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Draft
Remedial Options Pilot Study Documentation Report
Volume 1
Grasse River Study Area

Alcoa Inc.
Massena, New York

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Volume 1 of 2

Acknowledgments

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Acronyms and Abbreviations

%	percent
2004 ROPS Summary Report	2004 Remedial Options Pilot Study Baseline Monitoring Summary Report
AA Report	Analysis of Alternatives Report
ADCP	acoustic doppler current profiler
ADVs	acoustic doppler velocimeters
AGCs	New York State Annual Guideline Concentrations
AHAs	Activity Hazard Analyses
Alcoa	Alcoa Inc.
AMS	Allen Marine Services
APE	area of potential effects
Aquatec	Aquatec Biological Services, Inc.
ARP	Alcoa Responsible Person
ATL	Atlantic Testing Laboratories
Barrett Paving	Barrett Paving Materials, Inc.
BBL	Blasland, Bouck & Lee, Inc.
Berger	The Louis Berger Group, Inc.
^{o}C	degrees Celsius
CAP	Community Advisory Panel
CBOD	carbonaceous biochemical oxygen demand
CCLGR	Comprehensive Characterization of the Lower Grasse River
CCLGR Addendum	Draft Addendum to the Comprehensive Characterization of the Lower Grasse River
CDM	Camp Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
Chadwick	Chadwick & Associates, Inc.
CHASP	Remedial Options Pilot Study Community Health and Safety Plan
ChemLab	Alcoa Massena ChemLab
CMP	Coastal Management Program
Collins-Hammond	Collins-Hammond Electrical Contractors, Inc.
Con-Test	Con-Test Analytical Laboratories
Contingency Plan	Remedial Options Pilot Study Contingency Plan
CPS	Capping Pilot Study
CRA	Cultural Resources Assessment
CRZ	contaminant reduction zone
CSM	conceptual site model
cy	cubic yards
cy/hr	cubic yards per hour
CZCA	coastal zone consistency assessment
D_{50}	average median particle size
DCF	Design Clarification Form
DCO	Design Change Order
DE	diatomaceous earth
DGPS	differential global positioning system
DMR	Alcoa's Discharge Monitoring Reports
DO	dissolved oxygen
DoC	depth of contamination
DOF	Dalton, Olmsted & Fuglevand, Inc.
DQOs	Data Quality Objectives

DustTrak	DuskTrak meter
EBCT	empty bed contact time
ECN	Engineering Change Notice
EEE	Environmental Excursion or Event
EHS	Environmental Health and Safety
ELMR	Effluent Limitations and Monitoring Requirements
Envirocon	Envirocon, Inc.
ft	feet
ft/s	feet per second
GAC	granular activated carbon
g/cm^3	grams per cubic centimeter
GPD	gallons per day
gpm	gallons per minute
GPR	ground penetrating radar
GSI	Geo-Synthetics, Inc.
HASP	Health and Safety Plan
HDPE	high density polyethylene
HP	horse power
hr/day	hours per day
ICS	ice control structure
in	inches
IQAT	Independent Quality Assurance Team
IQAT Plan	Independent Quality Assurance Team Plan
JHAs	Job Hazard Analyses
JSAs	Job Safety Analyses
kg	kilogram
kg/day	kilograms per day
kHz	kiloHertz
lbs/day	pounds per day
L/kg	liter per kilogram
MBAS	methylene blue activated substances
MGD	million gallons per day
mg/kg	milligram per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
m/day	meters per day
mm	millimeters
MPP	materials processing pad
m^2/s	meters per second
mS/cm	milliSiemens per centimeter
MSDS	Material Safety Data Sheet
MS/MSD	matrix spike/matrix spike duplicate
µg/L	micrograms per liter
µS/cm	microSiemens per centimeter
NA	not available/applicable
NEA	Northeast Analytical, Inc.
ng/L	nanogram per liter
NOAA	National Oceanic and Atmospheric Administration
NTCRA	Non-Time-Critical Removal Action
NTUs	Nephelometric Turbity Units
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation

NYSDOH	New York State Department of Health
NYSDOW	New York State Department of Water
NYS ECL	New York State Environmental Conservation Law
Operational HASP	Remedial Options Pilot Study Operational Health and Safety Plan
Operations Plan	Remedial Options Pilot Study Operations Plan
OSHA	Occupational Safety and Health Administration
OSI	Ocean Surveys, Inc.
OTF	"On-The-Fly"
PAHs	polycyclic aromatic hydrocarbons
PC	personal computer
PCBs	polychlorinated biphenyls
PDA	personal digital assistant
PEHSRs	Project Environmental, Health & Safety Reviews
PEL	permissible exposure level
Perras	Perras Environmental & Excavating
PFDs	personal flotation devices
PID	photoionization detector
PM_{10}	particulate matter less than 10 microns
PPA	project personnel area
ppm	parts per million
ppt	parts per trillion
psi	pounds per square inch
PVC	poly vinyl chloride
QA	quality assurance
QC	quality control
QEA	Quantitative Environmental Analysis, LLC
RBPs	Rapid Bioassessment Protocols
RDS	residual disturbed sediment
ROPS	Remedial Options Pilot Study
ROPS O&M Amendment	Remedial Options Pilot Study Secure Landfill Operations and Maintenance Manual Amendment
ROPS Work Plan	Remedial Options Pilot Study Work Plan
RTK	real-time kinematic
RTMM	real-time monitoring methods
Sevenson or SES	Sevenson Environmental Services, Inc.
S.G.	specific gravity
SHPO	New York State Office of Parks, Recreation, and Historic Preservation; State Historic Preservation Office
SLF	Alcoa's Secure Landfill
SLF Cell 3 Air Monitoring Plan	Additional Air Monitoring Activities Associated with the Operation of Secure Landfill Cell
S&L	S&L Electric
SOP	Standard Operating Procedure
SORs	Safety Observation Reports
SPA	single point of accountability
SPDES	New York State Pollutant Discharge Elimination System
SPT	standard penetration test
SRMT	St. Regis Mohawk Tribe
SRS	Supplemental Remedial Studies
SSOP	Safe Standard Operating Procedure
SWPPP	Remedial Options Pilot Study Stormwater Pollution Prevention Plan

