than 50 ft^3/s, since these sections would not need to be replaced during the 50-year life of the Project and the O&M for concrete should be less than what is now required for an earth-lined canal. Reclamation's experience on other projects has been that, for canals smaller than 50 ft^3/s, the O&M would be reduced, but replacement at 25 years would result in a net increase in OM&R for these waterways.

Historical records indicate that the District has been paying about $104,000 annually for OM&R in addition to individual farmers' collective payment of $46,000 annually for pumping costs.

PROJECT CONSTRUCTION SCHEDULE

Project construction is estimated to occur for a 3-year period during the nonirrigation season. Two and one-half years of preconstruction work to develop designs and estimates and to organize contractors would precede

Table IV-12.—Construction cost estimate

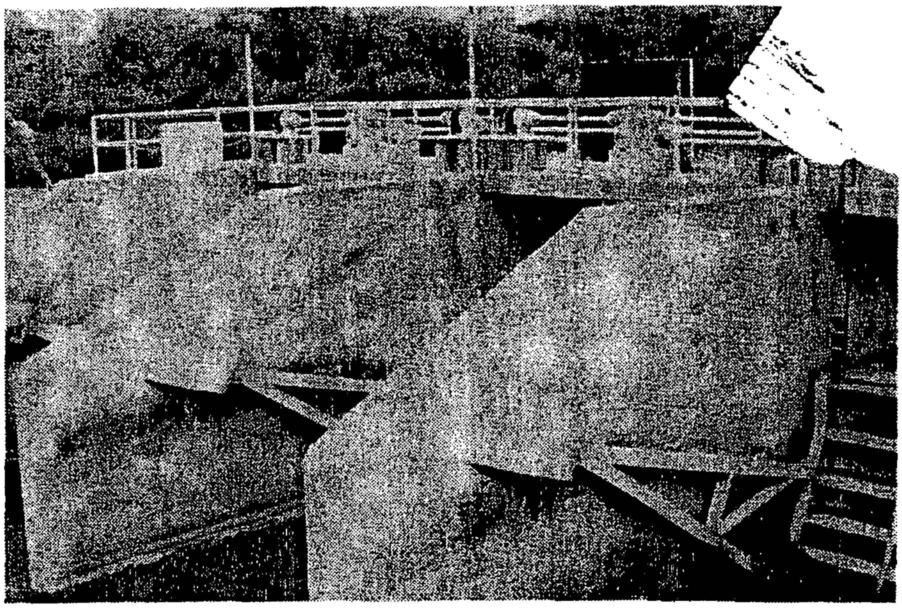
PROJECT	Colorado River Water Quality Improvement Program	BY	Denver Office
		DATE	October 1993
UNIT	San Juan River Unit	TYPE	Appraisal
FEATURE	New concrete canal lining	LEVEL	January 1993

Item	Description	Quantity	Unit	Price ($)	Amount ($)
	Hammond Canal				
	(1) Main Canal				
1	Compacted fill in ditch	254,800	yd^3	7.20	1,834,560
2	Excavation, canal	184,400	yd^3	2.60	479,440
3	Drainfill material	11,820	yd^3	25.75	304,370
4	Prep foundation—concrete lining	197,120	yd^2	1.55	305,540
5	Concrete canal lining	13,316	yd^3	107.10	1,426,140
6	Cement	3,755	tons	100.00	375,500
7	Refill	3,610	yd^3	20.60	74,370
8	Miscellaneous structures	lump sum	ls	lump sum	355,000
9	Fence	39.1	mile	8,080.00	315,930
10	Mobilization	lump sum	ls	lump sum	274,000
11	Allowance for unlisted items	10	pct	lump sum	574,000
	Contract cost				6,318,900
	Contingency	20	pct	lump sum	1,264,000
	Field cost				7,583,000
	Noncontract cost	30	pct	lump sum	2,275,000
	Construction cost (Main Canal)				9,858,000
	(2) Gravity Extension Canal				
1	Compacted fill in ditch	14,800	yd^3	7.20	106,560
2	Excavation, canal	12,400	yd^3	2.60	32,240
3	Drainfill material	840	yd^3	25.75	21,630
4	Prep foundation—concrete lining	24,160	yd^2	1.55	37,450
5	Concrete canal lining	1,500	yd^3	107.10	160,650
6	Cement	424	tons	100.00	42,400
7	Refill	730	yd^3	20.60	15,040
8	Miscellaneous structures	lump sum	ls	lump sum	30,800
9	Fence	7.9	mile	8,080.00	63,830
10	Mobilization	lump sum	ls	lump sum	26,000
11	Allowance for unlisted items	10	pct	lump sum	54,000
	Contract cost				590,600
	Contingency	20	pct	lump sum	118,000
	Field cost				709,000
	Noncontract cost	30	pct	lump sum	213,000
	Construction cost (Gravity Extension)				922,000
	(3) East Highline Lateral				
1	Compacted fill in ditch	8,950	yd^3	7.20	64,440
2	Excavation, canal	7,500	yd^3	2.60	19,500
3	Drainfill material	510	yd^3	25.75	13,130
4	Prep foundation—concrete lining	14,420	yd^2	1.55	22,350
5	Concrete canal lining	890	yd^3	107.10	95,320
6	Cement	252	tons	100.00	25,200
7	Refill	440	yd^3	20.60	9,060
8	Miscellaneous structures	lump sum	ls	lump sum	18,400
9	Fence	4.6	mile	8,080.00	37,170
10	Mobilization	lump sum	ls	lump sum	15,000
11	Allowance for unlisted items	10	pct	lump sum	32,000
	Contract cost				351,600
	Contingency	20	pct	lump sum	70,000
	Field cost				422,000
	Noncontract cost	30	pct	lump sum	127,000
	Construction cost (East Highland)				549,000

Table IV-12.—Construction cost estimate (continued)

Item	Description	Quantity	Unit	Price ($)	Amount ($)
	Hammond Canal (continued)				
	(4) West Highline Lateral				
1	Compacted fill in ditch	3,500	yd^3	7.20	25,200
2	Excavation, canal	3,100	yd^3	2.60	8,060
3	Drainfill material	190	yd^3	25.75	4,890
4	Prep foundation—concrete lining	5,920	yd^2	1.55	9,180
5	Concrete canal lining	370	yd^3	107.10	39,630
6	Cement	105	tons	100.00	10,500
7	Refill	180	yd^3	20.60	3,710
8	Miscellaneous structures	lump sum	ls	lump sum	7,500
9	Fence	2.0	mile	8,080.00	16,160
10	Mobilization	lump sum	ls	lump sum	6,000
11	Allowance for unlisted items	10	pct	lump sum	13,000
	Contract cost				143,800
	Contingency	20	pct	lump sum	29,000
	Field cost				173,000
	Noncontract cost	30	pct	lump sum	52,000
	Construction cost (West Highland)				225,000
	Construction cost, Hammond Canal				11,554,000
	(5) Project mitigation				143,000
	Total estimate, Hammond Canal (January 1993 prices)				11,697,000

* Cubic yards.
** Square yards.
*** Lump sum.
**** Percent.



Gate structures on diversion dam.

Table IV-13.—Concrete Canal Lining Alternative for San Juan River Unit (preferred alternative; CRWQIP)

Waterway	Tons of salt removed	Canal length (feet)	Canal size (ft^3/s)	Component reaches[1]
		Main Canal		
1	280	8,012	90	1,2,3
2	0	1,600	90	4
3	1,374	6,350	90	5,6
4	0	5,005	90	7
5	866	6,430	90	8,9
6	4,548	18,445	55	10,11,12,13,14
7	1,917	8,966	45	17
8	498	2,662	45	18
9	957	9,695	35	20,22,24
10	999	11,792	25	25,27
11	971	3,789	15	28
12	1,808	12,510	15	30,31,33,34,35
13	621	6,460	10	36
14	82	1,333	5	37
Total	14,921	103,049		
		Gravity Extension Lateral		
15	392	1,557	10	38
16	4,994	15,268	10	40,41,42,43,44,45
17	642	3,971	3	46
Total	6,028	20,796		
		East Highline Lateral		
18	5,207	10,970	10	47,48,49
19	383	1,251	3	50
Total	5,590	12,221		
		West Highline Lateral		
20	709	2,588	10	52
21	452	2,555	5	53
Total	1,161	5,143		

[1] Reaches 4, 7, and 9 do not remove salt; however, for efficiency in lining the system, these reaches were added to the preferred alternative. Reaches are shown in figure I-1.

the construction effort. The system would be operable during the affected irrigation seasons, and project benefits would accrue after the first year of construction for that portion completed. The project schedule is shown on table IV-14.

FINANCIAL AND ECONOMIC ANALYSIS

COST EFFECTIVENESS

Cost effectiveness, as noted earlier, is the primary criterion for development and selection of salinity control projects and is defined as the cost to the Federal Government required to achieve a 1-ton reduction per year in salt loading from the project area. The total annual salinity costs include the annual value of the capital investment amortized over the 50-year life of the unit at an interest rate of 8-1/4 percent, in addition to the annual OM&R costs.

Table IV-15 shows the cost-effectiveness summary for the Hammond portion of the San Juan River Unit.

ECONOMIC ANALYSIS

Since salinity control is the primary purpose of the San Juan River Unit, Hammond Project Portion, Reclamation off-farm salinity reduction plans are formulated to maximize salinity control based on cost effectiveness and minimize environmental and social impacts.

COSTS AND BENEFITS

The Project would consist of salinity reduction resulting from the irrigation systems improvements. As shown in table IV-15, the total annual investment (including construction cost and interest during construction) would be about $1.15 million for the Canal Lining Alternative.

The $6,000 increase in OM&R costs for irrigation improvements is based on the estimate of the preproject OM&R. For each ton of salt reduction, the annual cost would be $41.65 per ton to reduce salt loading by 27,700 tons annually.

FINANCIAL REPAYMENT

The Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320) provides for cost sharing on Reclamation salinity reduction projects. The Salinity Control Act further specifies that no more than 15 percent of the reimbursable cost be allocated to the Upper Basin.

Table IV-14.—Cost schedule—preferred alternative

Program item	Quantity (miles)	Estimated total cost ($)	1st year	2nd year	3rd year	4th year	5th year	6th year
				Design ($)			Construction ($)	
Hammond Canal								
Main Canal	19.52	9,858,000	119,000	643,000	125,000	3,050,000	3,479,000	2,442,000
Gravity Extension	3.94	922,000	80,000			842,000		
East Highline	2.30	549,000		50,000			499,000	
West Highline	0.97	225,000			22,000			203,000
Mitigation		143,000	2,000	5,000	80,000	20,000	10,000	26,000
Total	26.73	11,697,000	201,000	698,000	227,000	3,912,000	3,988,000	2,671,000
IDC[1]		1,951,000	110,000	299,000	73,000	857,000	504,000	108,000
Total cost		13,648,000	311,000	997,000	300,000	4,769,000	4,492,000	2,779,000

[1] Interest during construction.

Table IV-15.—Cost-effectiveness summary for viable action alternatives (San Juan River Unit)

Action alternatives	Annual cost ($)	Tons removed	Dollars per ton
Canal Lining	1,153,730	27,700	41.65
Low-Pressure Pipeline (10-foot head)	1,632,980	18,400	88.75
High-Pressure Pipeline (100-foot head)	1,975,510	18,400	107.36

The actual amount allocated to each basin from the basin funds will be made after consultation with the advisory council created in section 207(2) of the Colorado River Basin Salinity Control Act.

Public Law 98-569 (October 30, 1984) amended Public Law 93-320 by providing that 30 percent of the costs of construction and OM&R of newly authorized units therein (including measures to replace wildlife values foregone) would be reimbursed from the basin funds as follows:

> *The Upper Colorado River Basin Development Fund's portion of construction and replacement would be repaid with interest within 50 years or less if the life of the facilities is shorter than 50 years.*
>
> *The Lower Colorado River Basin Development Fund's portion of construction and replacement would be repaid with or without interest during the year the costs are incurred, or, if the fund is unable to repay during the year the costs are incurred, with interest as soon as monies are available.*[7]

Table IV-16 displays the annual reimbursable amount to be paid by each entity and the total annual nonreimbursable costs (repayment period, 50 years).

Amounts are based on the FY93 repayment rate for the Colorado River Basin Salinity Control Act of 7-3/8-percent interest and a 50-year repayment period. For the off-farm irrigation improvement plan, Upper Colorado River Basin Funds would reimburse $46,000 annually. Annual reimbursement from the Lower Colorado River Basin Funds would be $262,000 including interest.

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[7] Reclamation Planning Instruction No. 85-08 (April 24, 1985).

Table IV-16.—Reimbursable and nonreimbursable costs for preferred alternative (January 1993 dollar values) (Units—$1,000)

Item	Canal Lining
Construction cost	11,697
Interest during 5-1/2-year design and construction period[1]	1,732
Total investment	13,429
Annual construction cost	888
Annual interest during construction	131
Annual OM&R	6
Total average annual investment	1,025
Reimbursable costs from Upper and Lower Basin Funds[2]	308
Upper Colorado River Basin Funds (15 percent of total annual reimbursable)[3]	46
Lower Colorado River Basin Funds (85 percent of total annual reimbursable)[3]	262
Total annual nonreimbursable costs[4] (Annual investment $717)	717

[1] Fiscal year 1993 repayment rate at 7-3/8-percent interest.

[2] Thirty percent of annual reimbursable cost with interest (Public Law 98-569, October 1984).

[3] According to Public Law 93-320.

[4] Maximum Federal cost shares are not to exceed 70 percent unless higher levels are approved by the Secretary of Agriculture (Public Law 98-569).

ACTIONS AND PERMITS

Implementation of the preferred alternative may require a Clean Water Act—Section 402 National Pollution Discharge Elimination System permit for discharges of pollutants into waters of the United States from construction-related activities, such as concrete mixing. No activities within jurisdictional U.S. Army Corps of Engineers' waters of the United States are anticipated, so a Clean Water Act—Section 404 permit would not be needed. State or county permits for water and air quality protection for construction activities may be required. The contractor would obtain all required permits before construction activities were initiated.

FUTURE CONSIDERATIONS/CONDITIONS PRECEDENT TO CONSTRUCTION

Before construction could begin on lining the Hammond Project Main Canal, a cooperative agreement between the United States and the Bloomfield

Refinery (Refinery) would be necessary to outline involvement and responsibilities in the construction of the canal lining as in the attached letter of intent and in the EA. These agreements would specify the proper removal and disposal of the hydrocarbon-contaminated soils in the Main Canal from the Refinery, delineate the associated cost-sharing obligations, and specify the type of lining material to be used.

In addition, a contract would be required with the District to assure the continued proper O&M of the lined facilities and to insure that they would be operated in a manner so that the planned salinity reduction would be realized.

Continued, formal consultation would be conducted with the Navajo Nation, other area tribes, and the Bureau of Indian Affairs, as described in requirements of Reclamation's Indian Trust Assets policy.

Table IV-17.—Summary comparison—viable alternatives

Alternatives	Significant features	Economic/social or environmental effects (impacts to be offset by mitigation)	Achievements/ other issues
Canal Lining	Unlined portion (19.52 miles) of the Main Canal and laterals (7.21 miles) to be lined with concrete, clay, or other.	Some reduction or conversion of persistent emergent wetlands and habitat. Rough-textured concrete surface and/or shallow prism would provide adequate footing for large mammal escape. Slight visual effects. Possible short-term, minor population change during construction.	Greatest beneficial income effects of the three viable action alternatives. Improved water quality, reduced salinity—27,700 tons annually at $41.65 per ton.
Low-Pressure Pipeline	Upper section of Main Canal to be replaced with 5.7 miles of new pipeline; existing laterals to be abandoned; a 2,430-kW pumping plant would deliver water with 10 feet of head at the terminus through existing siphons to new pressurized pipe laterals (4.6 miles) in new rights-of-way.	Some reduction or conversion of persistent emergent irrigation-produced wetland and associated habitat. Slight visual effects. Possible short-term, minor population change during construction.	Salinity reduction of 18,400 tons at $88.75 per ton. Siphons untested for higher pressures.
High-Pressure Pipeline	Same as in low pressure (above), but water with 100 feet of pressure, rather than 10 feet, would be delivered to the pipe laterals, and the pumping plant capacity would be 3,370 kW.	Effects would be similar to those under the Low-Pressure Alternative. Slight visual effects. Possible short-term, minor population change during construction.	Salinity reduction of 18,400 tons at $107.36 per ton. Siphons untested for higher pressure.
No Action	No action would be taken to rehabilitate the Hammond Project to reduce salt loading to the Colorado River System.	The annual contribution of approximately 32,000 tons of salt to the Colorado River System would continue. A more rigorous O&M program would have some effect on phreatophyte/riparian areas and habitat. Urban expansion would occur at some point.	No additional cost for salt removal, but there would be a tradeoff in additional costs for salinity damage downstream on the Colorado River System.

OVERVIEW: This chapter, in conjunction with relevant parts of the environmental assessment (EA), chapter VI, serves as the Public Involvement Summary Report for this phase of Project development.

CHAPTER V

CONSULTATION AND COORDINATION

PUBLIC INVOLVEMENT ACTIVITIES—SAN JUAN RIVER UNIT

Date	Activity
November 1982	- Initial meeting to prepare the first plan of study.
	- State of New Mexico was informed of preliminary findings of salt contributions on San Juan River.
	- Letters were sent to the following, informing them of the study and asking them to participate: Arizona Department of Transportation Arizona Public Service Company Bureau of Land Management, Farmington, New Mexico Environmental Protection Agency (EPA), Denver, Colorado Navajo Water Commission New Mexico Environment Improvement Division, Santa Fe, New Mexico San Juan County, Farmington, New Mexico U.S. Army Corps of Engineers U.S. Fish and Wildlife Service (Service) Utah Department of Health
Spring 1983	- First draft plan of study completed.

Date	Activity
August 1983	Project funding was dropped from 1985 and future years' budget.
February 1985	Initial meeting with U.S. Geological Survey (USGS) on coordinating work with them.
March 26, 1985	Draft plan of study was sent to study participants for review.
April 1985	Planning conference was held on the plan of study.
May 1985	The Southern Ute Indian Tribe, the Ute Mountain Ute Tribe, the Jicarilla Apache Indian Tribe, and the Navajo Nation were contacted in the study process.
October 1985	The study was reinitiated.
December 16, 1985	Newspaper articles were placed in the *Cortez Centennial,* the *Moab Times-Independent,* and the *Farmington Times,* which informed the public of the study and asked them to participate in the study if they so desired.
April 1986	Newsletter was distributed to study participants.
	Contact with State of Utah on coordinating Project work.
	Contact with New Mexico Game and Fish Department informing them about the Project and gaining their input.
September 1986	Social input to the Preliminary Findings Memorandum was completed.
September 26, 1986	Preliminary Findings Memorandum was distributed.
November 1986	USGS water quality work.
December 1986	Work continued on social setting analysis.