TAMS	TAMS/EarthTech
TAT	turn-around-time
TDS	total dissolved solids
TIN	triangular irregular network
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TSCA	Toxic Substances Control Act
TSS	total suspended solids
UI	untouched inventory
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USLS	United States Lake Survey
VOAs	volatile organic analytes
VOCs	volatile organic compounds
WCT	Waste Stream Technologies
WET	whole effluent toxicity
WINOPS	Windows Offshore Positioning System
YOY	young-of-year

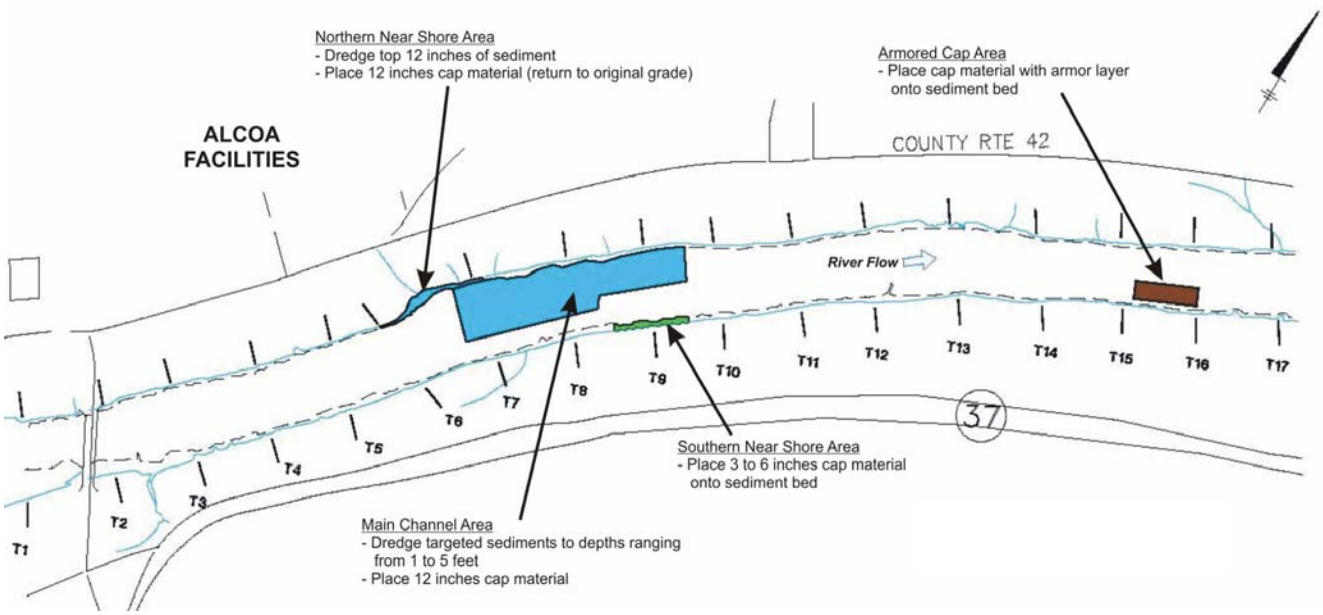
Executive Summary

Alcoa Inc. (Alcoa), with oversight from the United States Environmental Protection Agency (USEPA), conducted a Remedial Options Pilot Study (ROPS) during 2005 to further evaluate potential remedial options for a stretch of the lower Grasse River near its Massena West Plant in Massena, New York. Since 1989, Alcoa has worked with the USEPA, the New York State Department of Environmental Conservation (NYSDEC), and the St. Regis Mohawk Tribe – collectively referred to as the Agencies – to investigate the river and develop a comprehensive approach to address potential human health and ecological risks associated with the sediments in this area of the river that are impacted by polychlorinated biphenyls, or PCBs. The ROPS is the latest effort in advancing this collaborative process.

The three primary objectives of the ROPS were:

- Evaluate remedial options to reduce potential risks associated with exposure to buried PCBs that could be mobilized by a future ice jam-related sediment scour event in the lower Grasse River;
- Develop information to address outstanding issues regarding remedy effectiveness, remedy implementation, and the conceptual site model that impact the analysis of remedial alternatives; and
- Make progress in the lower Grasse River to support final remedy development, evaluation, selection and implementation.