Date	Activity
January 1987	Team member met with Bureau of Indian Affairs representatives in Shiprock, New Mexico, to discuss the Project and access required.
March 1987	Met with Hammond Conservancy District (District) to discuss status of the project.
April 1987	Discussion with key individuals on social and economic analysis in Shiprock, New Mexico.
	Salinity Forum Work Group toured the Project area.
August 1987	Meeting with New Mexico State Engineer Office, Santa Fe, New Mexico, informing them of the Project and getting their direction.
January 1988	Meeting with New Mexico Department of National Resources (Oil, Gas, and Mining Division) and San Juan County, New Mexico.
November 1988	Soil Conservation Service (SCS) and State of New Mexico were contacted and expressed support for onfarm salinity work.
November 3, 1988	District was informed of Project status.
November 23, 1988	Coordination meeting was held with SCS to discuss possibility of onfarm salinity program.
December 7, 1988	Service coordination letter initiating the Bureau of Reclamation's (Reclamation) need for their review and analysis of alternatives.
August 1989	Contact with SCS to discuss Project coordination (off-farm and onfarm salinity programs).
December 1989	Reclamation/SCS coordination meeting.
February 15, 1990	Meeting with SCS regarding wetland delineation of the Project area.

Date	Activity
May 1, 1990	Field trip of the Project area with Service representative to initiate wetland coordination.
June 26-28, 1990	Wetland coordination meeting. Field trip with representative of EPA and Service.
September 11, 1990	Meeting with EPA and Service representative to determine mitigation/enhancement needs for wetlands impacted by lining of the Hammond Canal and laterals.
September 21, 1990	Meeting with the District to update them on the salinity control lining alternative in conjunction with their annual operation, maintenance, and replacement review.
September 28, 1990	Planning Aid Memorandum, Service.
May 9, 1991	Field trip of Project area with Service representative to survey cottonwood trees that could be impacted by lining alternative.
June 12, 1991	First interdisciplinary team meeting with representatives requested to participate from the: District, Service, SCS, Bloomfield Refinery, and New Mexico Department of Game and Fish. This meeting initiated work on the EA.
July 17 and 31, 1991	Interdisciplinary team meetings.
April 15, 1992	Meeting with representatives of EPA and Bloomfield Refinery concerning petrochemical contamination and cleanup along Hammond Ditch.
November 5, 1992	Meeting with the District to update them on studies of the salinity control lining alternative.
April 30, 1993	Meeting with EPA and Service to discuss outstanding mitigation issues.
April 1994	As part of continuing coordination, formal Indian Trust Assets consultation began with the Navajo Nation.

Date		Activity
May 2, 1994	-	Discussion with San Juan County Assessor's Office on land retirement issues.
May 1994	-	Consultation continued with Service on the biological assessment.

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Name	Position	Education	Experience	Input to report
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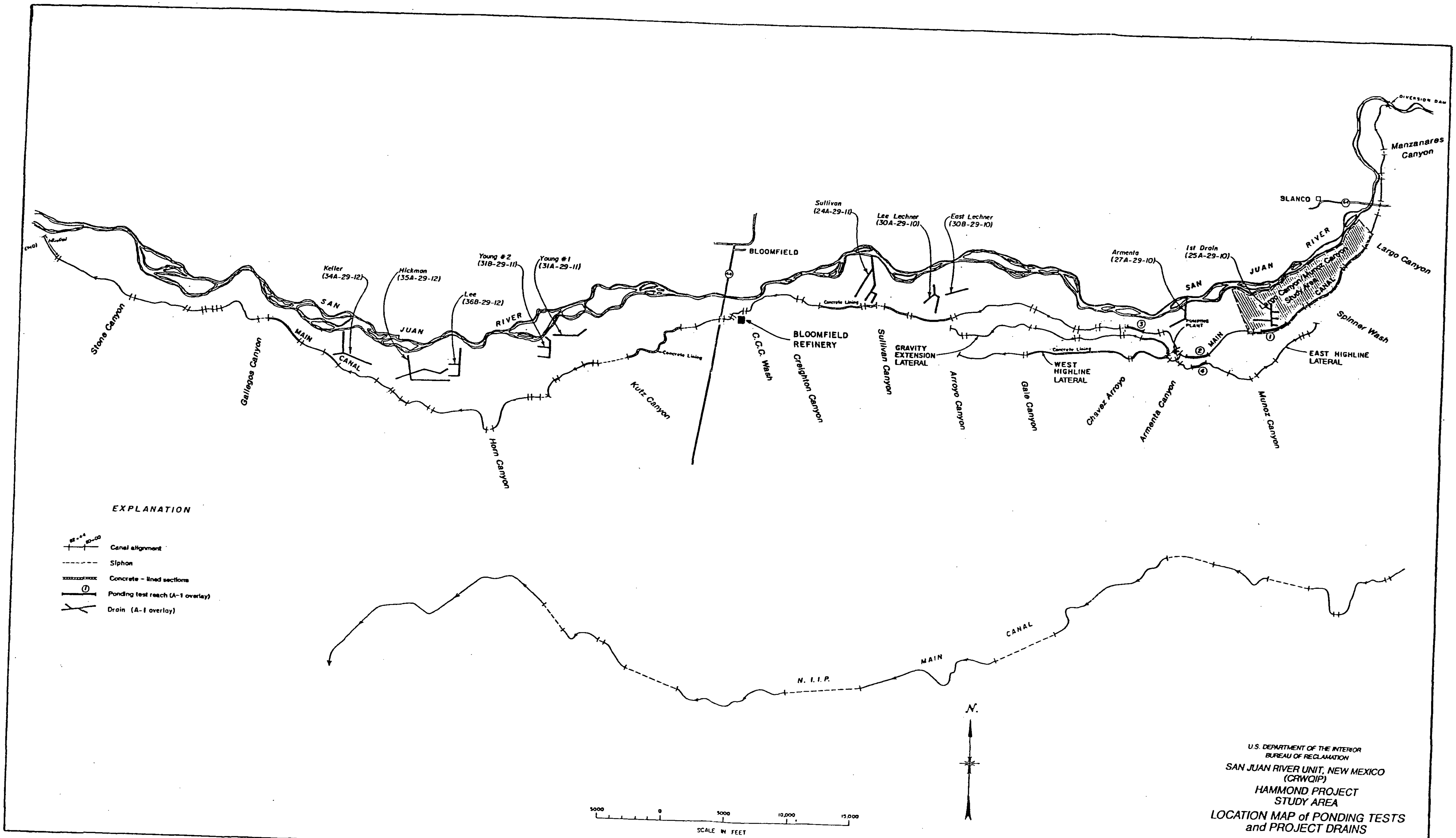
Craig Albertsen	Hydraulic Engineer	B.S., Civil Engineering	17 years	Surface water
Will Allington	Civil Engineer	B.S., Engineering	32 years	Engineering
Ken Beck	Team Leader	M.S., Agricultural Economics	11 years	Team leader
Carol Berry	Writer/Editor	M.A., English/Linguistics M.S., Economics	18 years	Writing, editing, coordinating, printing
Linda Branch	Writer/Editor	B.A., Technical Journalism	15 years	Writing, editing, coordinating, printing (preliminary draft)
Thayne Coulter	Sociologist	B.A., Sociology	22 years	Social/public involvement
Mack Foster	Economist	M.S., Economics	14 years	Economics
Robert George	Hydraulic Engineer	B.S., Ph.D., Hydraulic Environmental Engineering	30 years	Water quality review
Steve Hansen	Civil Engineer	B.S., Agricultural Engineering	12 years	Surface water and groundwater hydrology/ water quality
Gorgie Hofma	Resource Economist	B.A. and M.A., Finance and Resource Economics	11 years	Economics
Patrick Koelsch	Fishery Biologist	M.S., Environmental Science	15 years	Environment
Bob McCaig	Civil Engineer	B.S., Civil Engineering	16 years	Engineering and planning coordination
John P. Ozga	Hydraulic Engineer	M.S., Civil Engineering/ Hydrology	17 years	Water quality

Name	Position	Education	Experience	Input to report
David Redhorse	Social Science Analyst	B.A., Anthropology	20 years	Indian trust assets
Jerry Robins	Ground-Water Geologist	B.S., Geology	18 years	Ground water
Wayne Willis	Hydraulic Engineer	B.S., M.S., Civil/Irrigation Engineering	25 years	Ground-water and hydrology review
Doug Yoder	Ecologist	B.S., Wildlife Management	20 years	Environment



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SAN JUAN RIVER UNIT, NEW MEXICO
(CRWQIP)

HAMMOND PROJECT
STUDY AREA

LOCATION MAP of PONDING TESTS
and PROJECT DRAINS

Denver, Colorado
August 1989

Figure II-1

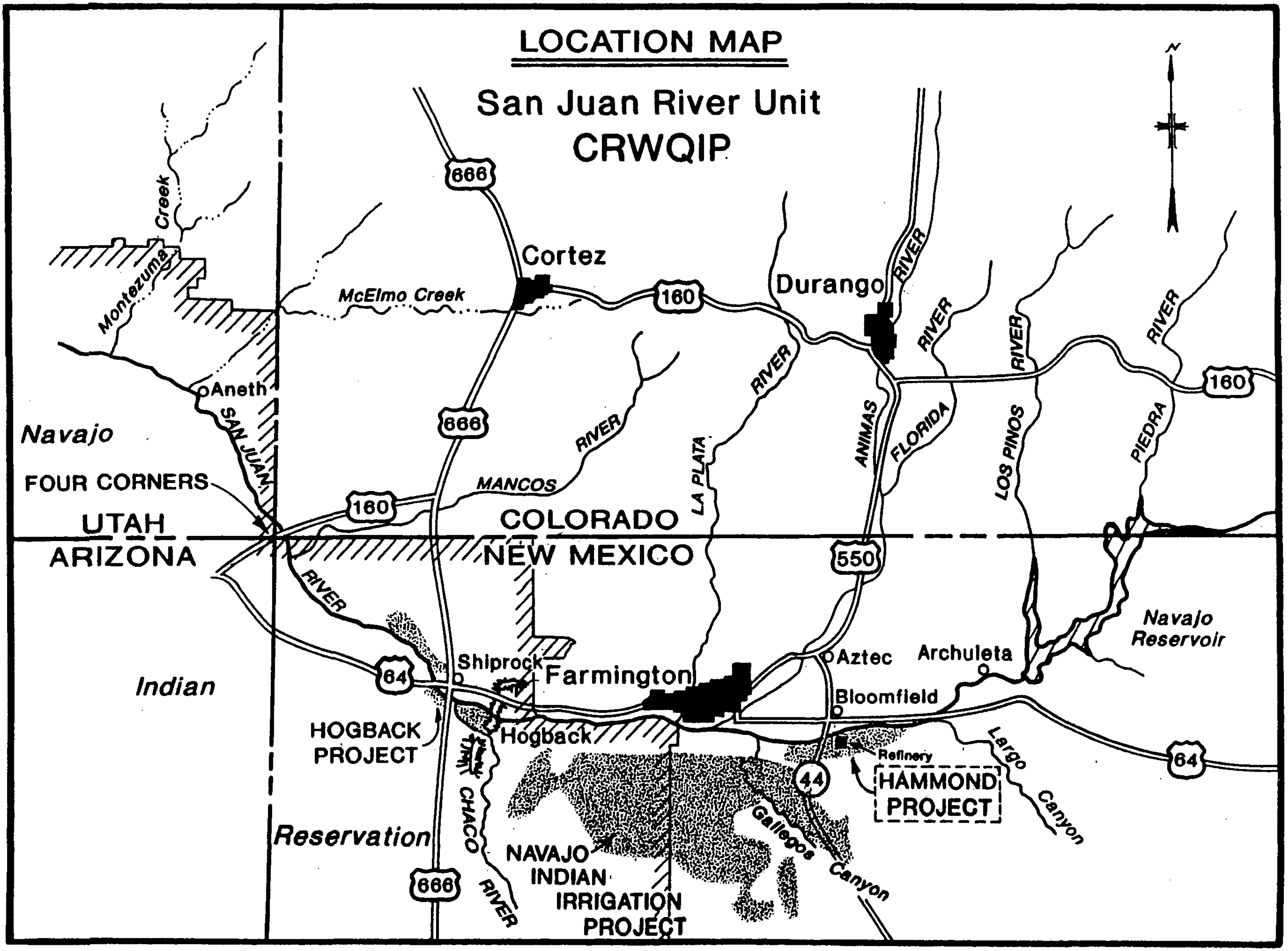
Final Planning Report / Environmental Assessment / Finding of No Significant Impact
San Juan River Unit, Hammond Project Portion
Colorado River Water Quality Improvement Program, San Juan County, New Mexico

Prepared by the: United States Department of the Interior,
Bureau of Reclamation, Upper Colorado Region

This document describes and evaluates alternative plans and potential impacts of those plans to reduce the increase of salt contributed to the Colorado River System from the existing Hammond Project, an existing irrigation project located in San Juan County, New Mexico. This planning report/environmental assessment (PR/EA) recommends a feasible and cost-effective plan for implementation and assesses area needs, resources, constraints, potential alternative solutions, and environmental consequences.

This PR/EA/Finding of No Significant Impact meets planning report requirements and complies with the procedural requirements of the National Environmental Policy Act and fulfills the requirements of Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands).

For further information, please contact the Regional Environmental Office, Upper Colorado Region, Bureau of Reclamation, PO Box 11568, Salt Lake City UT 84147, (801) 524-5580.



LOCATION MAP

San Juan River Unit
CRWQIP

SUMMARY

The San Juan River Unit, Hammond Project Portion (Project), a part of the Colorado River Water Quality Improvement Program (CRWQIP), is a Bureau of Reclamation (Reclamation) plan intended to reduce salt loading to the Colorado River System from the existing Hammond Project, an irrigation project located in San Juan County, New Mexico. The Hammond Project extends in a 20-mile strip along the southern bank of the San Juan River south of Bloomfield, New Mexico, while the San Juan River Unit encompasses the larger San Juan River Basin of the Four Corners area.[1]

This planning report/environmental assessment summarizes the potential alternatives for controlling salinity sources from the Hammond Project and recommends a feasible and cost-effective plan for implementation.[2] The report also complies with the procedural requirements of the National Environmental Policy Act (NEPA). The document includes an assessment of area needs, resources, constraints, and potential alternative solutions. The environmental assessment (EA) portion of the document incorporates an overview of environmental issues.

Reclamation is studying alternatives to reduce salinity in the San Juan River drainage, which annually contributes approximately 1 million tons of salt to the Colorado River. Problems associated with the Hammond Project include irrigation-related salt pickup and excessive operational costs from pumping excessive amounts of water to offset losses of irrigation water due to seepage. The existing Hammond Project annually contributes 31,650 tons of salt to the Colorado River System.

Salinity control studies on the San Juan River Unit, CRWQIP, were authorized as part of the Colorado River Basin Salinity Control Act (Salinity Control Act) of June 24, 1974 (Public Law [P.L.] 93-320, as amended by P.L. 98-569 on October 30, 1984), and the Federal Water Pollution Control Act Amendments of October 1972 (P.L. 92-500), as amended by the Clean Water Act of 1977 (P.L. 95-217). Title II of the Salinity Control Act was directed toward salinity control of the Colorado River in the United States upstream from Imperial Dam. The Salinity Control Act originally authorized the current Project for study as part of a basinwide program to enhance and protect the quality of water in the Colorado River for use in the United States.

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[1] The Four Corners area describes the junction of the States of Colorado, New Mexico, Arizona, and Utah, as shown on the location map.

[2] Cost effectiveness is measured as the total annualized cost per ton of salt removed for each action alternative.

EXISTING HAMMOND PROJECT

The Hammond Project provides a full-service irrigation supply to 3,933 acres of land by diverting water from the San Juan River. However, natural flows are supplemented by storage releases from Navajo Reservoir, when necessary.

Hammond Project water is diverted from the San Juan River by the Hammond Diversion Dam located about 2 miles upstream from Blanco, New Mexico, and 13 miles downstream from Navajo Reservoir. The diverted water is conveyed to Hammond Project lands by the 27-mile-long Main Canal westward along the south side of the San Juan River valley. The capacity of the canal varies from 90 cubic feet per second (ft^3/s) at the headworks to 5 ft^3/s at the terminus. The capacity of the laterals varies from 12 ft^3/s to 3 ft^3/s. Table S-1 shows the miles of the Hammond Project canal system that are presently lined, unlined, or in siphons.

Table S-1.—Hammond Project
(Present characteristics of canal system)

Main Canal	Miles	East Highline Lateral	Miles
Unlined	9.66	Unlined	1.48
Earth-lined	9.86	Earth-lined	0.82
Concrete-lined	4.50		
Siphons	2.93		
Total miles	26.95	Total miles	2.30
Gravity Extension Lateral	**Miles**	**West Highline Lateral**	**Miles**
Unlined	3.68	Unlined	0.97
Earth-lined	0.26		
Concrete-lined	0.62	Concrete-lined	2.21
Siphons	0.15	Siphons	0.06
Total miles	4.71	Total miles	3.24

NEED FOR ACTION

The Colorado River has a salinity concentration of about 50 milligrams per liter (mg/L) at its headwaters in the mountains of north-central Colorado. The concentration progressively increases downstream as a result of water diversions and salt contributions from a variety of sources. Annual salinity concentrations at Imperial Dam (near Yuma, Arizona) are estimated to increase from the 1987 measured average level of 850 mg/L to an average of 970 mg/L by 2010 unless additional control measures are implemented to prevent the salinity increase.

More than 18 million people use the Colorado River for their water supply. Increases in salinity threaten that use and cause $311 million per year in damages, primarily to culinary water systems and agriculture. The objective of the CRWQIP is to find cost-effective ways to control salinity and limit those damages.

To limit the salinity of the Colorado River, and in response to the Federal Water Pollution Control Act and its amendments, the seven Colorado River Basin States adopted, and the Environmental Protection Agency approved, salinity standards for the lower Colorado River.

Table S-2.—Numeric criteria for the lower Colorado River

	Annual flow-weighted concentration (mg/L)
Below Hoover Dam	723
Below Parker Dam	747
At Imperial Dam	879

Decreased water quality in the Colorado River Basin due to the presence of salt results from two general causes—salt loading and salt concentration. Specifically, salt loading is the addition of salt to the river from such sources as salt dissolving from saline geologic formations, irrigation return flows, and saline springs and seeps. Salt concentration results from reducing the volume of water through consumptive use[3] without reducing the total salt carried.

Both salt loading and salt concentration occur on the Hammond Project, which was originally designed as an earth-lined system. After the Hammond Project was completed in the early 1960's, several sections of the system were concrete lined to reduce canal water loss (seepage) and for operation and maintenance (O&M) reasons. Sections that have not been lined show significant deterioration of the canal prism. Following the original construction of earth-lined sections, the lining was unintentionally

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[3] Consumptive use is the amount of water used by plants in transpiration (the process by which plants give off water vapor through their leaves), retained in plant tissue, and the evaporation of water from adjacent plant and soil surfaces during a specified time period.

removed during O&M activities. Conveyance and operation losses currently average approximately 50 percent of the diversions into the Hammond distribution system, and canal seepage is a substantial part of this loss. Salt pickup results from canal seepage water and excess irrigation deep percolation flowing through the underlying shales high in salt content and returning to the river.

Salt concentration occurs on the Hammond Project because of consumptive use by the irrigated crops and by evapotranspiration in wetlands created by operational waste and conveyance losses.

Results of preliminary river salt budgets indicate a total salt pickup to the San Juan River of 98,000 tons unaccounted for per year between the U.S. Geological Survey gauges at Archuleta and Farmington, New Mexico, shown on the frontispiece location map. Hydrosalinity studies on the Project show an estimated canal and lateral loss of 5,600 acre-feet per year, with an associated salt load of 31,650 tons per year. Other sources include: Largo Canyon, 17,000 tons per year; Gallegos Canyon, 4,000 tons per year; and unaccounted-for contributors.

OBJECTIVES AND INSTITUTIONAL CONSTRAINTS

The primary objectives for this Project include the determination of:

- Sources of salt entering the San Juan River via the Hammond Project.
- The most cost-effective salinity control alternative to recommend for construction.
- The appropriate environmental mitigation measures to implement with the recommended salinity control alternative (preferred plan).

Some of the potential legal and institutional constraints affecting the study include: State of New Mexico water rights administration; the possible use of Navajo tribal lands and facilities for salinity control purposes; the effects of alternatives on wetlands, cultural resources, and endangered species, as detailed in chapter VI; the potential use of water for mitigation of Project effects; and resolution of issues concerning petroleum refinery contaminants in the Project area.

ALTERNATIVES

During the San Juan study, the following alternatives were considered:

- Lining the Hammond Project canals with such impermeable materials as earth, concrete, or polyvinyl chloride membrane.

- Three pipeline options: (1) replacing the existing Hammond Project irrigation system with a gravity-pressurized pipeline, (2) replacing the existing system with a pipeline pressurized by electrical-powered pumping, and (3) replacing the system with a pipeline pressurized by gravity and fed by diverting Hammond Project water out of the Navajo Indian Irrigation Project Canal. Low- and high-pressure variations were identified within each of the pressurized pipe alternatives.

- No action (the projected future condition without a project to reduce salinity). This alternative is required by NEPA.

- Retirement of lands in the irrigated area.

Alternatives were determined to be nonviable that exceeded cost-effectiveness criteria, that were not acceptable to water users or State government, or that posed insurmountable operational problems. In some cases, while an overall alternative might have been considered nonviable, an individual reach within that alternative was identified as viable, and therefore, eligible for further consideration. Upper and lower canal sections, for example, differed in viability; and the lower section was subsequently eliminated from further consideration.[4]

VIABLE ALTERNATIVES

Four viable alternatives were formulated for further evaluation by Reclamation. The four viable alternatives are: (1) Canal Lining Alternative (either membrane or concrete); (2) the Low-Pressure Pipeline Alternative (pressurized pipe, low pressure, upper section); (3) the High-Pressure Pipeline Alternative (pressurized pipe, high pressure, upper section); and (4) the No Action Alternative. The two piped alternatives were derived from the initial pipeline option which placed the system into a pipeline pressurized by electrical-powered pumping. Table S-3 provides a summary comparison of these alternatives.

NONVIABLE ALTERNATIVES

The following alternatives were originally considered but were found to be nonviable and were eliminated from further study: gravity-pressurized pipeline; land retirement; pressurized pipe, low pressure (both upper and lower sections); pressurized pipe, low pressure, Muñoz Canyon; and pressurized pipe, high pressure, both upper and lower sections.

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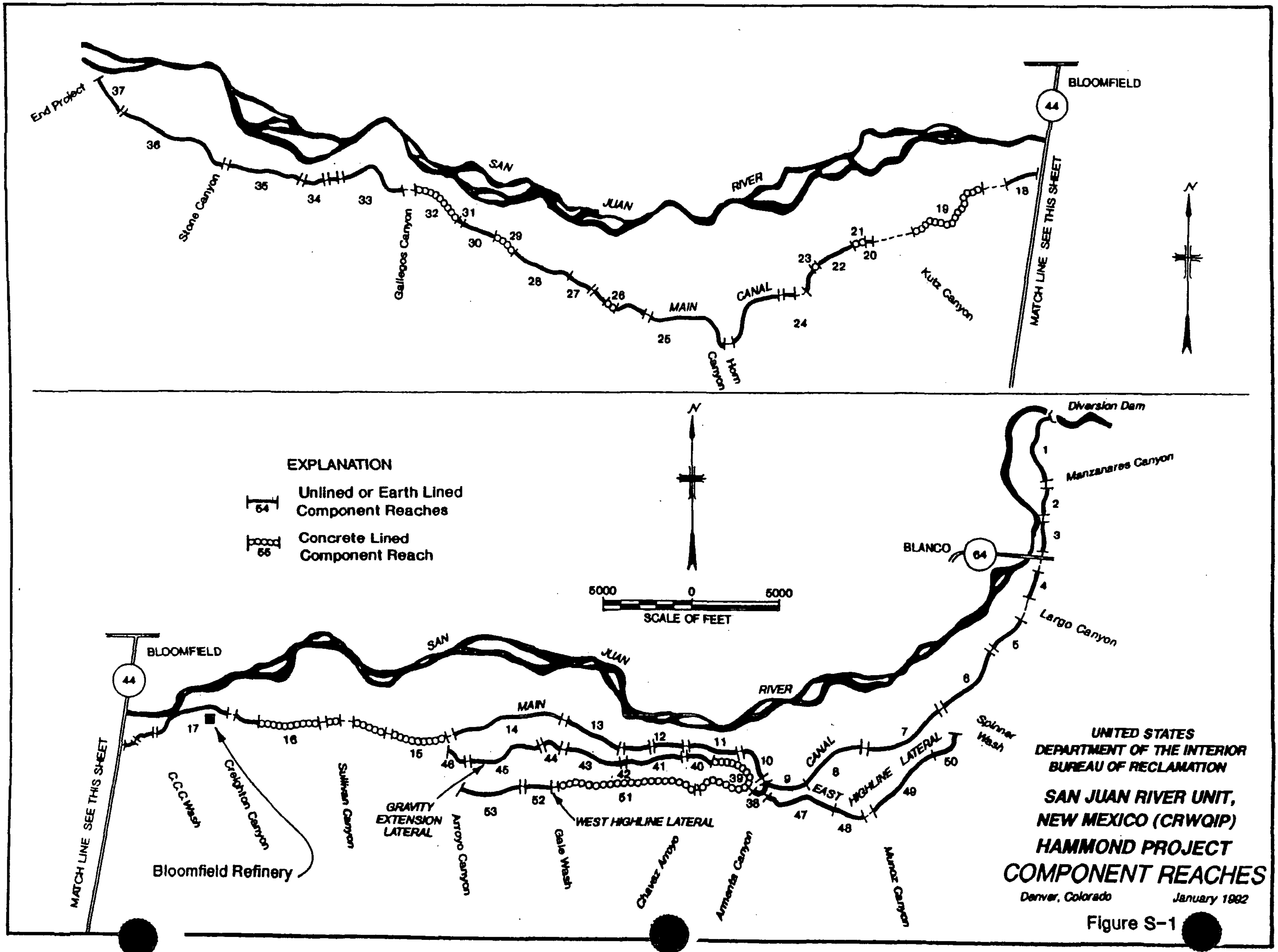
[4] The lower section lies below a point 2 miles east of State Highway 44 to the end of the Project. The upper section begins 4.9 miles down the Main Canal from the diversion structure, as shown in figures S-1 and I-1 and in table IV-1.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SAN JUAN RIVER UNIT,
NEW MEXICO (CRWQIP)
HAMMOND PROJECT
COMPONENT REACHES

Denver, Colorado January 1992

Figure S-1

Table S-3.—Summary comparison—viable alternatives

Alternative	Significant features	Economic/social or environmental effects (impacts to be offset by mitigation)	Achievements/ other issues
Canal Lining	Unlined portion (19.52 miles) of the Main Canal and laterals (7.21 miles) to be lined with concrete, clay, or other material.	Some reduction or conversion of persistent emergent vegetation and habitat. Rough-textured concrete surface and/or shallow prism would provide adequate footing for large mammal escape. Slight visual effects. Possible short-term, minor population change during construction.	Greatest beneficial income effects of the three viable action alternatives. Improved water quality, reduced salinity—27,700 tons annually at $41.65 per ton.
Low-Pressure Pipeline	Upper section of Main Canal to be replaced with 5.7 miles of new pipeline; existing laterals to be abandoned; a 2,430-kilowatt (kW) pumping plant would deliver water with 10 feet of head at the terminus through existing siphons to new pressurized pipe laterals (4.6 miles) in new rights-of-way.	Some reduction or conversion of persistent emergent vegetation and associated habitat. Slight visual effects. Possible short-term, minor population change during construction.	Salinity reduction of 18,400 tons at $88.75 per ton. Siphons untested for higher pressures.
High-Pressure Pipeline	As in low pressure (above), but water with 100 feet of head at the terminus would be delivered to the pipe laterals, rather than 10 feet; and the pumping plant capacity would be 3,370 kW.	Effects would be similar to those under the Low-Pressure Pipeline Alternative. Slight visual effects. Possible short-term, minor population change during construction.	Salinity reduction of 18,400 tons at $107.36 per ton. Siphons untested for higher pressure.
No Action	No action would be taken to rehabilitate the Project to reduce salt loading to the Colorado River System.	The annual contribution of approximately 31,650 tons of salt to the Colorado River System would continue. A more rigorous O&M program would have some effect on phreatophyte/riparian areas and habitat. Urban expansion would occur at some point.	No additional cost for salt removal, but there would be a tradeoff in additional costs for salinity damage downstream on the Colorado River System.

SELECTION OF THE PREFERRED ALTERNATIVE

Of the three viable action alternatives, the Canal Lining Alternative was recommended by the study team as the preferred alternative for the following reasons:

- The program would satisfy the national goal of reducing salinity impacts within the Colorado River Basin.
- The cost effectiveness of canal lining is $41.65 per ton, the most cost effective of the viable construction alternatives.
- Canal lining is the alternative that reduces the most salt loading to the San Juan River (27,700 tons).
- Environmental impacts are minimized with this alternative.
- This alternative represents the approach preferred by the local water users.
- The social and regional economic effects of this alternative are minor but beneficial.

PREFERRED PLAN

PROJECT FACILITIES

The Hammond Project system has 26.95 miles of canal and 10.25 miles of laterals. The preferred plan would line all remaining unlined sections of the Project system with either a concrete or membrane lining; the Hammond Conservancy District (District) prefers concrete canal lining to the membrane lining option. Costs are similar for either of the two lining systems, and the final decision on which lining system is to be used would be determined in preconstruction (design data collection) activities. Component reaches are shown in figure S-1, and cost data are cited in tables S-4 and S-5.

PROJECT COST AND REPAYMENT

Total costs for new concrete or membrane lining the canals and laterals are essentially the same, totaling approximately $11,697,000 in construction costs or $13,648,000 total cost (January 1993 prices). Total annual operation, maintenance, and replacement (OM&R) costs for the new system are approximately $71,000; however, the District has been paying $104,000 annually of OM&R in addition to individual farmers' collective payment of $46,000 annually for pumping costs.

Table S-4.—Cost effectiveness of alternatives

	No Action	Canal Lining	Low-Pressure Pipeline (10-foot head)	High-Pressure Pipeline (100-foot head)
Capital costs[1]				
Construction cost	$0	$11,697,000	$12,507,000	$14,599,000
Interest during construction	0	1,951,000	2,154,000	2,471,000
Capital investment	$0	$13,648,000	$14,661,000	$17,070,000
Annual investment	$0	$1,147,730	$1,232,980	$1,435,510
Annual operation, maintenance, replacement, and energy (increase)	0	6,000	400,000	540,000
Total annual cost	$0	$1,153,730	$1,632,980	$1,975,510
Tons of salt removed	0	27,700	18,400	18,400
Cost per ton	0	$41.65	$88.75	$107.36

[1] Preauthorization and archeological costs excluded.

PROJECT SCHEDULE

Annual reimbursement of the costs of the preferred alternative over a 50-year repayment period at 7-3/8-percent interest (the fiscal year 1993 repayment rate under the Colorado River Basin Salinity Control Act) would include $46,000 from the Upper Colorado River Basin Fund and $262,000 from the Lower Colorado River Basin Fund, under proportionate payment established by P.L. 98-569. Annual nonreimbursable costs total $717,000.

ENVIRONMENTAL ISSUES/MITIGATION MEASURES

Constraints that limit the Project include physical, statutory, and institutional limitations, and also environmental factors discussed in chapter VI. One potential environmental issue associated with salinity control measures is the potential loss of irrigation-supported wetlands resulting from changes in existing water use practices. Loss of irrigation-produced (or artificially maintained) wetland is an issue because of its value to a variety of wildlife species and because of the nationwide concern about

Table S-5.—Cost schedule—preferred alternative

Program item	Quantity (miles)	Estimated total cost ($)	1st year	2nd year	3rd year	4th year	5th year	6th year
				Design ($)			**Construction ($)**	
Hammond Canal								
Main Canal	19.52	9,858,000	119,000	643,000	125,000	3,050,000	3,479,000	2,442,000
Gravity Extension	3.94	922,000	80,000			842,000		
East Highline	2.30	549,000		50,000			499,000	
West Highline	0.97	225,000			22,000			203,000
Mitigation		143,000	2,000	5,000	80,000	20,000	10,000	26,000
Total	26.73	11,697,000	201,000	698,000	227,000	3,912,000	3,988,000	2,671,000
IDC[1]		1,951,000	110,000	299,000	73,000	857,000	504,000	108,000
Total cost		13,648,000	311,000	997,000	300,000	4,769,000	4,492,000	2,779,000

[1] Interest during construction.

wetlands.[5] Irrigation water often produces wetland and riparian vegetation, and it can contribute to aquatic habitats that would not normally occur in this arid environment. Water conservation measures can reduce deep percolation and the occurrence of wetland/riparian vegetation associated with irrigation water.

The concept of improving irrigation efficiency to reduce the salt load (improved water quality) carried to the Colorado River presents a conflict with the environmental values of protecting the irrigation-produced wetlands, riparian vegetation, and aquatic habitats. The Colorado River Basin Salinity Control Act (P.L. 93-320, as amended) establishes water quality improvement (salt reduction) as the main objective. One purpose of this document is to disclose the environmental effects resulting from improving water quality while reducing the amount of water that produces wetlands and riparian vegetation associated with irrigation and, at the same time, attempting to minimize adverse impacts.

Management practices would be employed during construction activities to minimize environmental effects and would be included in construction specifications. Construction activities would be timed and coordinated with the District to minimize interruptions of Project water deliveries to the maximum extent practicable. All construction-disturbed areas would be regraded and revegetated.

Adverse effects on irrigation-produced wetland and riparian vegetation outside of the canal structure would be mitigated and monitored by Reclamation (in cooperation with the U.S. Fish and Wildlife Service) before, during, and after construction to evaluate canal lining effects on these areas.

Cultural resources surveys would be conducted in all Project areas where no inventory exists or the information requires clarification. Reclamation would monitor the progress of the remedial actions undertaken by the Bloomfield Refinery and assess the effects on the Main Canal, as noted in the EA. The 25 acres of wetland/riparian vegetation that occur near the Bloomfield Refinery may be largely or entirely affected by remediation activities at the refinery. Impacts caused by remediation activities would not be mitigated by Reclamation.

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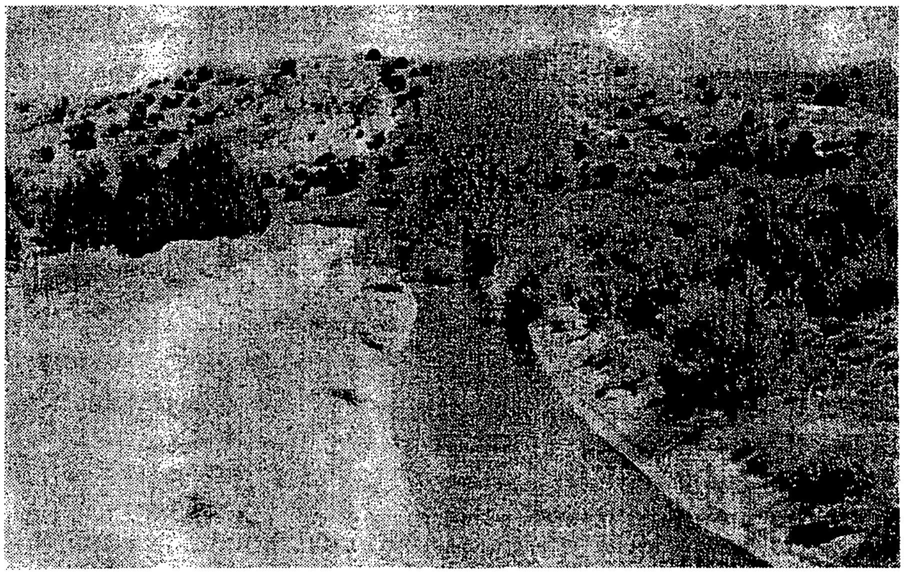
[5] These areas are not defined as the "waters of the United States" (using the procedures in the 1987 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*). However, they do possess minimal functional values of naturally occurring wetland/riparian areas and similar wildlife habitats under provisions of the Fish and Wildlife Coordination Act.

FUTURE CONSIDERATIONS/CONDITIONS PRECEDENT TO CONSTRUCTION

Before construction could begin on lining the Hammond Project Main Canal, a cooperative agreement would need to be finalized between the United States and the Bloomfield Refinery. The agreement, as described in the EA and attachment D, would outline involvement and responsibilities in the construction of the canal lining. It would specify the proper removal and disposal of the hydrocarbon-contaminated soils from the refinery in the Main Canal; it would also delineate the associated cost-sharing obligations and specify the type of lining material to be used. A mitigation plan would be required before construction because of the water rights issue.

In addition, a contract would be required with the District to assure the continued proper O&M of the lined facilities and to insure that they would be operated in a manner so that the planned salinity reduction would be realized.



Existing lined section in foreground, unlined in background.

CONTENTS

CONTENTS (continued)

CONTENTS (continued)

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ATTACHMENTS

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TABLES

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FIGURES

OVERVIEW: This report summarizes planning for alternative methods to reduce salinity in the San Juan River. This chapter describes the study area and the history, purpose, and scope of this hydrosalinity investigation. A discussion of other water resource investigations and studies and their interrelationship with this study is included.

ISSUES: Water quality in the Colorado River System as it relates to salinity contributions from the Hammond Irrigation Project.

CHAPTER I

INTRODUCTION

LOCATION AND GENERAL DESCRIPTION OF SAN JUAN RIVER UNIT

The San Juan River Unit, Hammond Project Portion (Project) is included in a comprehensive water quality study of the Colorado River drainage called the Colorado River Water Quality Improvement Program (CRWQIP). The purpose of the current Project is to reduce salt loading to the Colorado River from the existing Hammond Project, located in San Juan County, New Mexico. As shown on the frontispiece map, the Hammond Project extends along the southern bank of the San Juan River in a 20-mile strip south of Bloomfield, New Mexico, while the San Juan River Unit itself encompasses the larger San Juan River Basin of the Four Corners area.[1]

The San Juan River Basin ranges from about 3700 feet to 14,000 feet elevation and is bounded on the north by the San Juan Mountains in Colorado; on the south by the San Mateo, Zuni, and Chuska Mountains of New Mexico and Arizona; on the west by Lake Powell in Utah and Arizona; and on the east by the Continental Divide.