The multiple components of the study – removing sediment by dredging; covering areas of the river bed with different types of caps; monitoring conditions in the river before, during, and after the work; and conducting longer-term post-construction monitoring in 2006 – were selected and developed to build upon previous work and achieve the three main objectives by addressing outstanding issues associated with the formulation, evaluation, effectiveness, and cost of long-term remedial options for the river. Locations of each component of the study are shown on the figure below.



Remedial Options Pilot Study – Program Elements

Historical Overview

Cleanup at the Massena West Plant

Alcoa has conducted extensive site remediation and wastewater treatment system upgrade work at the Massena West Plant under agreements with the NYSDEC. A major focus of these efforts, which took place over a 10-year period, was the control of PCB discharges to the Grasse River. Source control is a critical component of the overall strategy to reduce PCB levels in fish in the lower Grasse River.

As part of an Administrative Order issued by USEPA in 1989, Alcoa has conducted extensive investigations, and analyzed a range of remedial alternatives for the Grasse River Study Area. Results of the studies indicated that the evaluation of potential remedial options should be focused on a 7-mile stretch of the Grasse River between the Massena Power Canal and the St. Lawrence River. This reach is referred to as the lower Grasse River.

The primary contaminant of concern in the lower Grasse River is PCBs. The results of the most recent human health risk assessment – developed in 2001 – indicated that consumption of fish from the lower Grasse River was the primary driver of potential risks at this site. In the near term, this potential risk is being addressed by the New York State Department of Health's fish consumption advisory, which recommends that people eat no fish taken from the lower Grasse River. In support of a long-term solution, Alcoa has been sampling Grasse River sediments, surface water, and biota since the early 1990s. These investigations have been designed to develop an understanding of the nature and extent of site-related impacts to the river as well as PCB fate and transport processes, particularly with regard to identifying where opportunities exist to control the transfer of PCBs from environmental media to fish. A major effort was also undertaken during this timeframe to control PCB discharges to the river through on-site remedial actions and wastewater treatment system upgrades.

In addition, Alcoa began evaluating potential remedial alternatives to address potential risks associated with PCBs in river sediments, surface water, and biota (particularly fish) by performing two in-river pilot studies. In 1995, Alcoa completed a Non-Time-Critical Removal Action, which resulted in the removal of sediments from a 1-acre area of the river directly offshore of the main wastewater discharge outfall from the Massena West Plant. Alcoa performed another pilot study in 2001 in a 7-acre area to evaluate the feasibility and effectiveness of various approaches to subaqueous (underwater) capping. The conceptual site model for the lower Grasse River – developed from extensive site investigations, pilot projects, and the 2001 risk assessment – indicated that reducing surface sediment PCB levels should be the focus of any future remedial efforts directed at addressing potential site risks. Following the completion of these activities, Alcoa developed an Analysis of Alternatives (AA) Report for the site that was submitted to USEPA in June 2002.

Data collected in 2001 and 2002 indicated that the subaqueous cap installed in 2001 was intact, there was no evidence of PCBs moving into or through the cap, and a variety of organisms were re-colonizing the capped area. However, monitoring of the river in spring 2003 revealed that the cap, and in some areas the underlying sediment, had been disturbed. A severe ice jam, which occurred in the lower Grasse River in spring 2003, increased water velocities and generated turbulence underneath the ice, causing the scouring of sediments in some portions of the study area. The ice jam-related scour was not expected, and the pilot cap had not been designed to withstand the forces generated by such a severe event.

Remedial Options Pilot Study – Overview and Results

Although the 2003 ice jam did not result in system-wide changes in PCB levels in fish, sediments, or surface water, the impact of ice jam-related scour was a new factor that had not been previously considered in the evaluation of remedial alternatives presented in the 2002 AA Report. In addition, Alcoa and the Agencies realized that despite the extensive studies undertaken to date, there were still some outstanding questions regarding the conceptual site model and the potential effectiveness of long-term remedial options that needed to be answered to support the development of a comprehensive, effective remedy for the site. To gather

information necessary to advance the evaluation and selection of a remedy for the lower Grasse River and revise the 2002 AA Report, Alcoa and the Agencies agreed to perform the ROPS during the 2005 construction season.

An extensive pre-project planning effort was undertaken, given the magnitude and complexity of the proposed activities as well as the constraints imposed upon the project for protection of the environment and surrounding community with respect to water quality criteria, effluent discharge criteria, air quality, noise, and lighting. Specific activities undertaken in this regard included developing detailed plans for project safety, conducting a rigorous 8-month long contractor selection process, completing site-specific treatability studies, collecting baseline monitoring data, submitting a significant number of project planning documents to USEPA for review and approval, conducting public information sessions, and assembling a technical advisory team for the project.

Selection of the contractor was a critical element of the project planning effort. The solicitation distributed to prospective contractors did not specify means and methods, but set forth the objectives of the program and the constraints that would apply in the conduct of the work. The horizontal auger dredge used for the majority of the site dredging work was recommended by the selected contractor (Sevenson Environmental Services, Inc. [Sevenson]) based on their prior experience in the remediation of sediment sites coupled with site conditions information provided by Alcoa. Additional information considered in the contractor selection process included: the level of experience and results of other sediment remediation work conducted by the contractor; use of similar dredging equipment (e.g., horizontal auger) for both the 1995 Non-Time-Critical Removal Action and a sediment remediation project on the St. Lawrence River; and the ability to successfully manage all of the project elements, including safety, sediment processing, water treatment, compliance with water quality action levels, and community impacts. As discussed in the *Dredging Implementation* section (below), alternative dredging equipment was also brought on site toward the end of the project in an effort to evaluate whether the different technologies would provide substantially different results.