The San Juan River, a tributary of the Colorado River, originates in the San Juan Mountains in Colorado and drains an area about 43,000 square miles upstream from Bluff, Utah. The drainage also includes the Navajo, Piedras, Los Pinos, Animas, La Plata, Largo Canyon, Chaco, and Mancos Rivers and McElmo and Montezuma Creeks.

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[1] The Four Corners area is the surrounding area of the junction of the States of Colorado, New Mexico, Arizona, and Utah, as shown on the frontispiece location map.

Most of the San Juan River drainage basin in New Mexico, Arizona, and Utah is composed of sparsely vegetated sedimentary rock cut by many canyons and arroyos that carry large quantities of sediment into the river during torrential summer storms. However, most of the flow of the San Juan River comes from runoff from winter snowpack in the San Juan Mountains. Riverflows decrease rapidly after the spring runoff and usually are lowest during December and January.

The primary water storage is provided by Navajo Dam, the principal feature of the Navajo Unit, Colorado River Storage Project (CRSP). The Navajo Unit also stores water for the Navajo Indian Irrigation Project (NIIP), located south of the San Juan River.

San Juan County's population was 91,605 in 1990, representing an annual increase of 1.2 percent over the 1980 figure. The county seat, Aztec, had a 1990 population of 5,479. Farmington, to the west of the Project and the county's major trade center, had a population of 33,997, an increase of 0.9 percent annually since 1980. Bloomfield had a 1990 population of 5,214, a slight increas since 1980. Rural areas on the Navajo Nation appear to be the only areas with significant growth. The two major minority groups within the county in 1990 were Native American (3.7 percent) and Hispanic (13 percent).

The average frost-free period in the area is 158 days; the mean average temperature is about 51 degrees Fahrenheit (°F), with extremes of -30 °F to 107 °F. The average annual precipitation is about 9 inches, with extremes of 3 to 20 inches.

PURPOSE, OBJECTIVE, AND SCOPE OF STUDY

The purpose of this report is to document study results and comply with the procedural requirements of the National Environmental Policy Act (NEPA). The main part of this document includes an assessment of area needs, resources, constraints, and potential alternative solutions. Chapter VI addresses potential environmental consequences.

The Bureau of Reclamation (Reclamation) is currently studying alternatives to reduce salinity in the San Juan River drainage, which annually contributes approximately 1 million tons of salt to the Colorado River. The objective of the study on the San Juan River Unit, as stated earlier, is to reduce as much of the salt loading from the Hammond Project system into the river as is cost effective.[2]

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[2] Cost effectiveness is the total annualized cost per ton of salt removed for each alternative.

Current problems associated with the Hammond Project include increased deep percolation, salt pickup from excessive seepage, and increasing costs from pumping excess amounts of water to offset irrigation water lost to seepage. Suggestions to improve these conditions will be discussed in the scope of this study.

BACKGROUND AND AUTHORIZATION

Salinity control studies on the San Juan River Unit, CRWQIP, were authorized as part of the Colorado River Basin Salinity Control Act (Salinity Control Act) of June 24, 1974 (Public Law [P.L.] 93-320, as amended by P.L. 98-569 on October 30, 1984), and the Federal Water Pollution Control Act Amendments of October 1972 (P.L. 92-500), as amended by the Clean Water Act of 1977 (P.L. 95-217). Title II of the Salinity Control Act was directed toward salinity control of the Colorado River in the United States upstream from Imperial Dam. Under Section 203(b)(2) of the Salinity Control Act, "the Secretary is directed to undertake research on additional methods for accomplishing the objectives of this title . . .." The Salinity Control Act originally authorized the San Juan River Unit for study as part of a basinwide program to enhance and protect the quality of water in the Colorado River for use in the United States. This report is tiered to the *Final Environmental Statement, Colorado River Water Quality Improvement Program* (INT FES 77-15), for purposes of NEPA.

Public Law 92-500 established a public policy of nondegradation for water quality, limitations for pollution effluent discharge, and eventual zero-pollution discharge by 1985. In response to this law and related Federal and State guidelines, the CRWQIP has the specific objective of identifying and evaluating control measures to prevent salinity concentrations from exceeding 1972 levels in the lower main stem of the Colorado River (see table I-1). One of the major problems facing the Colorado River Basin is to maintain adopted salinity standards while the seven Basin States (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) continue to develop their water supplies under the Colorado River Compact of 1922.

Table I-1.—Numeric criteria for total dissolved solids
(Lower Colorado River)

	Annual flow-weighted total dissolved solids concentration (milligrams per liter)
Below Hoover Dam	723
Below Parker Dam	747
At Imperial Dam	879

PUBLIC INVOLVEMENT

Reclamation's Durango Projects Office has contacted agencies, groups, and individuals that have interest in the study. From these contacts, issues and constraints related to the study were identified and are discussed in subsequent sections of this document. Numerous meetings have been held, and no groups or individuals have voiced opposition to the study or the alternatives being considered. Chapter V presents a more detailed discussion of public involvement activities.

HISTORY OF DEVELOPMENT

In the early 1900's, about 2,000 acres upstream from Bloomfield, New Mexico, were irrigated by private individuals or small groups. Because most of the area was served by the Hammond Ditch, that project was termed the Hammond Project. These early irrigation systems were damaged so extensively by floodflows of the San Juan River and its tributaries that by 1916, farming practices in the area were nearly abandoned.

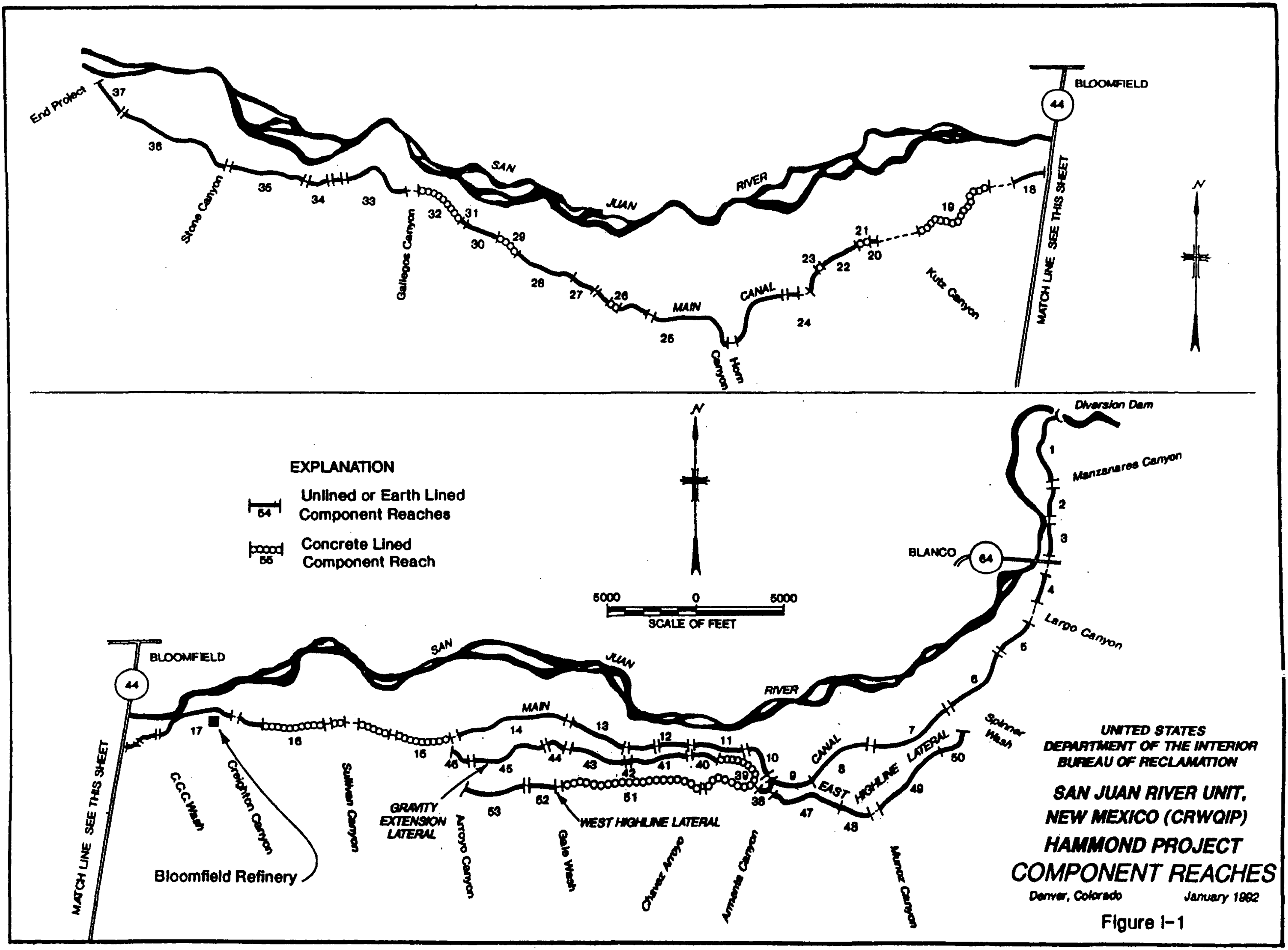
Other early irrigation efforts included formation of the Kutz Canyon Water Users' Association in 1945 and five small gravity irrigation systems in 1955. These efforts were plagued with operational problems and high costs to repair diversion structures.

Most individual irrigators abandoned these systems and contracted for a full water supply under the current Hammond Project. The Hammond Project was authorized as a participating project of the CRSP by the Act of April 11, 1956. Subsequent action resulted in the formation of the Hammond Conservancy District.

EXISTING HAMMOND PROJECT

From a diversion on the San Juan River, the Hammond Project provides a full-service irrigation water supply to 3,933 acres of land. The entire irrigation supply is obtained from the direct flow of the river and, if necessary, receives a supplemental water supply from Navajo Reservoir. Canal and lateral reaches are shown on figure I-1.

Water for the Hammond Project is diverted by the Hammond Diversion Dam located about 2 miles upstream from Blanco, New Mexico, and 13 miles downstream from Navajo Reservoir. The diversion dam consists of a 1,700-foot-long, compacted earth dike with a maximum height of 8 feet above original ground; a 350-foot-long concrete overflow section; a 68-foot-wide concrete sluiceway section controlled by four radial gates; and a canal headworks controlled by one slide gate. The diverted water is conveyed by



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SAN JUAN RIVER UNIT, NEW MEXICO (CRWQIP)

HAMMOND PROJECT

COMPONENT REACHES

Denver, Colorado January 1982

Figure I-1

the 27-mile Main Canal westward along the south side of the river valley. The capacity of the canal varies from 90 cubic feet per second (ft^3/s) at the headworks to 5 ft^3/s at the terminus. The capacities of the laterals vary from 12 ft^3/s to 3 ft^3/s.

As originally constructed, the Main Canal consisted principally of open channel in earth-cut and compacted fill sections, about half of which was unlined and the remainder of which was lined with compacted earth lining. Since that time, approximately 4.5 miles of concrete lining have replaced the more leaky portions of the original canal. The new linings vary in capacity from 15 ft^3/s through 55 ft^3/s. Table I-2 shows the miles of the Hammond Project canal system that are presently lined, unlined, or in siphons.

Table I-2.—Hammond Project
(Present characteristics of canal system)

Main Canal	Miles	East Highline Lateral	Miles
Unlined	9.66	Unlined	1.48
Earth-lined	9.86	Earth-lined	0.82
Concrete-lined	4.50		
Siphons	2.93		
Total miles	26.95	Total miles	2.30
Gravity Extension Lateral	**Miles**	**West Highline Lateral**	**Miles**
Unlined	3.68	Unlined	0.97
Earth-lined	0.26		
Concrete-lined	0.62	Concrete-lined	2.21
Siphons	0.15	Siphons	0.06
Total miles	4.71	Total miles	3.24

About 6 miles below the head of the Main Canal, a turbine-driven, direct-drive pump uses a 32-foot elevation drop to lift a maximum of 18 ft^3/s approximately 53 feet to the West and East Highline Laterals. Because this pump has not been able to achieve its design capacity, a second pump (powered by natural gas) was added to the Main Canal approximately one-half mile upstream to supplement flows to the East Highline Lateral.

After dropping through the hydraulic turbine, the water continues down the Main Canal and is used for irrigating Hammond Project lands at lower elevations. Two main laterals extend west and east from the discharge lines of the pumping plant. The 3.24-mile West Highline Lateral has a capacity of 12 ft^3/s, and the 2.30-mile East Highline Lateral has a capacity of 10 ft^3/s. A third lateral, the Gravity Extension Lateral, with a capacity of 10 ft^3/s, continues westward 4.71 miles from the pumping plant intake to irrigate lands between that lateral and the Main Canal.

OPERATION OF HAMMOND PROJECT IRRIGATION SYSTEM

The Hammond Project presently has a water right to divert approximately 26,700 acre-feet annually. Historically, 31,240 acre-feet have been diverted, approximately 9,500 acre-feet of which is returned to the San Juan River by wasteways or natural channels.

Except for the lands associated with the diversion dam, the pumping plants, and the operational headquarters, right-of-way for the Hammond Project was obtained through the Reserved Right of Way Act of 1890.

RELATIONSHIP OF OTHER WATER AND RELATED RESOURCE ACTIVITIES TO THIS STUDY

SOIL CONSERVATION SERVICE

Approximately 75 percent of Hammond Project area farmland is currently under sprinkler irrigation. After consulting with the Soil Conservation Service (SCS), Reclamation determined that no additional sprinkler irrigation is anticipated in the area. It is believed that Project area farmers interested in using sprinkler systems are already doing so. Reclamation's consultation with SCS is documented in chapter V.

NAVAJO UNIT

Reclamation constructed the Navajo Unit in the late 1950's and early 1960's as part of the CRSP; its main feature is Navajo Dam on the San Juan River, east of and upstream from Farmington. The Navajo Unit's purpose is to provide irrigation water, short-term municipal and industrial water, flood control, recreation, and fish and wildlife benefits. Navajo Reservoir supplements Project irrigation flows in critically dry years.

NAVAJO INDIAN IRRIGATION PROJECT

The NIIP, under construction since 1964, diverts Navajo Reservoir water to irrigate NIIP land in the Navajo Nation on an elevated plain south of the

San Juan River. Total diversions have varied from year to year, but through the 1990 irrigation season, up to 170,000 acre-feet of water was diverted from Navajo Reservoir. Six blocks of NIIP land have currently been developed with each block equal to approximately 10,000 acres. A part of the seventh block was irrigated for the first time in 1991. Block 7 is nearing completion and is scheduled to receive a full irrigation water supply in 1994. With all seven blocks receiving NIIP water, up to 210,000 acre-feet may be diverted from Navajo Reservoir. Reclamation is constructing the NIIP using Bureau of Indian Affairs funding. Completed features include Cutter Dam, located southeast of Blanco, New Mexico; canals and laterals; and onfarm irrigation facilities. Approximately 60,800 acres are under irrigation to date. A discussion of Indian Trust Assets is included in chapter VI.

INELIGIBLE LAND STUDIES

The Hammond Project was selected for Reclamation's Ineligible Land Review because of the problems of excess water diversions and irrigation of class 6 land.[3] Initially, Reclamation staff met with the Hammond Conservancy District secretary to review landowner records. An onsite Hammond Project survey was then made comparing irrigated fields against land classification maps; approximately 360 acres of class 6 land were identified as presently being irrigated.

In 1984, the Hammond Conservancy District requested a reclassification of about 800 acres of lands within the Hammond Project, in cooperation with Reclamation. Approximately 400 existing acres were determined to be arable or eligible to receive Project water. The Commissioner of Reclamation approved the reclassification of 408.3 acres of Project lands on July 25, 1989. A Compliance Review for the Project (under the Reclamation Reform Act of 1982) was submitted to Reclamation.

POWERPLANTS

Two coal-fired powerplants currently are operating in the San Juan Basin: the Four Corners Powerplant, a five-unit, 2,175-megawatt (MW) plant near Fruitland, New Mexico, operated by the Arizona Public Service Company; and the San Juan Generating Unit, a two-unit, 1,588-MW station jointly operated by the New Mexico Public Service Company and Tucson Gas and Electric Company. The San Juan Generating Unit is located across the San Juan River, north of the Four Corners Powerplant.

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[3] Under recent legislation, Reclamation is reviewing whether potential Project lands are within contract service areas, are arable, and are therefore eligible to receive Project water. Class 6 lands do not meet a minimum requirement for arable lands due to shallow soils, poor drainage, gradient, or other similar factors; they are ineligible to receive irrigation water via Reclamation facilities.

The Four Corners Powerplant currently withdraws about 29,000 acre-feet of water annually from the San Juan River at about 350 milligrams per liter (mg/L) of total dissolved solids and returns 12,000 acre-feet of water to the river annually at about 720 mg/L. The Arizona Public Service Company has examined the powerplant's salinity impacts as part of renewing its National Pollution Discharge Elimination System (NPDES) permit. This powerplant has been waived from meeting zero-discharge standards because of the acceptable quality of water returning to the river and the impracticality of containing these return flows. The San Juan Generating Unit has complied with NPDES requirements and no longer discharges into the river.

REFINERY

The Bloomfield Refinery (Refinery) near Bloomfield has been identified as being responsible for releasing or causing to be released hazardous waste and hazardous waste constituents to the ground water, surface water, and soil at the Refinery. Portions of the Project distribution system have also been affected. On April 10, 1992, the Environmental Protection Agency (EPA) Region 6 sent the Refinery an Administrative Consent Order under Section 3008(h) of the Resource Conservation and Recovery Act. In summary, the order states the Administrator (EPA) has determined that releases of hazardous waste by the Refinery have occurred, and corrective action/measures need to be taken to protect human health and/or the environment. The order provides for the Administrator to bring civil action in the form of a temporary or permanent injunction and, subsequently, to levy monetary penalties for noncompliance. The period from initiation of action to its completion normally ranges from 3 to 5 years. Environmental Protection Agency representatives have emphasized that the process in which they are currently engaged with the Refinery is one of negotiation/ cooperation and a good-faith effort to achieve the corrective measures.

Reclamation has contacted the Refinery manager and environmental staff representative to identify their interest in participating in the lining of that portion of the Main Canal that borders the Refinery. The Refinery would take full responsibility via letter of intent (attachment D) for the proper disposal of all contaminated material removed during the construction of the canal lining. It appears that any remaining issues concerning contamination within the area would not affect the proposed salinity control project because these issues would be expected to have been resolved through these negotiations or through the mandates of regulatory entities as cited. However, if for some reason this issue is not resolved and the salinity reduction benefits can only be realized upstream from the Refinery, some of the Project's salinity reduction benefits would be lost. Under that condition, tons of salt removed would be reduced by 53 percent on the Main Canal and by 28 percent for all canal systems, including laterals.

PREVIOUS REPORTS RELATED TO THIS STUDY

RECLAMATION

The Colorado River, March 1946 (basinwide report).
Hammond Project, New Mexico, Feasibility Report, March 1947.
Supplemental Report, November 1950 (amended April 1953).
Hammond Project Definite Plan Report, March 1958.
Final Environmental Statement, Colorado River Water Quality Improvement Program, INT FES 77-15, May 19, 1977.
Fish, Wildlife, and Habitat Assessment, San Juan River, New Mexico and Utah, Gallup-Navajo Indian Water Supply Project, October 1978.
Planning Report / Draft Environmental Statement, Gallup-Navajo Indian Water Supply Project, New Mexico, Arizona, and Utah, January 1984.
Draft Plan of Study, San Juan Unit, CRWQIP, August 1985.
Field Draft Preliminary Findings Memorandum, San Juan Unit, CRWQIP, September 1986.
Project History—Hammond Project, 1960-87.
O&M Memorandum, April 26, 1989.
Plan Formulation Working Document, San Juan Unit, CRWQIP, August 1989.

OTHER

Gallup-Navajo Indian Water Supply Project, San Juan County, New Mexico, Final Fish and Wildlife Coordination Act Report, U.S. Fish and Wildlife Service, U.S. Department of the Interior, September 1981.

OVERVIEW: This chapter describes and quantifies the salinity problem and salt-loading and concentrating mechanisms.

ISSUES: Measurement of the irrigation project's salinity contribution in the Colorado River System.

CHAPTER II

NEED FOR ACTION

PROBLEM IDENTIFICATION

At its headwaters in the mountains of north-central Colorado, the Colorado River has a salinity concentration of about 50 milligrams per liter (mg/L). The concentration progressively increases downstream as a result of water diversions and salt contributions from a variety of sources. Annual salinity concentrations at Imperial Dam are estimated to increase from the 1987 measured average level of 850 mg/L to an average of 970 mg/L by 2010 unless additional control measures are implemented to prevent the salinity increase.

To limit the salinity of the Colorado River, and in response to the Federal Water Pollution Control Act and its amendments, the seven Colorado River Basin States adopted, and the Environmental Protection Agency approved, salinity standards for the lower Colorado River.

Numeric criteria for the lower Colorado River

	Annual flow-weighted concentration (mg/L)
Below Hoover Dam	723
Below Parker Dam	747
At Imperial Dam	879

SALT LOADING AND SALT CONCENTRATION

Decreased water quality in the Colorado River Basin results from two general causes—salt loading and salt concentration. Salt loading is the addition of salt to the river from such sources as salt dissolving from saline geologic formations, irrigation return flows, and saline springs and seeps. Salt concentration results from reducing the volume of water through consumptive use[1] and evaporation without reducing the total salt carried.

Both salt loading and salt concentration occur on the Hammond Project, which was originally designed as an earth-lined system. After the Hammond Project was completed in the early 1960's, several sections of the system were concrete lined to reduce seepage and to reduce canal maintenance and repair. Sections that have not been lined show significant deterioration of the canal prism. Following the original construction of earth-lined sections, the lining was unintentionally removed during operation and maintenance activities. Conveyance and operation losses currently average approximately 50 percent of the diversions into the Hammond Project system, and canal seepage is a part of this loss. Salt pickup results from canal seepage water and excess irrigation deep percolation flowing through and dissolving salts from underlying shales high in salt content.

Salt concentration occurs on the Hammond Project because of consumptive use by the irrigated crops and by evapotranspiration in wetlands created by operational waste and conveyance losses.

Salt load entering the San Juan River in the Project area is partly due to canal seepage, as noted. The soil in the area is composed primarily of moderately saline shales and sandstones. Water seepage from the canal system flows toward the river through the alluvium and along the bedrock, where it picks up soluble salts. Irrigation deep percolation and canal system seepage contribute to the amount of saline water entering the San Juan River.

LAND FORMS AND GEOLOGY

The Project area is underlain by, or lies adjacent to, the San Jose, the Nacimiento, the Ojo Alamo, and the Kirtland Formations.

The Nacimiento Formation is the most widespread of the formations which underlie or border the area from Largo Canyon to Horn Canyon. It is composed of shale and sandstone. The shale deposited in brackish water is moderate in soluble salts and alkali.

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[1] Consumptive use is the amount of water used by plants in transpiration (the process by which plants give off water vapor through their leaves), retained in plant tissue, and the evaporation of water from adjacent plant and soil surfaces during a specified time period.

Table IV-1.—Hammond Project canal and lateral system
(19 waterways and component reaches)

Canal and lateral system	Waterway[1]	Component reaches[2]
Main Canal	1	1, 2, and 3
	3	5 and 6
	5	8
	6	10, 11, 12, 13, and 14
	7	17
	8	18
	9	20, 22, and 24
	10	25 and 27
	11	28
	12	30, 31, 33, 34, and 35
	13	36
	14	37
Gravity Extension Lateral	15	38
	16	40, 41, 42, 43, 44, and 45
	17	46
East Highline Lateral	18	47, 48, and 49
	19	50
West Highline Lateral	20	52
	21	53

[1] "Waterway" denotes component reach(es) with similar characteristics grouped together for cost calculation purposes.

[2] Reaches 4, 7, and 9 do not remove salt; however, for efficiency in lining the system, these reaches were added to the preferred alternative. Reaches not included are concrete lined, as shown in figure I-1.

Viable Alternatives

Four viable and reasonable alternatives were formulated for further evaluation in detail by Reclamation. The four viable alternatives are: (1) Canal Lining Alternative (either membrane or concrete); (2) the Low-Pressure Pipeline Alternative (pressurized pipe, low pressure, upper section); (3) the High-Pressure Pipeline Alternative (pressurized pipe, high pressure, upper section); and (4) the No Action Alternative. The two piped alternatives were derived from the initial pipeline option which placed the system into a pipeline pressurized by electrical-powered pumping. Pipe alternatives were retained for further consideration, but their cost was considerably higher than that of the other viable alternatives.

Evaluation of Salt-Loading Reduction for Viable Alternatives

Salt-tonnage reduction and cost-effectiveness estimates were evaluated for the three viable action alternatives on the Project. Field tests showed estimated annual salt-loading and seepage values and reduction from canals and laterals were computed to be 31,650 tons and 5,600 acre-feet, respectively.

For the Canal Lining Alternative, the reaches used in the hydrosalinity analysis were grouped into 21 waterways (table IV-13, as it appears later in this chapter). The cost-effectiveness analysis showed that 19 of the 21 waterways (table IV-1) (all except waterways 1 and 3) had a high probability of being cost effective (not exceeding approximately $100 per ton). Inclusion of these waterways yielded an overall cost effectiveness for canal lining that was still much lower than $100 per ton.

Reclamation's statistical analysis showed that inclusion of all 21 waterways in the preferred alternative yielded ranges in seepage and tonnage reduction of 4,900 to 10,924 acre-feet per year and 27,700 to 68,560 tons of salt per year, respectively. Selected for analysis were minimum seepage and tonnage reduction values of 4,900 acre-feet and 27,700 tons of salt per year. These values show the highest probability of occurrence (99.9 percent) and, therefore, are considered suitable values on which to base plan formulation analysis. Analysis based on these values would yield conservative estimates of reducing salinity in the San Juan River.

For the canal and lateral lining alternative, canal reaches that are presently concrete lined and reaches which are located in areas of high ground-water levels were not considered in the evaluation.

To evaluate the pressurized pipeline alternatives (both low pressure—10 feet of head at the terminus and high pressure—100 feet of head at the terminus), the canal and lateral system was divided into two sections, as shown in table IV-2. The probability analysis indicated the upper section alternatives could be expected to reduce salinity by 18,400 tons per year to a level that is equivalent to preproject conditions. Piping of the lower section was not cost effective.

Canal Lining Alternative

Features.—Under this alternative, 19.52 miles of the Main Canal, 3.94 miles of the Gravity Extension, 0.97 mile of the West Highline Lateral, and 2.30 miles of the East Highline Lateral would be lined with either concrete or membrane material to reduce seepage. Reaches to be lined are shown on figure I-1. The existing canal and lateral prisms would be cleaned out and refilled, and the canal prism would then be reshaped and lined. Construction would be staged over 5-1/2 years, which would include 2-1/2 years of preconstruction and design work, including 1 year of design data collection, 1 year for designs and specifications, and 1/2 year for solicitation of bids.

Table IV-2.—Hammond Project pipeline systems
(Upper and lower sections and component reaches)

Canal and lateral system	Pipeline component reaches (numbers)[1]
Upper section	
Main Canal	8 - 16
Gravity Extension Lateral	38 - 46
East Highline Lateral	47 - 50
West Highline Lateral	51 - 53
Lower section	
Main Canal	17 - 37

[1] Shown in figure I-1 and tabulated in tables IV-1 and IV-13.

Costs.—At January 1993 cost levels, this alternative had an estimated construction cost of approximately $11.7 million. Interest during construction would amount to an additional $1.951 million. For concrete lining, the total annual cost including operation, maintenance, and replacement (OM&R) would be about $1.15 million.

Annual OM&R was estimated to increase from current levels by approximately $6,000.

This alternative would reduce salt loading to the Colorado River by an estimated 27,700 tons per year without significant environmental, cultural, or social impacts. An estimated 228 acres of irrigation-produced wetland/ riparian vegetation would be temporarily affected by construction of this alternative.

Determination of Viability.—The Canal Lining Alternative is effective, reducing 27,700 tons of salt annually and about 4,900 acre-feet of seepage per year. That reduction is accomplished efficiently at a cost effectiveness of $41.65 per ton. This cost assumes using the existing cross drains and turnout structures. The alternative is complete and is one of the preferred alternatives of the Project irrigators. The plan is acceptable to the State of New Mexico, and the anticipated environmental, social, and cultural resources impacts appear to be negligible. This alternative was considered viable and was considered in the four-account analysis.

Low-Pressure Pipeline Alternative (Upper Section)

Features.—Starting approximately where the Main Canal now emerges from the siphon beneath Muñoz Canyon about 4.9 miles below the diversion dam (see figure I-1), a 2,430-kW pumping plant would pressurize a new pipeline with a total length of 5.7 miles for the upper section down to about 2 miles east of State Highway 44. The plant would create an initial head of 234 feet, and the pipeline would be installed in the existing canal alignment. Sections that are now concrete lined would have the lining removed, and existing laterals would be abandoned. Existing siphons[3] would be used; but all other structures, including the constant head orifice turnouts and pumping plants, would be abandoned. Water would be delivered into 13 new pipe laterals to distribute to the Project farms. The head would be sufficient to provide at least 10 feet of pressure at the delivery end of each lateral. Pipeline diameters for the Main Canal would range from 30 to 42 inches. The pipe laterals would follow new rights-of-way (ROW's) for a total combined length of about 4.6 miles and would range in diameter from 14 to 18 inches.

Full Project delivery for sprinkler-irrigated lands would require a pipeline capable of handling an initial flow of 80 cubic feet per second (ft^3/s); thus, some land could remain under gravity irrigation. Most farmers would be expected to add sufficient pressure at their delivery point to irrigate with sprinklers, while for some of the lands lying between the Main Canal and the San Juan River, the pressure in the main line could be sufficient to provide enough head to operate sprinklers. Flow would be approximately 50 ft^3/s at the end of the new pipe. The remainder of the Project would be operated by the present system. If all Project lands were converted to sprinkler irrigation, an annual project requirement of 15,600 acre-feet would be delivered to the beginning of the pipeline, with a pumping energy of about 5.8 million kWh.

A moss and debris removal system and a small basin to hold sediment would be placed at the upstream side of the Muñoz Canyon siphon. The initial 4.9 miles in the Main Canal above the proposed pumping plant would be expected to settle out most sediment carried in the water diverted from the San Juan River. Moreover, except when localized storms create flows in the washes below Navajo Dam, the water diverted to the Hammond Project is relatively sediment free.

Costs.—The estimated total cost for the Low-Pressure Pipeline Alternative at January 1993 cost levels was approximately $14.7 million. Based on 8-1/4-percent interest and a 50-year project life, this alternative would cost $1.63 million annually, including an additional annual OM&R cost of $400,000 over current levels, which would be paid by the Federal

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[3] These siphons were not investigated for their capability to withstand this additional head and resulting pressure. Should this alternative ever become the preferred alternative, their strength capability would have to be investigated and subsequent additional costs (which could be substantial) included.

Government. This figure does not account for any work that might be required to strengthen siphons. Overall cost effectiveness for this alternative is $88.75 per ton of salt removed.

This alternative would reduce salt loading to the Colorado River by an estimated 18,400 tons per year without significant environmental, cultural, or social impacts. An estimated 14 acres of irrigation-produced wetland/riparian vegetation within the canal and lateral structures would be adversely affected.[4] Approximately 28 acres of upland vegetation would also be temporarily affected by the construction of piped laterals.

Determination of Viability.—The Low-Pressure Pipeline Alternative passes the efficiency test, if no significant costs are added to strengthen existing siphons. With a reduction of 18,400 tons of salt per year, this alternative is an effective means of reducing salinity in the Colorado River, and the alternative is complete. The Hammond irrigators prefer it less than the Canal Lining Alternative, but this alternative is considered acceptable. Therefore, this alternative is viable and was considered in the four-account analysis.

High-Pressure Pipeline Alternative (Upper Section)

Features.—This alternative is similar to the Low-Pressure Pipeline Alternative, but it would provide 100 feet of head at the delivery end of each new pipe lateral. The alignments of the main pipeline (5.7 miles) and lateral pipeline (4.6 miles) would be the same as that in the Low-Pressure Pipeline Alternative, and existing siphons would be used, possibly requiring strength capability tests (see annotation under Low-Pressure Pipeline Alternative).

The pumping plant for this alternative would have a capacity of 3,370 kW and would deliver 324 feet of head at the pumps. The energy needed to pump 15,600 acre-feet of water per season would be about 8 million kWh. This alternative includes a moss and debris removal structure at the beginning of the pipeline at Muñoz Canyon.

The alternative does not appear to have any unacceptable environmental, social, or cultural resources impacts.

Costs.—A substantial increase in OM&R would result from the increased pumping. The new additional OM&R cost would be $540,000 per year. Presently, it is estimated that $46,000 per year is being spent by individual farmers to fully pressurize their sprinkler systems.

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[4] Please note that impacted, within-prism acreages of the pipeline alternatives are less than acreages impacted under the lining alternatives (approximately 4 acres).

Including interest during construction, this alternative would require a total expenditure of $17.1 million, resulting in an annual cost of $1.98 million and a cost effectiveness of approximately $100 ($107.36) per ton, based on a removal of 18,400 tons of salt.

This alternative would reduce salt loading to the Colorado River by an estimated 18,400 tons per year without significant environmental, cultural, or social impacts. An estimated 14 acres of irrigation-produced wetland/ riparian vegetation within the canal and lateral structures would be affected.

Determination of Viability.—As with the Low-Pressure Pipeline Alternative, this alternative shows a cost effectiveness that can be considered efficient. By reducing salt loading to the Colorado River by 18,400 tons, the High-Pressure Pipeline Alternative is effective on its own, and implementing it constitutes a complete alternative. Although the Project irrigators would prefer the entire distribution system to be pressurized, this alternative would be highly acceptable to them and to the State of New Mexico. Therefore, the High-Pressure Pipeline Alternative is viable.

No Action Alternative

Features.—This alternative would not implement a Federal salinity control program on the existing Project. No canal or lateral improvements would be completed to control salinity in the area. The irrigation system would be maintained by the Hammond Conservancy District (District). The District would continue measures to control deep-rooted vegetation in the canal and lateral ROW's. Canal and lateral ROW's would be cleared of vegetation in a corridor which varies from 50 feet to 150 feet on either side of the canal. Salt loading from the Hammond Project would probably continue at or near its present level; however, some limited lining and other conveyance improvements might occur under existing operation and maintenance (O&M) and rehabilitation and betterment programs.

Analysis.—If no Federal action were to occur, the Hammond Project would continue to operate. An effective OM&R program would remove all deep-rooted vegetation from the canal prism and canal ROW's, which could increase the water-holding integrity of canal walls and lead to some decrease in canal seepage, deep percolation, and the resulting salt pickup. The quantity of salt reduction has not been estimated, but effects would be insignificant when compared to the salt reduction of other alternatives.

Additional land at the lower end of the Hammond Project may be converted to subdivision and residential land use, resulting in a small reduction of onfarm salt loading if irrigation were discontinued. However, off-farm salt loading would remain essentially the same because canal flows would not change.

Impacts to the natural resources of the Project area for the future-without-project conditions are expected to be minor. No change would occur in the area's overall wetland habitat; however, irrigation-produced wetland vegetation within the canal structure would be removed due to O&M on the Hammond Project's canals and laterals.

Nonviable Alternatives

The following alternatives were considered but were found to be nonviable and unreasonable and were eliminated from further study at this time. Nonviable alternatives exceeded cost-effectiveness criteria, were not acceptable to water users or State government, or posed difficult operational problems.

Gravity-Pressurized Pipeline (Entire Hammond Project)

This alternative would place the existing Hammond system into a pipeline pressurized by gravity. The pressure would be sufficient to deliver water to farm turnouts along the Main Canal alignment. Pressurization to provide delivery to individual farms would be provided by the District or the farmer. The existing laterals would be abandoned.

Subappraisal-level costs indicate that the size of pipeline required to meet the above objectives resulted in an alternative with excessive costs. Therefore, the gravity-pressurized pipeline alternative failed the efficiency test and was eliminated from further consideration.

Land Retirement

Under this alternative, Hammond Project lands could either be selectively retired based on how much salinity they contribute to the San Juan River, or the entire lands could be removed from service. The impacts of retiring all of the Hammond Project land would include eliminating as much as 3,933 acres of irrigated land; also, 27 miles of canal and 10.3 miles of laterals would be abandoned.

In this alternative, the 3,933 acres under the Hammond Project would be purchased by the Federal Government, and the lands would be retired from irrigation. The water rights would be made available to the State of New Mexico for transfer to a new beneficial use. Reclamation would then express a concern that such a new beneficial use would not contribute to the salinity of the Colorado River.

From 1990 to 1993, land in the Hammond Project area has sold for costs ranging from $2,000 per acre to $20,000 per acre. Large amounts of

Hammond Project land near Farmington have been sold and developed for use as subdivisions for individual residences. This change in land use from agricultural to subdivisions accounts for the higher-end sale prices. The lower-end prices are more indicative of land sold only for agricultural use.

Reclamation offers to purchase lands for retirement would need to reflect increases in land costs due to subdivision. A cost of $8,000 per acre has been estimated for the 3,933 acres; this cost, combined with typical Reclamation administrative costs (30 percent), results in a total cost of about $40.9 million, amortized to an annual cost of about $3.44 million. To calculate cost effectiveness, the conservative value of 34,350 tons was used and resulted in a cost effectiveness of $100 per ton.