Detailed plans were then developed for the primary elements of the study, which originally included:

- Dredging in the main channel of the river (including the side slopes) and northern near shore area;
- Placing three different types of sediment caps (post-dredge, thin-layer, and armored) in four different locations in the study area;
- Monitoring conditions in the river before, during, and after dredging and capping activities; and
- Designing and constructing an ice control structure.

Installation of an ice control structure was identified as a method of mitigating potential impacts of severe ice jams like the one that occurred in spring 2003. This approach was initially proposed as a component of the ROPS, with the recognition that it could potentially be incorporated as a component of a final remedy to protect the section of river prone to ice scour from future ice jam-related events. After reviewing physical characteristics at locations along the river, an area upstream of the Route 37 Bridge was initially identified as the preferred spot for construction of such a structure as part of the ROPS. However, in response to community concerns raised with respect to the originally proposed location (which was several miles upstream of the study area), Alcoa and USEPA agreed to evaluate alternative siting locations for an ice control structure and review alternative interim ice control measures. This effort is now proceeding as a separate activity.

In general, the ROPS was carried out as follows:

- Mobilization to the site: April to June 2005;
- Dredging and debris removal in the northern near shore and main channel: June to October 2005;
- Northern near shore and main channel capping: September to November 2005;
- Armored capping: September to October 2005;

- Thin-layer capping: November 2005; and
- Demobilization and restoration: October to December 2005.

Monitoring activities were carried out before, during, and after the study to assess the effects of implementation on the river system and surrounding communities, to gauge progress, and to evaluate achievement of ROPS objectives. Waste materials generated during the ROPS were disposed in Alcoa's on-site Secure Landfill. A new disposal cell had to be designed and constructed for this purpose – work started in 2004, and USEPA and NYSDEC approved operation of Cell 3 in July 2005.

Each of the major elements of the ROPS is described below, followed by a discussion of the critical findings and conclusions that will be considered during future efforts to develop and evaluate potential long-term remedial options for the site.

General Activities

Mobilization – Mobilization activities in the project area began on April 11, 2005. Four distinct areas were established to support implementation of the in-river work: 1) project personnel area – for office space, training, shelter for field workers, parking, and restrooms; 2) materials processing pad – for handling and processing dredged materials; 3) river operations area – for supporting on-river activities including dredging booster pump area, floating dock, and materials staging area; and 4) Secure Landfill Cell 3 – for disposal of waste materials generated during the ROPS.

Silt Curtain Installation – To mitigate movement of resuspended sediment and PCBs outside the various work zones, a silt curtain containment system was installed around each area targeted for dredging and/or capping. The curtains enclosed the northern near shore and main channel dredging/capping areas. Installation of curtains in the main channel began on May 20, 2005 and was completed by June 4, 2005. Additional silt curtains were installed in an "L" configuration downstream of the armored cap area and the southern near shore cap area later in the construction season, closer to the time capping was carried out in each area.

Throughout the ROPS, the curtains required full-time maintenance by a three-man dive crew – an unexpected task. This was necessitated by damage incurred as a result of both the pressure wave phenomenon in the Grasse River associated with the release of water from the Snell Locks at the mouth of the river and from several extreme flow events that occurred during the study. Daily inspections were carried out, and damage – such as ripped seams, broken anchor lines, misalignment, and tears in the skirt – was noted and repaired as quickly as possible. A second dive team was called in as necessary to keep down time to a minimum. As the ROPS progressed, modifications were made to the curtain system, including installing gates to allow barge and scow traffic to more easily move in and out of the work zones, and later replacing those gates with air curtains. In addition, new higher strength curtains were ordered and installed, and supplemental anchors were added to the downstream curtains, all in a continuous effort to improve performance and reduce maintenance. Even with these extra efforts, severe damage to the curtains occurred after a number of high flow events and intense local storms in September and October. In each of these cases, dredging was shut down until the silt curtain system could be completely repaired. These maintenance efforts increased dredging down time, added significant cost to the project, and the need for full-time diver support resulted in additional project-related safety risks.

Dredging – Pre-ROPS Conditions in the Main Channel

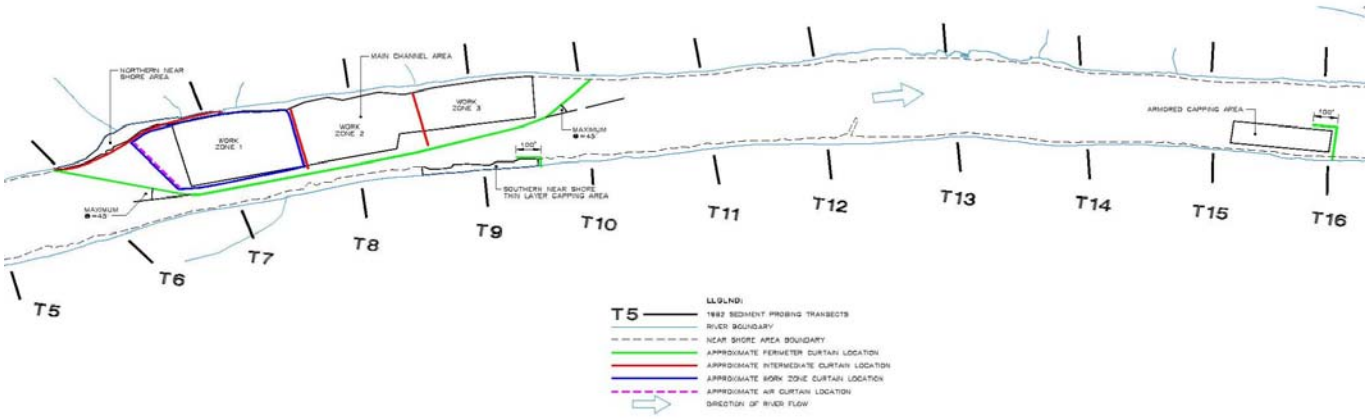
As part of planning the dredging activities in the main channel – the primary dredging component of the ROPS – Alcoa reviewed the data and findings generated from extensive historical characterization efforts as well as new information gathered during ROPS-related baseline investigations. Critical factors considered included:

- The targeted area of the main channel had been dredged between 1914 and 1918 to accommodate the increased water flow from the Massena Power Canal. Operation of the canal ceased in 1957, and as a result, sediments began to accumulate over the dredged river bottom.
- The topography of the surfical sediment layer in the area to be dredged was relatively flat and featureless, with the exception of the steeper side slope areas bordering the main channel.
- Profiles developed from sediment push coring activities indicated that PCB concentrations in the upper portion of the sediment column were relatively low, compared to the deeper portions of the recoverable sediment column, where peak PCB concentrations ranged as high as several thousand parts per million (ppm).
- Previous sediment probing and push coring work conducted in the river indicated that the PCB-containing sediments were underlain by hard bottom material comprised of some combination of rock and/or dense glacial till. Evidence of bedrock and rock formations in the river bed at or close to the river bottom was observed in geotechnical borings conducted at the Alcoa bridge (located a short distance upstream of the work area), and a dense till layer had been identified as a regional stratigraphic feature during site-related geotechnical work.
- Some boulders and cobbles were expected to be present in the sediments targeted for dredging based on the results of the 1995 Non-Time-Critical Removal Action. During the 1995 work, these materials were managed by completing debris removal operations prior to dredging.
- Efforts to characterize the sub-bottom (e.g., what was present under the surface sediment layer) at the site using remote sensing techniques were unsuccessful due to the presence of conditions that affected signal return.

Collectively, this information was used to establish the targeted removal depths (typically 3 to 5 feet) and volume (approximately 64,000 cubic yards [cy]), and to inform prospective contractors of the types of site conditions that would be expected to be encountered during the dredging component of the work.

Dredging Implementation

Main Channel – The main channel was initially divided into three separate work zones (see figure below). Debris removal began in Work Zone 1 on June 10, 2005 after the mobilization activities were complete and the silt curtains were in place. In general, debris removal preceded sediment removal, and was carried out continuously during the main channel work. Dredging was initiated on June 14, 2005. A MudCat horizontal auger hydraulic dredge was used for the work after it was determined during the system shakedown period that the ESG Manufacturing dredges originally brought on site by the contractor were not capable of providing a sustained flow of dredge slurry to the material processing pad.



Throughout the main channel dredging efforts, equipment maintenance was a continuous issue, and repairs – which ranged from fixing broken augers or gear housings to addressing hydraulic pump and electronic system problems – in conjunction with limitations imposed by the dredge slurry processing system resulted in significant down time for the dredges. Weather also complicated removal efforts. At times high winds, high river flows, and lightning all created potentially unsafe working conditions and/or impacted the integrity of the silt curtain system, so in these instances operations were shut down until work could be safely resumed.

Hydraulic dredging in the main channel area

After dredging the top layer of sediment, a variety of issues complicated removal of the remaining materials, and by mid-August, far less sediment had been removed than originally anticipated. The underlying river bottom was determined to be irregular and uneven, and dredge operators frequently encountered hard bottom, rocks, or interbedded debris – all of which resulted in equipment damage and delays. Further, the results of sampling efforts conducted to track the progress of the removal work indicated that significant deposits of PCB-containing sediments remained in many areas after repeated dredging attempts. These problems were compounded by the fact that as sediment removal became more difficult, the dredged material contained less sediment and more water, and that excess water had to be separated from the sediments and treated. Finally, the results of daily water column sampling showed periodic exceedances of the PCB water quality action level, which necessitated modifications to the type of equipment employed and operation of the debris removal process. Collectively, all these issues complicated removal efforts and significantly reduced dredging productivity.

Alcoa and the project team incorporated a variety of modifications to the dredging plan in an effort to address these complications and maintain progress toward the project goals. These actions included:

- implementing an alternative sediment sampling methodology (vibracoring) in an effort to accurately characterize the depth of remaining PCB-containing sediments;
- conducting a multibeam bathymetry survey across the work area to provide a better understanding of the actual bottom conditions encountered and to gauge progress on sediment removal efforts;
- deploying divers to collect video footage of selected topographic features (typically boulders, rocks, and rock formations) observed on the multibeam survey;
- varying the dredge operation parameters in terms of orientation relative to river flow, forward speed, and auger rotation rate in an effort to improve capture of the remaining sediments;
- performing numerous dredging passes in particular areas despite routinely encountering obstructions and hard bottom conditions to attempt to further remove residual PCBs;
- modifying debris removal equipment and associated operating practices in an effort to address periodic exceedances of the water quality action level for PCBs;
- deploying alternative dredging equipment towards the end of the study; and
- initiating the use of Geotubes in an effort to relieve capacity constraints in the sediment dewatering system.