Loss of agricultural production would have impacts beyond the cash value of the crops. The agricultural sector has provided a stabilizing influence on the local economy through San Juan County's many boom-and-bust cycles since the 1950's. Those farmers who are not willing sellers would experience condemnation procedures. Most would need to relocate. With only 5 percent of the county in private ownership, relocation options are extremely limited. The small communities located near the Project would experience a loss of jobs. Significant impacts would also occur to the tax base, environmental habitat (wetland and upland habitat), and future use of the land. Because of these reasons, this alternative is not considered acceptable from a social perspective.

Low-Pressure Pipeline (Both Upper and Lower Sections)

Under this alternative, all but the first 4.9 miles of the Main Canal would be replaced by a pressurized pipe. Pressure in the main line produced by pumping would be sufficient to distribute Project water into 41 piped laterals. Pressure at the end of each lateral would be at least 10 feet of head, but individual farmers would continue to provide the necessary additional pressure to supply their own farms.

This alternative was then divided into two separate sections for analysis. Of the two sections, the upper section of the system was found to be cost effective and was considered a viable alternative (see Low-Pressure Pipeline Alternative). The lower section, roughly from 2 miles east of the point where the canal alignment crosses State Highway 44 to the downstream end of the Project, was found to be not cost effective. This section would reduce salinity by an estimated 25,560 tons per year at an annual cost of $1.5 million, which results in a cost effectiveness of $214 per ton. As a result, the lower section fails the efficiency test. The entire Project has a combined cost effectiveness of $124 per ton.

Viability results for this and other alternatives are summarized in table IV-3.

PLAN FORMULATION

ALTERNATIVES CONSIDERED

During the San Juan study, the effects of the viable alternatives were compared with the No Action Alternative, and the results were then displayed, at a comparable level of detail, within the four accounts for plan selection purposes.

The following alternatives were considered:

- Lining the Hammond canals with such impermeable materials as clay, concrete, or polyvinyl chloride membrane.

- Three pipeline options—replacing the existing Hammond irrigation system with a gravity-pressurized pipeline, replacing the existing Project system with a pipeline pressurized by electrical-powered pumping, and replacing the existing system with a pipeline pressurized by gravity and supplied by diverting Project water from the Navajo Indian Irrigation Project (NIIP) Canal. Low- and high-pressure variations were identified within each of the pressurized pipe alternatives.

- No action (the projected future condition without project improvements). This alternative is required by NEPA.

- Land retirement.

From this array of alternatives, some were later eliminated and some were reduced in scope. Alternatives were determined to be nonviable that generally exceeded cost-effectiveness criteria, were not acceptable to water users or State government, or posed difficult operational problems.

In some cases, while an overall alternative might have been considered nonviable, an individual reach within that alternative was identified as viable and, therefore, eligible for further consideration. Upper and lower canal sections, for example, differed in viability; the lower section, subsequently defined more specifically, was found to have an unacceptably high cost effectiveness of $213 per ton; it was eliminated from further consideration.[2]

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[2] The lower section lies below a point 2 miles east of State Highway 44 to the end of the Project. The upper section begins 4.9 miles down the Main Canal from the diversion structure, as shown on figures S-1 and I-1 and table IV-1.

Public Law 93-320 (Colorado River Basin Salinity Control Act) sets forth a public policy of nondegradation of water quality, using a criterion of least cost to the Federal Government (cost per ton of salt removed). Section 201(b) of the act states: "The Secretary is hereby directed to expedite the investigation, planning, and implementation of the salinity control program generally as described in chapter VI of the Secretary's report entitled *Colorado River Water Quality Improvement Program, February 1972.*" In determining the relative priority of implementing additional units or new self-contained portions of units authorized by section 202, the Secretary or the Secretary of Agriculture, as the case may be, shall give preference to those additional units or new self-contained portions of units which reduce salinity of the Colorado River at the least cost per unit of salinity reduction. Under this criterion of cost effectiveness, plans which would result in the greatest reduction of salinity in the Colorado River System for the least cost would be recommended for implementation first.

Studies under the CRWQIP have used a value of about $100 per ton for cost-effective increments. The recommended plan was selected based on this cost-effectiveness criterion and reduction in salinity of the Colorado River at Imperial Dam near Yuma, Arizona.

Alternative costs for the viable alternatives were estimated using January 1993 price levels for a project life of 50 years.[1] The fiscal year (FY) 1993 interest rate was 8-1/4 percent for plan formulation. A comprehensive study *(Estimating Economic Impacts of Salinity of the Colorado River,* Reclamation, February 1988) updated the economic impacts of salinity in the Colorado River. It provided new estimates of salinity damages as a range of costs, depending upon the assumptions for current total dissolved solids (TDS) and baseline TDS conditions used in the analysis for this study. The study estimated an incremental cost increase of $311 million for a TDS concentration of 767 milligrams per liter (mg/L) at Imperial, California, as compared to the costs due to a baseline value of 500 mg/L. Although future damage levels have not been assessed in detail, Reclamation estimates that total damages in the Lower Colorado River Basin will increase at least two to three times above current levels.

The current economic value of power production was used for plan formulation. These values were estimated at $262 per kilowatt (kW) per year for capacity and 19.5 mills per kilowatthour (kWh) for energy. Colorado River Storage Project (CRSP) power would probably be available if the preferred alternative required power, since the Hammond Project, an initial CRSP project, participates.

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[1] The criterion for a 50-year project life has been used in the Federal salinity program because salinity control structural facilities can be relied upon to provide the estimated salinity benefits for only 50 years. Typical Reclamation structural facilities, such as dams and earth canals, have a project life of 100 years (smaller facilities have a project life of 25 years).

PLAN SELECTION CRITERIA

Several alternative irrigation system improvements were evaluated under the criteria of the Federal salinity control program and the *Principles and Guidelines.*

VIABILITY AND OTHER TESTS

The *Principles and Guidelines* mandate four tests of viability under the plan formulation process which provides the framework for decisionmaking. These tests are: (1) *completeness*—the extent to which an alternative provides and accounts for all necessary investments or other actions to ensure that planning effects are realized; (2) *effectiveness*—the extent to which an alternative alleviates the specific problem and achieves the desired results; (3) *efficiency*—the extent to which an alternative is cost effective; and (4) *acceptability*—the degree of acceptance by the public and the plan's adherence to all pertinent laws and regulations. Alternatives meeting all four tests were considered viable. More detailed economic, social, and environmental analyses were then performed.

Alternatives passing the four viability tests were analyzed in detail using the four account methods specified in the *Principles and Guidelines*—National Economic Development (NED), Regional Economic Development (RED), Social Effects (SE), and Environmental Quality (EQ)—and NEPA procedures.

COST EFFECTIVENESS

For units of the Colorado River Water Quality Improvement Program (CRWQIP) studied by the Bureau of Reclamation (Reclamation), a traditional comparison of benefits and costs is not totally valid since the benefits accrue from the reduction of salinity in the Colorado River and have not been fully quantified, while construction costs are estimated to a much higher accuracy. Therefore, Reclamation has obtained an endorsement from the Assistant Secretary of the Interior for Land and Water Resources on a proposal that units of the CRWQIP be excepted from the *Principles and Guidelines'* maximization criterion, and that cost effectiveness be used to select the preferred plan (cost effectiveness is defined as the cost to the Federal Government to prevent a ton of salt from reaching the Colorado River System and is expressed in dollars per ton).

On October 29, 1983, the Acting Assistant Secretary of the U.S. Department of the Interior endorsed the general principle that all CRWQIP projects be excepted in advance from the *Principles and Guidelines'* NED maximization criterion. Public Law 93-320 requires cost effectiveness as the controlling criterion for prioritizing salinity reduction plans for Reclamation and the U.S. Department of Agriculture. As a result, planning for individual salinity control projects under the general guidance of the *Principles and Guidelines* employs the specific criterion of cost effectiveness.

OVERVIEW: This chapter describes alternative ways to solve the identified problems. It also describes the economic, social, environmental, and other criteria by which alternative plans are ranked and identifies a preferred plan.

ISSUES: Portions of the studied alternatives were viable, while other portions were not.

CHAPTER IV

ALTERNATIVES

SCOPE OF THE STUDY

Preliminary hydrosalinity and cost data indicated that the most viable salinity control alternative for the San Juan River Unit was a conveyance system improvement project for the Hammond irrigation system. A Canal Lining Alternative was then identified as the plan that warranted more detailed study. This chapter summarizes analyses done on the viable and nonviable alternatives.

STANDARDS FOR PLANS

Alternatives were evaluated in accordance with the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (Principles and Guidelines)* (Water Resources Council, 1982) and the National Environmental Policy Act (NEPA). The plan formulation process consists of the following major steps:

- Identifying existing and projected problems, purposes, and needs.
- Evaluating resource capabilities and existing environmental resources.
- Formulating alternative plans to solve problems, address environmental issues, and meet needs with available resources.
- Analyzing the alternative plans to determine the advantages, disadvantages, and environmental consequences of them.
- Selecting a preferred plan from among viable and reasonable alternatives.

A significant environmental issue associated with salinity reduction proposals for the area is the potential loss of irrigation-produced wetlands resulting from changes in existing water-use practices. Losses of irrigation-produced wetlands are a concern because of their value to a variety of wildlife species and because of the nationwide concern about wetlands protection. Canal seepage often creates wetland and riparian vegetation and aquatic habitat that would not normally occur in this arid environment. The issue of wetland/riparian vegetation produced by irrigation water is addressed in detail in the EA.

The concept of improving irrigation efficiency to reduce the salt load (improved water quality) carried to the Colorado River presents a potential conflict with the environmental issue of protecting irrigation-supported wetlands, riparian vegetation, and aquatic habitats. The Colorado River Basin Salinity Control Act (Public Law 93-320, as amended) establishes water quality improvement (salt reduction) as the objective. A purpose of this planning report/environmental assessment is to disclose the environmental effects resulting from improving water quality while reducing the amount of water that produces wetlands and riparian vegetation associated with irrigation.

Existing lined portion of Main Canal with rabbitbrush, willows, and cottonwoods.

Any diversion from the San Juan River would adversely impact water rights claims (Indian Trust Assets) in the San Juan Basin by the Navajo Nation.

ISSUES AND INSTITUTIONAL CONSTRAINTS

Some of the potential legal and institutional constraints affecting the study include: State of New Mexico water rights administration; the possible use of Navajo tribal lands and facilities for salinity control purposes; the effects of alternatives on wetlands, cultural resources, and endangered species, as detailed in the environmental assessment (EA); and the potential use of State water for Project mitigation.

The issue with Bloomfield Refinery concerning contamination within the San Juan River Unit area would be resolved through negotiation or through the mandates of regulatory entities, as previously mentioned.

ENVIRONMENTAL ISSUES

Environmental issues and considerations could constrain the Project. Relevant environmental issues and resources specific to the project were identified through scoping activities and public involvement. The following environmental issues and resources are addressed in this document:

- Effects on water quality (specifically control of salinity from Project lands to the Colorado River).
- Effects on wetland and riparian vegetation produced by irrigation water from the Project canals (referred to as "irrigation-produced" wetland).
- Effects on federally listed threatened and endangered species (specifically Colorado squawfish and razorback sucker in the San Juan River).
- Effects on fish and wildlife habitat.
- Effects of construction-related activities on soil and vegetation resources.
- Effects of Bloomfield Refinery (Refinery)-generated soil contamination on the proposed Project and effects of proposed Project on corrective remedial action at the Refinery.
- Effects on cultural resources.
- Effects on Indian Trust Assets.

assumed to supply the entire existing Project, the conveyance losses would be presumed to be negligible, and with a farm irrigation efficiency (for sprinkler) of 70 percent, the river diversion requirement would be about 4.00 acre-feet per acre.

Using historic diversion data, the average annual canal diversion at the river was 9.64 acre-feet per acre for the 10-year period 1977 through 1986. With operational spills of approximately 30 percent, conveyance losses of approximately 20 percent, and an onfarm application efficiency of 60 percent, the historic average annual crop irrigation water delivery for the period was 3.07 acre-feet per acre. This compares favorably with the 3-acre-feet-per-acre crop irrigation requirement cited above used for estimating the annual project water budget under the viable alternatives derived in the study process.

WATER RIGHTS

An Application for Permit to Appropriate the Public Surface Waters of the State of New Mexico was filed and signed by the State Engineer in 1958. This application was for 23,000 acre-feet of unappropriated water which was originally filed for by New Mexico in 1955 and later assigned to and reserved for the U.S. Department of the Interior. In addition to this application for permit, several water rights which benefit the Project are held by the Hammond Conservancy District. These are shown in table III-1.

Table III-1.—Hammond Project water rights

Owner	Remarks	Use[1]	New Mexico file number	Priority date	Amount[2] (acre-feet)
United States	No time limit	Irrigation	2848	06-17-55	23,000.0
District	Lawson Ditch	Irrigation	2475	06-01-36	535.7
District	Kutz Canyon water users	Irrigation	2593	03-12-47	3,168.9
				Total	26,704.6

[1] Although water rights applications may permit various uses, the repayment contract between the Hammond Conservancy District and the United States restricts use to irrigation only.

[2] Although the water rights assigned to the Hammond Project presently exceed the total average annual diversion requirement of 18,500 acre-feet, the right under filing No. 2848 will be automatically reduced to correspond to the Project's requirements for full beneficial use when final proof of beneficial use is submitted to the State Engineer for perfection of the water right.

The March 1958 Definite Plan Report (DPR) for the Hammond Project was based on an annual farm delivery requirement of 3.11 acre-feet per acre and a diversion requirement of 4.75 acre-feet per acre for a project area of 3,900 acres. This yields a total diversion requirement of 18,525 acre-feet of water per year (listed as 18,500 acre-feet per year in the DPR).

OVERVIEW: This chapter describes the water resource potential for solving identified problems and constraints on the use of the resource.

ISSUES: State water rights and definitions of beneficial use, Navajo Nation interests, and environmental effects of salinity control measures.

CHAPTER III

OPPORTUNITIES, RESOURCES, AND CONSTRAINTS

HAMMOND PROJECT WATER SUPPLY

As noted, most of the irrigation supply for the Hammond Project is obtained from direct diversions of the natural streamflow of the San Juan River; but when necessary, these flows are supplemented by storage releases from Navajo Reservoir. Presently, and under conditions of existing development in the San Juan, there is ample water in the river at the Hammond Diversion Dam, except in critically dry years, to supply the Hammond Project water users with their water requirements. The Project can draw on Navajo Reservoir to supplement flows of the river to provide a stable irrigation supply for Hammond Project lands.

The crop irrigation water requirement was estimated at 3.00 acre-feet per productive acre (2.79 acre-feet per irrigable acre),[1] based on research data gathered from 1979 through 1982 at the nearby Navajo Indian Irrigation Project. Given an acreage-weighted farm irrigation efficiency of 63 percent (70 percent sprinkler efficiency and 45 percent gravity efficiency), the average annual farm delivery requirement is estimated to be 4.42 acre-feet per acre. With a conveyance efficiency of 80 percent for the distribution system, the diversion requirement at the head of the Main Canal is estimated to be 5.53 acre-feet per acre. This results in a crop irrigation requirement of 11,800 acre-feet per year, a farm delivery requirement of 17,385 acre-feet per year, and a diversion requirement of 21,750 acre-feet per year. However, if a totally pressurized pipe sprinkler system were

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[1] Irrigable acres include productive acres plus such areas as farmsteads and other nonirrigable acres. Data from *Consumptive Use on the Navajo Indian Irrigation Project* (U.S. Bureau of Reclamation/Bureau of Indian Affairs joint report, September 1983).

seepage volume, which was determined using a lined seepage rate of 0.07 cubic foot per square foot per day (recommended by Reclamation for concrete-lined canals in evaluating salinity impacts for planning studies).

Results of the Project hydrosalinity studies show an estimated canal and lateral water loss of 5,600 acre-feet per year with an associated salt load of 31,650 tons per year. Other sources include Gallegos Canyon (4,000 tons per year) and other unaccounted-for contributors.

OCD Remediation Project

Correspondence

1999

GIANT
REFINING COMPANY

May 27, 1999

RECEIVED
JUN 1
OIL CON. DIV.

Mr. William Olsen
NMOCD
2040 So. Pacheco St.
Santa Fe, New Mexico 87505

Re: San Juan River Terrace Remediation

Dear Bill:

Giant Refining Company – Bloomfield submits the work plan for the remediation of hydrocarbon contamination on the river terrace immediately north and below the refinery. As an addition to the approved Remediation Plan that was submitted in February, 1998 and approved by OCD on March 6, 1998, Giant submits this work plan that details the recovery/monitor collection system and the hydraulic loading of the sheet piling.

Some concerns about hydraulic loading behind the sheet piling had been discussed. I did some rough hydraulic loading calculations (attached) and determined that the pressure on the sheet piling at static water levels would be 0.598 psi. At maximum loading, the pressure would increase to 1.076 psi. Excessive hydraulic loading does not appear to pose a problem.

Please note that the proposed design of the collection system differs from the OCD well installation requirements in the March 6 approval letter (see attached drawing). Although not actually a well, the collection system will be used to monitor the presence of Separate Phase Hydrocarbons (SPH) as outlined in the approved remediation plan. Although it does not appear to be likely or necessary, the collection system can be used to recover water from behind the sheet piling to correct excessive hydraulic loading.

The depth of the horizontal was determined by taking the average depth to static water as determined by examination of lithologic drilling logs. Because the average depth to water during normal river flow levels is 6.04' the horizontal pipe will be placed at 7-8' deep. This will allow recovery of SPH during intervals of normal river flow, if necessary. The standpipe will consist of 4-5' of PVC 0.010 slotted screen pipe extending upward from a tee connection and then 6 foot of unslotted PVC pipe. This will allow for extra collection ability should the water level rise the two feet (estimated at 5,000 cfs in the San Juan River) used in the calculations and more nearly approximates the suggested OCD well design requirements.

A site drawing has been attached to show the location of the sheet piling and the collection system.

PHONE
505-632-8006
FAX
2-4034

111 COUNT
ROAD 499
BLOOMFIE
NEW ME
874

Giant proposes that the collection gallery system be installed within thirty days of completion of all work required for installation of the sheet piling.

Thank you for the extension for submitting this work plan. If you have any questions, please contact me at (505) 632 4168.

Sincerely:

Lynn Shelton

Lynn Shelton
Environmental Manager
Giant Refining Company – Bloomfield

Attachments

Cc: David J. Younggren, Senior Vice President, Gary-Williams Energy Corporation
Sarah R. Allen, Corporate Counsel, Giant Industries, Inc.

GIANT - BLOOMFIELD
HYDRAULIC LOADING OF SHEET PILING

ASSUME:

2.5' STATIC WATER LEVEL ABOVE NACEMIENTO FORMATION

2.0' MAXIMUM WATER LEVEL INCREASE (CHARGED BY RIVER AS BANK STORAGE)

35% POROSITY

LAND AREA:

$\frac{115' \cdot 125'}{2} + 120' \cdot 40' = 7667.5 \text{ ft}^2$

LAND VOLUME:

$7667.5 \text{ ft}^2 \cdot 2.5' = 19168.75 \text{ ft}^3$ (STATIC

$7667.5 \text{ ft}^2 \cdot 2.0' = 15335.0 \text{ ft}^3$ (INCREA

$19168.75 \text{ ft}^3 \cdot .35 = 6709.062 \text{ ft}^3$

$15335.0 \text{ ft}^3 \cdot .35 = 5367.25 \text{ ft}^3$

HYDRAULIC LOADING:

STATIC WATER -

$6709.062 \text{ ft}^3 \cdot 8.338 \text{ lb/ft}^3 = 55940.16$ lbs

MAXIMUM LOAD INCREASE -

$5367.25 \text{ ft}^3 \cdot 8.338 \text{ lb/ft}^3 = 44752.13$ lbs

PSI - STATIC

$130' \cdot 5' = 650 \text{ ft}^2$

$650 \cdot 144 = 93600 \text{ in}^2$

$\frac{55940.16}{93600} = .598$ psi

LOADED

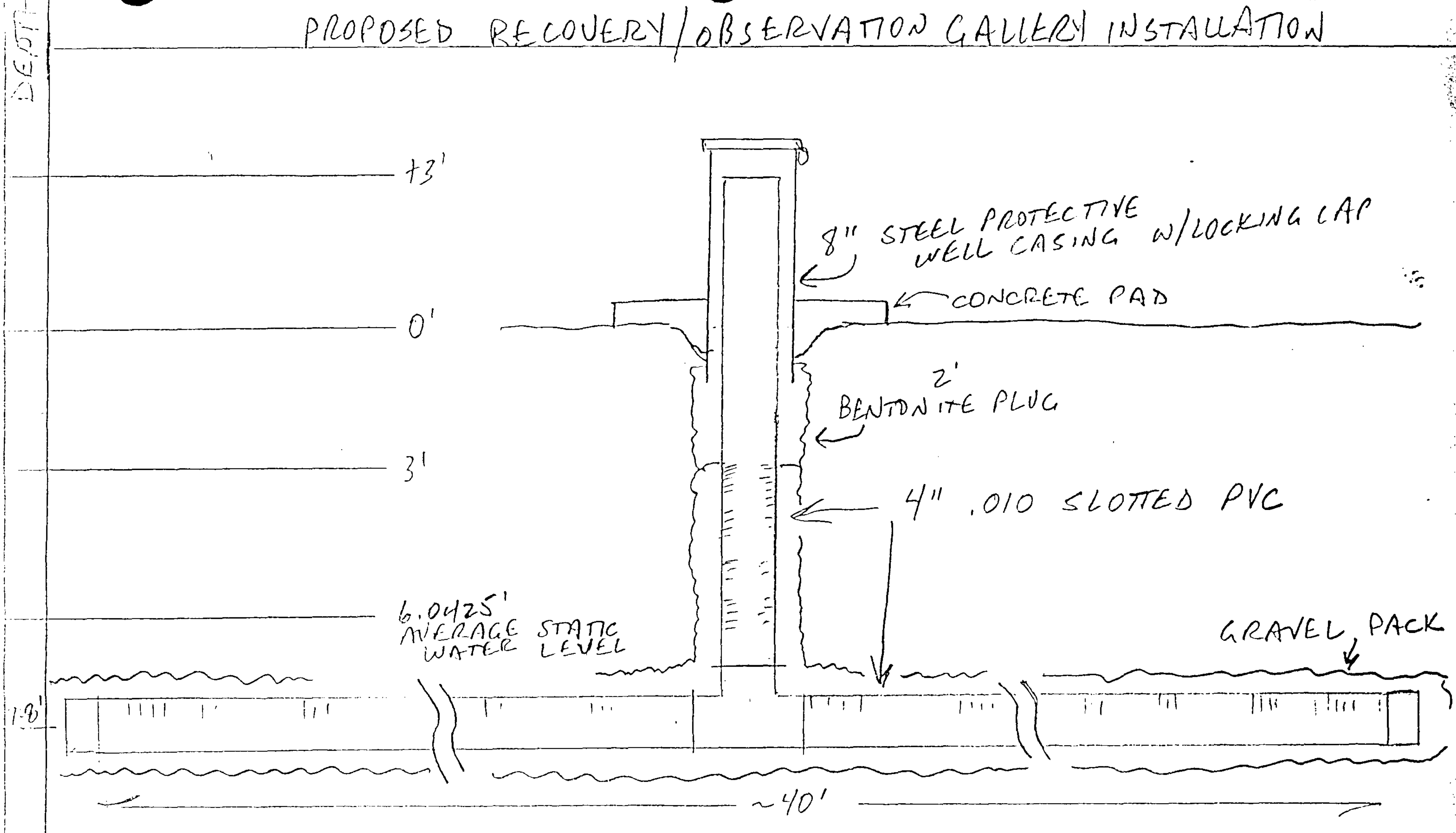
$130' \cdot 5' = 650 \text{ ft}^2$

$650 \cdot 144 = 93600 \text{ in}^2$

$\frac{55940.16 + 44752.13}{93600} = 1.0$

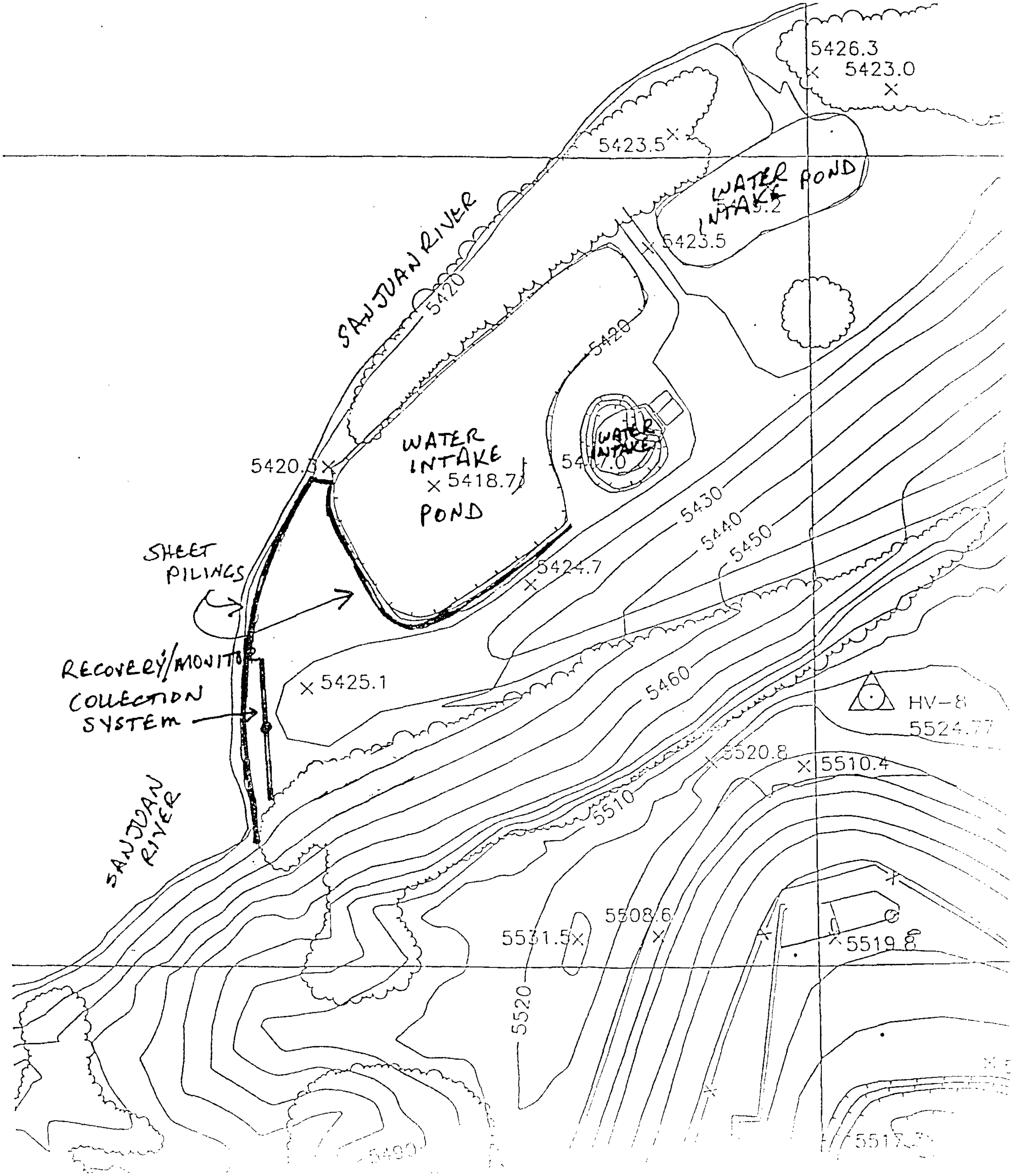
GI[illegible] - BLOOMFIELD

PROPOSED RECOVERY/OBSERVATION GALLERY INSTALLATION



NOT TO SCALE TLS 5/99

Giant Refining Company
Bloomfield
River Topographic Detail
OCD Remediation Project



1 cm² 0.1550 in²
1 in² — 6.452 cm²
1 m² — 10.764 ft²
1 ft² — [illegible] cm²

1 acre — 43 560 ft²
— 4047 m²

1 hectare — 10 000 m²
2.471 acres

1 mi² 2.590 km²
640 acres

Volume

1 m³ — 1000 liters
35.314 ft³
264 gal (U.S.)

1 ft³ — 28.320 liters
7.481 gal (U.S.)

1 gal 3.785 liters

1 acre-foot — 43 560 ft³
— 3.259 × 10⁵ gal
— 1234 m³

Discharge

1 ft³/min 0.472 liters/sec
1 acre-foot/day
3.259 × 10⁵ gal/day
1 ft³/sec — 448.8 gal/min
724 acre-feet/year

Density

Water 1.000 g/cm³ at 4°C
0.998 g/cm³ at 20°C
Sea water 1.025 g/cm³
at 15°C
Mercury 13.55 g/cm³
at 20°C
Air 1.20 × 10 – 4 g/cm³
at 20°C and
atmospheric pressure

Specific weight
water to air

8.335 lb/gal at 0°C
8.328 lb/gal at 60°F
8.322 lb/gal at 20°C
62.42 lb/ft³ at 60°F

Pressure

1 bar 0.9869 atmosphere
10⁶ dynes/cm²
— 14.50 lb/in²

pressure is exerted
from static water
1 cm mercury
— 0.01316 atmosphere
1 ft water
0.02950 atmosphere
33.90 ft water
1 atmosphere

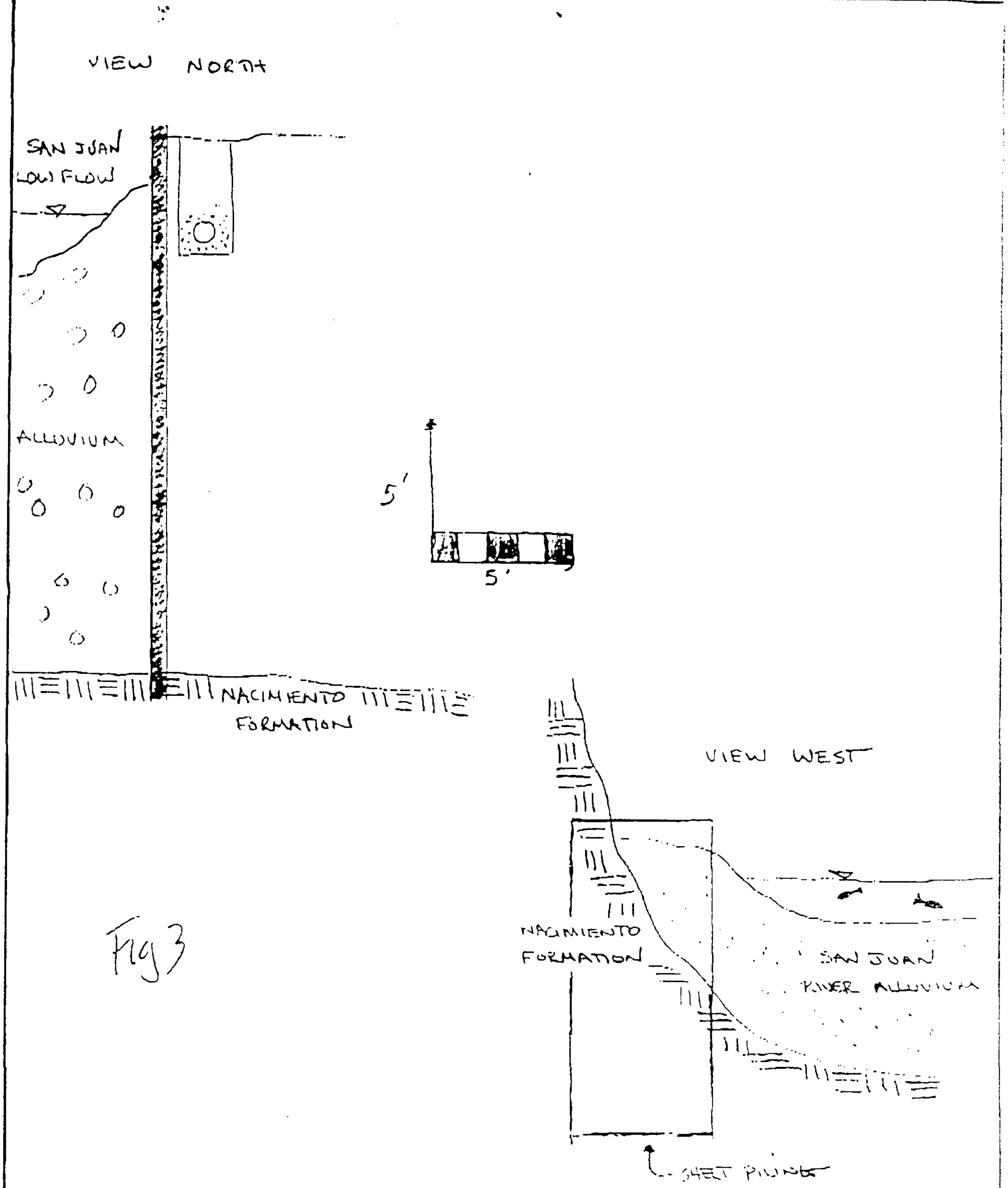


Fig 3

LOCATION:

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5419.09
TOTAL DEPTH: 10.0'
LOGGED BY: WHK
DATE: 3-14-97
STATIC WATER: 4.0'
BORING ID: SB3-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
0.0-1.0	****0****		C	SAND. LOOSE. BROWN. MOIST. (FILL) GRAVELLY	
1.0	****0****		C		
1.0-2.2	///**-///		C	CLAY. SANDY. SILT. BLACK-GREY. OLD HYDROCARBON ODOR. WET. NEARLY WATER BEARING	1[illegible]
2.2	///**-///		C		
2.2-6.0	*********		C	SAND. FINE-MEDIUM. WELL SORTED. BLACK. WET. WATER BEARING GREATER THAN 4.0 FEET	
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********	5.0	C		
	*********		C		1068
6.0	*********		C		
6.0-10.0	SSSSSSSSS		C	NACIMIENTO FORMATION	16 5
	SSSSSSSSS		C	SANDSTONE. ARGILLACEOUS. FINE. DENSE. GREENGREY. WET. NO ODOR	
	SSSSSSSSS		C		
	SSSSSSSSS		C		0
	SSSSSSSSS		C		
	SSSSSSSSS		C		
	SSSSSSSSS		C		
	SSSSSSSSS	10	C	MOIST AT 10.0 FEET	0
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5428.88
TOTAL DEPTH: 20.0'
LOGGED BY: WHK
DATE: 3-14-97
STATIC WATER: 11.5'
BORING ID: SB4-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PI (pp
0.0-6.0	///--*0//		C	CLAY, SILTY, SANDY, SOME LARGE COBBLES, BOULDER INFILL	0.0-[illegible] 0
	///--*0//		C	LARGE COBBLE (BOULDER) 4.5-6.0, BROWN	0
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//		C		
	///--*0//	5.0	C		
	///--*0//		C		
6.0	///--*0//		C		
6.0-9.5	*********		C	SAND, FINE, LIGHT BROWN, LOOSE, MOIST	
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
9.5	*********		C		
9.5-17.0	***000***	10	S	SAND, GRAVELLY, DENSE, BROWN, MOIST, WATER BEARING AT 11.5 FEET	
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000		S		
	000	15	S		
	000		S		
	000		S	GLASS FRAGMENT, HIGHLY WEATHERED FOUND AT 16.0 FEET	
	000		S		
17.0	***000***		S		
17.0-20.0	=========		S	NACIMIENTO FORMATION	
	=========		S	SHALE, BLACK/GREY, MOIST, HARD, FISSLE, LITTLE TO NO SAND	
	=========		S		
	=========		S		
	=========		S		
	=========	20	S		
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING. INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5423.26
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 4.0'
BORING ID: SB5-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE.CONDITION.COLOR.GRAINSIZE.ETC.)	FID ([illegible])
0.0-11.5	*********		C	SAND. FINE. LOOSE. MOIST. BROWN	
	*********		C		
	*********		C		
	*********		C		
	*********		C		[illegible]
	*********		C		
	*********		C		
	*********		C	BLACK. WATER BEARING AT 4.0'	
	*********		C		[illegible]
	*********	5.0	C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********	10	C		
	*********		C	SOME SHEEN	1056
	*********		C		
11.5	*********		C		
11.5-13.5	***00****		C	SAND. MEDIUM GRAINED. SOME COBBLES. DENSE. FLOWS. BLACK	
	00*		C		
	00*		C		231
13.5	***00****		C		
13.5-15.0	***00****		C	SAND. MEDIUM. GRAVELLY. GREY (DARK). NO ODOR. LOOSE	
	00*		C		
15.0	***00****	15	C		6
15.0-17.5	=========		C	SHALE. GREY. HARD. DAMP. FISSLE. (APPEARS DRY). LITTLE SAND	
	=========		C		
	=========		C		
	=========		C		
17.5	=========		C		
TOTAL DEPTH				NO SHEEN-ANY DEPTH	

LOGGED BY: W[illegible]

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-026
ELEVATION: 5422.69
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 4.67'
BORING ID: SB6-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0.0-14.5	*********		C	SAND, FINE, DAMP, BROWN, MODERATELY DENSE, BLACK, FINE AND COARSE GRAVEL	
	*********		C		
	*********		C		0
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C	BLACK AT 4.0 FEET	
	*********	5.0	C	WATER BEARING AT 4.67 FEET-NO SHEEN (NO SEPARATE PHASE)	
	*********		C	GRAVELLY AT 5.0 FEET, GRAVEL UP TO 2 INCHES IN SIZE	981
	*********		C	LITTLE TO NO SILT	
	*********		C		
	*********		C		
	*********		C		
	*********		C		511
	*********		C		
	*********		C		970
	*********		C		
	*********	10	C		
	*********		C		13
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		5[illegible]
	*********		C		
	*********		C		
14.5	*********		C		
14.5-17.5	SSSSSSSSS	15	C	NACIMIENTO FORMATION	
	SSSSSSSSS		C	SANDSTONE, FINE, GREY-BLUE, DENSE, MOIST-WET, NOT WATER BEARING, FRESH SAMPLE LOOKS	3
	SSSSSSSSS		C	DRY	
	SSSSSSSSS		C		
	SSSSSSSSS		C		
17.5	SSSSSSSSS		C		
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5423.17
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 5.0'
BORING ID: SB7-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE.CONDITION.COLOR.GRAINSIZE.ETC.)	PID (ppm)
0.0-1.0	///000///		C	CLAY. GRAVELLY. DRY-DAMP. SOFT. BROWN. NO ODOR	0.0-17.5
1.0	///000///		C		0
1.0-5.0	*********		C	SAND. FINE. LOOSE. MOIST. BROWN. NO ODOR	
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
	*********		C		
5.0	*********	5.0	C		
5.0-16.3	***000***		C	SLIGHTLY GRAVELLY GREATER THAN 4.0'	
	000		C	SAND. FINE-MEDIUM. WATER BEARING. GRAVELLY. LOOSE. BROWN. NO ODOR	
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000	10	C		
	000		C		
	000		C		
	000		C		
	000		C	BOULDER AT 11.5'-12.9'	
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000	15	C		
	000		C		
	000		C		
16.3	***000***		C		
16.3-17.5	=========		C	SHALE. GREY-BLUE. HARD. FISSLE. MOIST. APPEARS DRY	
17.5	=========		C		
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

PRECISION ENGINEERING, INC.