Large rocks and debris removed from the river

The results of some of these additional investigative efforts, coupled with a recognition in late August that estimates of the volume of sediment removed developed by the contractor were significantly in excess of actual removal volumes, led Alcoa, in coordination with USEPA to reassess what could be completed in the remaining

construction season. Specifically, Alcoa proposed to concentrate remaining removal activities in Work Zone 1 and the first 75 feet of Work Zone 2, which represented approximately one third of the main channel area included in the original plans. This area – referred to as "expanded Work Zone 1" – was targeted in an effort to learn as much as possible about the issues impacting removal of the remaining sediments and to complete removal to the extent possible before the end of the season. No further removal work would occur in Work Zone 2, and no removal would occur in Work Zone 3.

In addition, in early October, Alcoa tested a mechanical clamshell dredge and a swinging ladder cutterhead hydraulic dredge at the site. Specific attributes that were considered in mobilizing the cutterhead dredge included: the cutterhead's spud-based travel system might not be affected to the same degree by bottom obstructions as the cable-based travel system on the horizontal auger; and the smaller footprint of the cutterhead may be better able to work around some of the obstructions encountered and better handle small debris. The use of the cutterhead dredge was limited (October 12-21, 2005) and the dredge was targeted to work in specific areas within Work Zone 1, most of which had already been subject to multiple dredging passes by the horizontal auger. Results of sampling conducted after the completion of the work and measurements of the volume of sediment removed indicated that the cutterhead dredge did not provide any significant improvements in dredging efficiency.

The mechanical dredge employed consisted of an excavator mounted with a small hydraulically-actuated clamshell bucket. The mechanical dredge was used on five days in discrete sections of the work area and no significant improvements were noted. Although limited conclusions can be drawn from this effort due to the short duration of the work, the site bottom conditions encountered would be expected to impact the effectiveness of any conventional dredging technology.

Mechanical removal in the northern near shore area

Northern Near Shore Area – In the northern near shore area, conventional mechanical excavation equipment (i.e., a long stick excavator) mounted on a barge was used to remove debris and targeted sediments to a depth of 1 foot. Removal activities began on June 21, 2005 and the initial pass was completed on June 24, 2005. Efforts shifted to the main channel for a time, and removal did not resume in the northern near shore area until July 25, 2005. After five days of removal at the end of July, monitoring results revealed that less than 1 foot of material had been removed across much of this river section, so additional follow-up excavation was performed between August 12 and 22, 2005. Completion of the removal effort was documented by comparing pre- and post-dredging elevation measurements to verify that a minimum of 1 foot of sediment had been removed across the entire 700-foot by 30-foot area.

Dredging Results

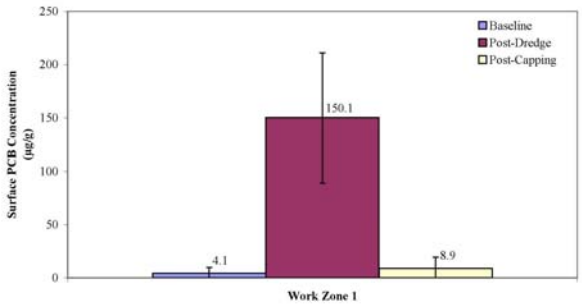
Damage to a silt curtain

Many valuable lessons were learned during dredging in the main channel, but removal efforts were complicated by a number of factors. As a result, despite numerous attempts to improve efficiency and productivity, at the end of the season, significant amounts of PCB-containing sediment remained in some portions of expanded Work Zone 1. In the early part of the season during the initial dredging passes, sediments were removed at about 38 cubic yards per hour (cy/hr), but as efforts turned to removing remaining sediments and negotiating the rockier, more irregular areas, dredging productivity dropped by nearly half, to about 20 cy/hr, then further declined in the

final two weeks. This overall decline was attributed to frequent damage to the equipment from the hard bottom and/or rocks, difficulty in removing the residual materials, and delays due to periodic insufficient capacity in the water treatment/dewatering system. Alcoa and the project team made various technical adjustments, brought in new dredging equipment, introduced Geotubes to speed the sediment dewatering process (as described in the *Sediment Dewatering* section below), and focused removal activities in September and October on expanded Work Zone 1. All these efforts were met with limited success. Removal volumes remained low, non-productive dredge time was significant, and productivity rates were below targets.

Further, removal activities resulted in PCB concentrations at downstream water quality monitoring stations that occasionally exceeded the action level established for the project, so a number of adjustments to the process (new equipment, modified implementation approaches, varying speeds) were implemented, with varying degrees of success. In addition, the project team studied the impacts of river flows on PCB transport. The information gathered and lessons learned during these efforts will be considered as the AA Report is revised.