LOCATION: SEE SITE PLAN

LOG OF TEST BORINGS

FILE #: 97-028
ELEVATION: 5421.52
TOTAL DEPTH: 17.5'
LOGGED BY: WHK
DATE: 3-20-97
STATIC WATER: 4.0'
BORING ID: SB8-397
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0.0-4.5	**0000***		C	SAND, FINE, LOOSE, BROWN, VERY COBBLEY, MOIST	0.0-17.5
	0000*		C		0
	0000*		C		
	0000*		C		
	0000*		C		
	0000*		C		
	0000*		C		
	0000*		C		
4.5	**0000***		C		
4.5-9.0	***///***	5.0	C	SAND, CLAYEY, WATER BEARING, LIGHT GREY, VERY LOOSE, NO ODOR	
	///		C	WATER BEARING GREATER THAN 4.0 FEET	
	///		C		
	///		C		
	///		C		
	///		C		
	///		C		
	///		C		
9.0	***///***		C		
9.0-13.5	***000***		C	SAND, COBBLEY, WATER BEARING, NO ODOR, MODERATELY DENSE, GREY-BROWN	
	000	10	C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
	000		C		
13.5	***000***		C		
13.5-16.5	***00****		C	SAND, FINE, SLIGHTLY GRAVELLY, WATER BEARING, GREY, NO ODOR	
	00*		C		
	00*	15	C		
	00*		C		
	00*		C		
16.5	***00****		C		
16.5-17.5	=========		C	NACIMIENTO FORMATION	
17.5	=========		C	SHALE, BLACK, FISSLE, DENSE, MOIST, NOT WATER BEARING	
TOTAL DEPTH					

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID CONTINUOUS FLIGHT HSA

RECEIVED
AUG 6 1999
OIL CONSERVATION DIVISION

GIANT
INDUSTRIES, INC.

111 Road 4990
Bloomfield, New Mexico 87413

505
632.8006

August 3, 1999

Mr. William Olson
NMOCD
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

**Re: RIVER TERRACE REMEDIATION
GIANT REFINING COMPANY – BLOOMFIELD**

Dear Mr. Olson:

Giant Refining Company – Bloomfield submits the permeability data for the slurry wall that was installed on the river terrace immediately north of this facility. Additionally, a copy of the Particle Size Distribution Test Report is included for your information.

If you need additional information, please contact me at (505) 632 4168.

Sincerely:

Lynn Shelton

Lynn Shelton
Environmental Manager
Giant Refining Company – Bloomfield

Enclosure

Cc: John Stokes, Vice President, Giant Refining Company
Denny Foust, NMOCD, Aztec

recon
Remedial Construction Services, Inc.

July 9, 1999

Mr. Lynn Shelton
Giant Refinery
#50 County Road 4990
Bloomfield, NM 87413

RE: Permeability Data

Dear Mr. Shelton;

Attached are the tests and the graphs to substantiate our claim that the backfill placed will have an permeability of less than 1x10-6. The sieve analysis shows that the fill contained approximately 75% passing the 200 sieve. The viscosity of the slurry was measured at 40 – 50 seconds with a marsh funnel. This viscosity of slurry contains 5% to 6% by weight bentonite. When 45 second slurry is blended with a backfill you will end up with approximately 1 to 1.5% bentonite by dry weight in the backfill.

You can then use the charts to show the range of permeabilities you can expect. Should you need any additional information or if you have any questions please contact me at 281-955-2442.

Respectfully Submitted;

St R Birdwell

Steven R. Birdwell
President

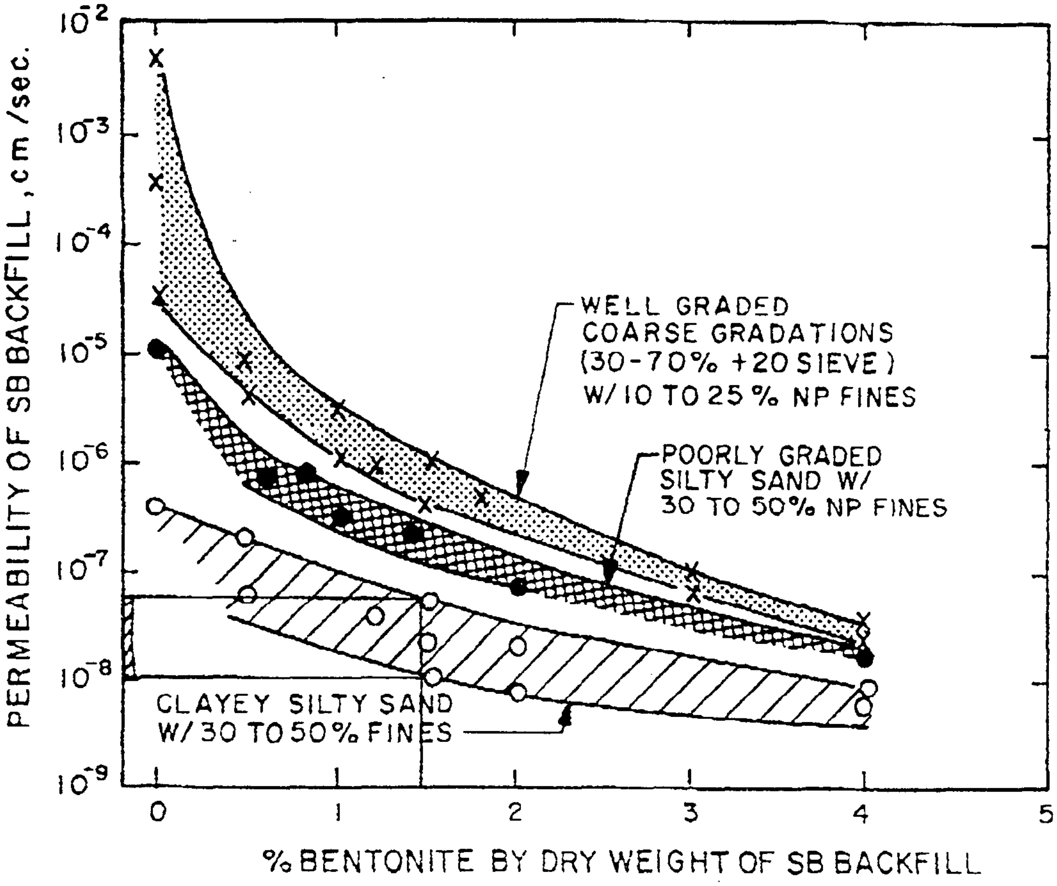


FIG. 11 RELATIONSHIP BETWEEN PERMEABILITY AND QUANTITY OF BENTONITE ADDED TO SB BACKFILL

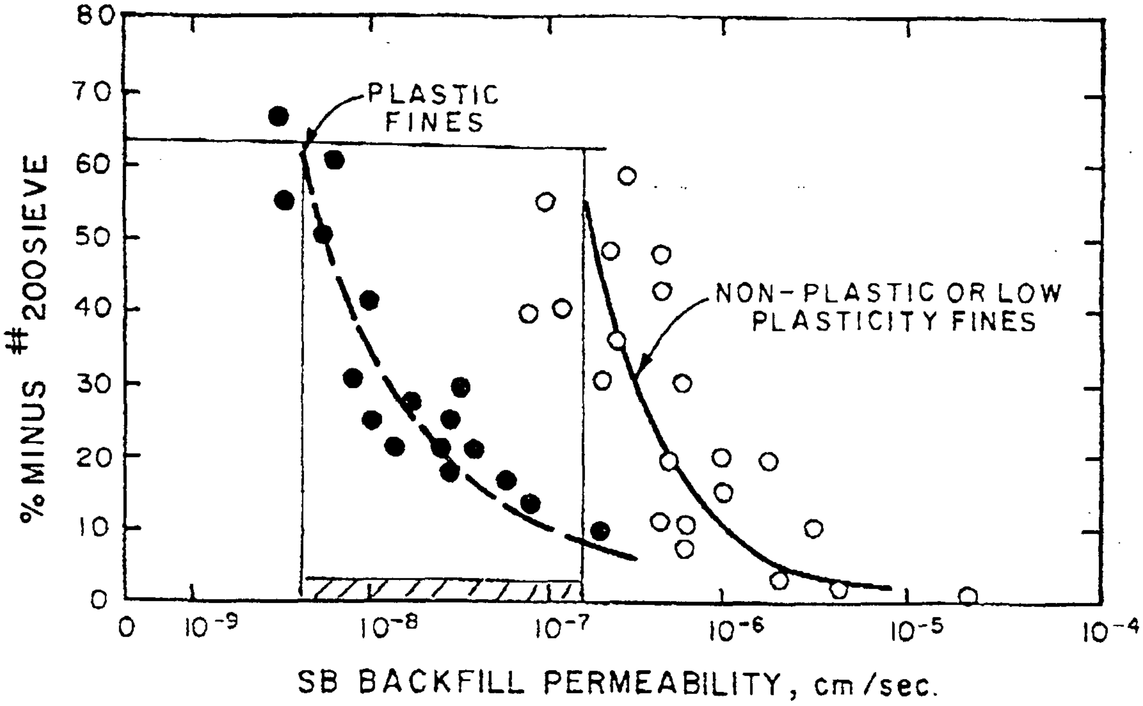
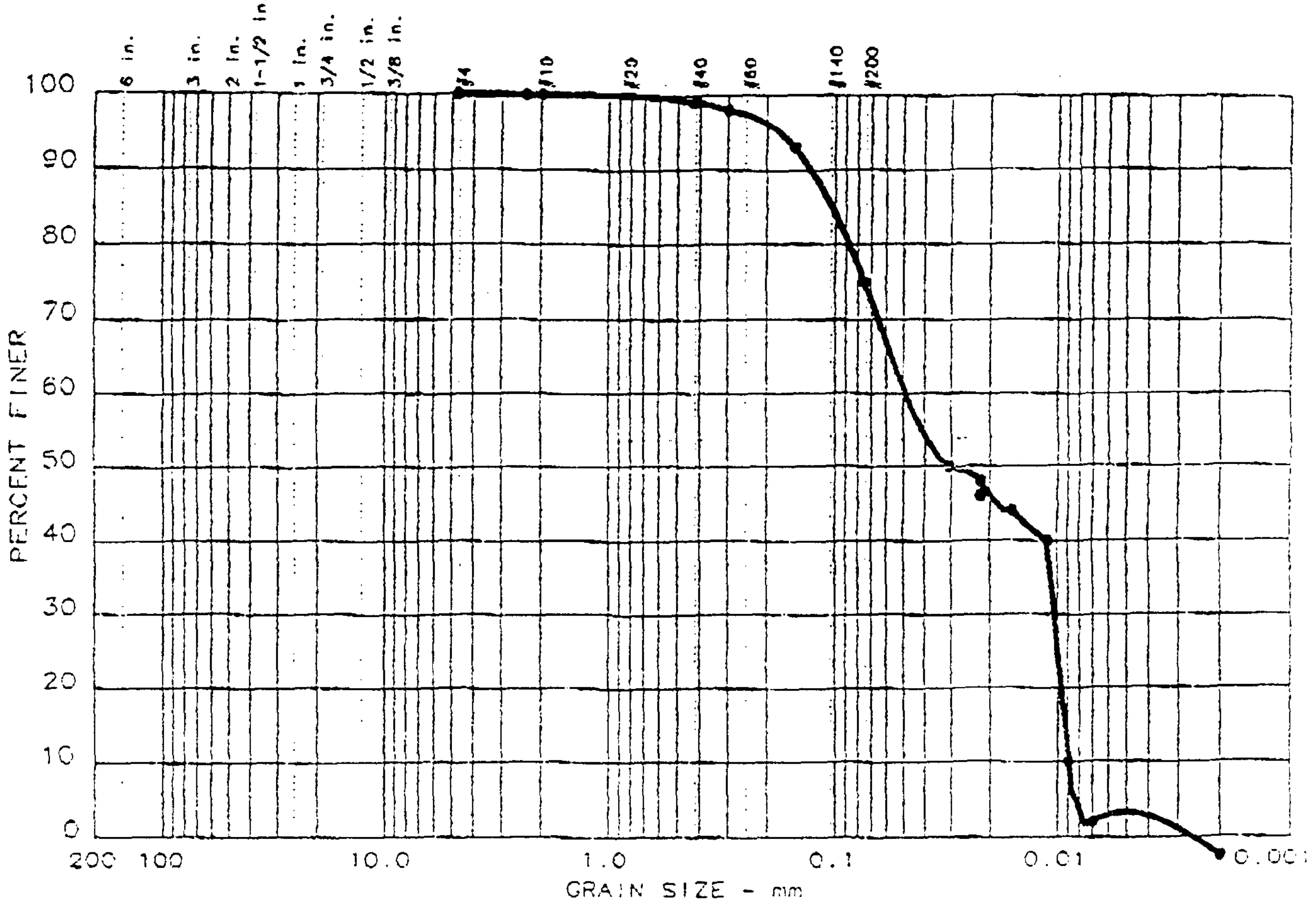


FIG. 12 PERMEABILITY OF SOIL-BENTONITE BACKFILL RELATED TO FINES CONTENT

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	13	0.0	0.0	25.0	71.7	3.3	ML		

SIEVE inches size	PERCENT FINER		
	●		

	GRAIN SIZE		
D_{60}			
D_{30}	0.01		
D_{10}	0.00		

	COEFFICIENTS		
C_c	0.24		
C_u	5.4		

SIEVE number size	PERCENT FINER		
	●		
4	100.0		
8	100.0		
10	100.0		
40	99.0		
50	98.0		
100	93.0		
200	75.0		

Sample information:
● San Juan Concrete
Silt with Sand

Remarks:
Submitted by: RCSI

Basin Engineering Inc.

Project No.: 9924-01
Project: Giant Refining Pump Station
Date: 06/23/99 Data Sheet No. 01

GIANT
INDUSTRIES, INC.

111 Road 4990
Bloomfield, New Mexico 87413

505
632.8006

June 22, 1999

Mr. William Olsen
NMOCD
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

Re: River Terrace Remediation Project

Dear Bill:

Giant Refining Company – Bloomfield recently submitted a remediation work plan outlining the steps proposed to install sheet piling. In it we proposed the use of 3/8" PVC sheet piling driven into place by a vibratory hammer and hardened steel mandrell.

Attempts to install the piling resulted in failure to penetrate the alluvial cobble zone, thereby precluding contact with the Nacimiento formation. Giant proposed to OCD to install 11' of sheet piling, which was the maximum achievable depth. It was determined that 11' of sheet piling would extend below the deepest water level of the river and meet the intended goals of the project. OCD denied this proposal.

Giant then proposed to install a slurry wall and sheet piling by excavating to the Nacimiento formation. OCD approved the approach because it extended the impermeable wall down to the Nacimiento formation. After witnessing the excavation and verifying the contact with the Nacimiento formation, we believe the slurry wall alone provides the necessary hydraulic barrier. The use of sheet piling appears to be advantageous only on the western side of the river terrace along the active river bank where erosion could take place during high water levels in the river, thereby compromising the integrity of the hydraulic barrier. Giant proposes to install sheet piling in addition to the slurry wall on the west side of the river terrace (see attached drawing).

We find no value in placing sheet piling on the interior perimeter of the hydraulic barrier where erosion is not an issue. The bentonite slurry wall will accomplish the goals of the remediation plan.

Because we are currently installing the bentonite slurry wall and will be installing the sheet piling along the west edge of the river terrace by Wednesday afternoon, we request a timely review and decision on this proposal.

If you have any questions concerning this proposal, please contact me at (505) 632 4168.

Sincerely:

Lynn Shelton
Environmental Manager
Giant Refining Company – Bloomfield

Attachment

Cc: John Stokes, Vice President, Giant Refining Company

OCD 3

In the OCD letter to Giant Refining Company dated July 17, 2002, OCD submitted the following comments and requests as Number 3: "The main text of the document discusses the need for additional upgradient and downgradient monitoring wells in order to determine background water quality and complete the delineation of the extent of groundwater contamination at the refinery. OCD requested that BRC provide a work plan to accomplish this task.

Response

BRC is currently installing a new well to establish background water quality and contamination concentrations. Information related to this well is provided in the Groundwater Monitoring and Sampling Work Plan provided in Attachment 6.

OCD 4

In the OCD letter to Giant Refining Company dated July 17, 2002, OCD submitted the following comments and requests as Number 4: The OCD defers comment on Giant's conclusions regarding the source of the total dissolved solids (TDS), chloride, nitrate, and metals contamination of groundwater and the need for remediation of these constituents until the OCD has the opportunity to review information on background quality for the site.

Response

BRC will provide additional background groundwater analytical results as soon as this information becomes available from the new monitoring well.

OCD 5

In the OCD letter to Giant Refining Company dated July 17, 2002, OCD submitted the following comments and requests as Number 5: Please provide a work plan for the proposed enhanced in-situ bioremediation pilot study for remediation of dissolved phase hydrocarbon contamination of groundwater.

Response

BRC has included the work plan for the natural attenuation for remediation of dissolved phase hydrocarbon contamination of ground water in Attachment 6.

OCD 6

In the OCD letter to Giant Refining Company dated July 17, 2002, OCD submitted the following comments and requests as Number 6: The recommended monitoring plan does not include a plan for monitoring potential migration of contaminants into surface water in the San Juan River. Please submit such a surface-water monitoring plan.

Response

BRC has included a surface water monitoring plan in the facility groundwater monitoring and sampling work plan contained in Attachment 6.