Dredging in the main channel ended October 21 to allow enough time to complete capping activities before the end of the construction season. Comparison of pre- and post-dredging multibeam surveys indicated that approximately 24,400 cy (20,600 cy in Work Zone 1 and 3,800 cy in Work Zone 2) of the originally targeted 49,500 cy of sediments had been removed from these main channel work areas. Post-dredging surveys in the expanded Work Zone 1 revealed that approximately 84% of the PCB mass targeted was successfully removed, but residual sediments were, on average, 16 inches thick with an average surface PCB concentration of 150 ppm, compared to the pre-dredging baseline concentration of 4.1 ppm. The significant increase in PCB concentrations after dredging and the quantity of PCB-containing sediment remaining – despite extensive efforts to remove all the targeted materials – will be among the factors considered when the potential effectiveness of dredging is assessed as part of the revisions to the AA Report. As discussed below, the entire area of the main channel that was subject to dredging and/or debris removal operations was capped prior to the conclusion of construction activities to isolate remaining PCBs.



In the northern near shore area, the 1-foot thick layer of sediment targeted for removal was successfully dredged, although much more material was removed than originally anticipated (1,600 cy versus the initial estimate of 800 cy). No significant operational issues were encountered with the exception of survey control issues resulting in the area needing to be revisited twice following the initial removal effort to achieve the target depth of removal. The average post-dredging surface PCB concentration was an order of magnitude lower than pre-ROPS conditions (1.9 ppm compared to 19 ppm). This result, in contrast to the post-dredging concentration measured in the main channel dredge area, is likely due to the fact that PCB concentrations in the materials removed from the northern near shore area were significantly lower than the concentrations present in the sediments from the main channel work area. Further, with the target removal depth limited to 1 foot, the dredge operators never had to contend with the issues associated with encountering the hard, rocky, uneven river bottom.

Sediment Dewatering, Processing, and Disposal at Alcoa's Secure Landfill Cell 3

Material removed from the river was sent to the materials processing pad. Large objects within the hydraulically dredged materials (small debris, stones, wood, etc.) were segregated using screens; remaining materials were dewatered; water removed from the sediments was captured, treated, and tested before being discharged to the river; and the dewatered material was disposed in Cell 3 of Alcoa's Secure Landfill. The mechanically removed sediment and debris were stockpiled at the materials processing pad and stabilized as necessary before being shipped to the Secure Landfill for final disposal.

Disposing removed materials at the Secure Landfill

The dewatering process included several steps. A sedimentation tank and two hydrocyclone desanding units were used to separate and collect the coarse fraction of sediments, a polymer was mixed in to the sediments to improve dewatering, and then filter presses were used to remove water from the fine fraction of sediment that passed through the sedimentation tank/hydrocyclone units. The filter presses squeezed out as much remaining water as possible, and the resulting "filter cake" was removed from the press, stockpiled at the materials processing pad, and ultimately transported by truck to the Secure Landfill.

All water extracted from the dredged sediments was collected and treated on-site, along with stormwater that came in contact with the materials processing pad and incidental ROPS-related water from pressure washers and other operations. The treatment system was designed to achieve 99% removal of PCBs, 99.8% removal of suspended solids, and 95% removal of total organic carbon. To achieve these targets, the water was filtered to remove most of the suspended solids and associated PCBs, sent through granular activated carbon vessels to remove remaining PCBs and other organic compounds, then filtered again to capture fine particles and associated PCBs. The treated water was sampled to verify achievement of the removal targets before being discharged to the Grasse River. No exceedances of the effluent criteria for PCBs occurred at any time during the study.

Geotubes used for dewatering

Several times during the ROPS, dredging in the main channel was delayed because of insufficient capacity in the dewatering system. In response to this issue, the previously scoped Geotube pilot study was performed as a method of increasing dewatering capacity. Four 60-foot circumference, 203-foot long Geotubes were positioned at the materials processing pad to evaluate the efficiency of this alternate dewatering approach. Geotubes are similar to long fabric socks – the sediment slurry from the river is pumped inside the tube, and sediment is retained while river water drains out through the fabric. A polymer was added to the sediment before it was pumped into the Geotubes to improve the dewatering characteristics of the slurry. The filled Geotubes were allowed to dewater, then they were cut open, the contents were stabilized, and the dewatered sediments were removed and disposed at the Secure Landfill. All the water that drained out of the Geotubes was captured and treated before being discharged back to the Grasse River. Although valuable information on the use of Geotubes was collected and operational dredging time was increased, the addition of the Geotubes did not have a significant impact on dredging productivity rates.

Capping Implementation

After dredging, the removal areas were covered, or capped, with a clean mixture of sand and topsoil to limit the potential for exposure to remaining PCB-impacted sediments. In the main channel and northern near shore area,

the plan called for the placement of approximately 1 foot of a sand and topsoil mixture, and the goal in the northern near shore area was to restore the riverbed to the pre-ROPS elevation/grade.

Caps were also placed in two areas that were not dredged. A thin-layer cap, consisting of 3 to 6 inches of sand and topsoil, was placed in the southern near shore area over top of the existing sediments to evaluate implementation of capping in an area with shallow water that had not been dredged. In addition, an armored cap was placed on native (un-dredged) sediments in an approximately 1-acre location downstream of the main ROPS work area. There were two different configurations of the armored cap, which was designed specifically to resist the faster water flows and scour forces associated with ice jams. In the upstream half of the area, the cap consisted of a layer of sand and topsoil, a filter layer of small gravel, and then an armor layer of large stones. The downstream half cap consisted of two different filter layers of small gravel, and a top layer of large armor stones.

Capping Results

Placing capping materials

Since more than the targeted 1 foot of sediments were removed in the northern near shore area, additional capping material was necessary to restore the original bottom elevation across the area. Approximately 1,700 cy of sand and topsoil were placed as part of the capping effort in the northern near shore area, which lasted for 11 days between September 12-22 and November 2-5, 2005. The final cap thickness ranged from 0 to 2.2 feet, averaging 1 foot across the area. Post-placement samples of the cap surface analyzed for PCBs showed an average concentration of 0.24 ppm, which represents an 87% reduction relative to post-dredging conditions (1.9 ppm) and a 99% reduction compared to baseline conditions (19 ppm). In addition, there was relatively little mixing of the underlying sediments and cap materials, and the mixing that did occur appeared to be limited to the bottom 2 to 4 inches of the cap.

In the main channel area, capping was completed in 17 days, beginning on October 22 and ending on November 10, 2005. Approximately 11,600 cy of sand and topsoil were placed across expanded Work Zone 1 and Work Zone 2. Samples of the main channel cap surface analyzed for PCBs showed an average concentration of 7.4 ppm, which represents a 95% reduction relative to post-dredging conditions (139 ppm). However, the average post-capping concentrations actually reflect an increase from average surface sediment PCB levels across Work Zones 1 and 2 prior to the ROPS (3.8 ppm). Placement of the cap materials in a single lift, which was successfully performed during the Capping Pilot Study in 2001 over areas of the river that had not been dredged, was likely a factor in the post-capping PCB levels observed. These findings will be among the issues considered as the AA Report is revised and a range of site-wide remedial alternatives are developed and assessed.

Grid-based elevation measurements were taken during cap placement to monitor achievement of the target cap material thickness of 1 foot (with an allowable over placement of 6 inches). A multibeam bathymetric survey conducted at the conclusion of all site construction activities indicated that there was significant variability in the thickness of the final main channel cap, which ranged from 0.5 to 2.5 feet with an average of 1.5 feet in the main channel capping area. Although there are uncertainties associated with the results of the multibeam work due to considerations such as consolidation of the cap material, these results indicate the need to further evaluate cap placement techniques in the future to achieve a more uniform coverage across the targeted area.

The armored cap was placed over a 22-day period, beginning September 23 and ending October 21, 2005. Approximately 2,600 cy of materials were placed during this time. Grid-based elevation measurements were

taken during armored cap construction to monitor achievement of the target cap material thickness of 2.1 feet in the upstream half of the cap area and 1.7 feet in the downstream half of the cap area (with an allowable over placement of 12 inches). Comparison of pre- and post-armored capping multibeam bathymetric surveys indicated that, on average, final cap thicknesses were 1.9 feet in the upstream portion (which included the sand/topsoil base layer) and 1.3 feet in the downstream area. As with the caps in the main channel and northern near shore areas, these results will be used to evaluate future cap placement techniques. Post-placement PCB levels were not measured in the armored cap area due to logistical considerations associated with sampling the materials used for the armor and base layers.

Finally, the thin-layer cap consisting of approximately 300 cy of sand and topsoil was placed in the southern near shore area in 3 days, between November 15 and 17, 2005. Cap thickness estimates from manual elevation measurements indicate an average cap thickness of about 0.4 feet (range of 0.3 to 0.5 feet), which was within the target cap thickness of 0.3 to 0.5 feet (3.6 to 6.0 inches). PCB levels measured at the cap surface post-placement were near or below the detection limit in five of the six cores collected from this region. One core (SNS-4) contained a surface PCB concentration of 3.3 ppm; however, this sample appeared to consist of native sediment and not cap material. The average PCB concentration in the surface of the thin-layer cap was 99% lower than the pre-ROPS value (0.06 ppm compared to 8.3 ppm), considering the five cores that contained cap material. Considering all six of the post-placement cores, the average PCB concentration in the surface of the cap was about 0.60 ppm. This value is nearly 93% lower than the pre-ROPS value of 8.3 ppm. Further, there appeared to be little mixing of the cap material and underlying sediments.

Demobilization

After dredging in the main channel was completed, demobilization began. A variety of activities were carried out between October 22 and December 16, 2005 to restore the work areas and prepare the site for winter, including:

- Equipment that either came in contact with waste or was used/located in a restricted work area was pressure washed and wipe sampled before being released from the site;
- The wastewater treatment system was dismantled and decontaminated;
- Dredges and other equipment were drained of water to prevent damage from freezing;
- Silt curtains and associated anchors, chains, and floats were removed from the river and disposed at an offsite waste facility; and
- The project personnel area was shut down and the structures were removed.

Concurrent with the demobilization effort, most site areas disturbed during the ROPS were restored. Restoration could not be completed before the onset of winter weather in December, so these efforts will be finished in 2006.

Monitoring

An intensive monitoring program was developed for the ROPS, consisting of baseline, during-construction, and post-construction monitoring. Baseline monitoring was conducted in 2004 and spring 2005, during-construction monitoring was performed from April to November 2005, and post-construction monitoring was conducted in

November and December 2005. Longer-term monitoring – developed in coordination with the Agencies and consideration of the results of the various monitoring events – is currently underway.

ROPS-related monitoring efforts completed to date include:

- Conducting profiling surveys to characterize the topography of the river bottom and the depth of sediments. These surveys were done before dredging to establish baseline conditions, during dredging and capping to assess progress, and after dredging and capping activities to evaluate the effectiveness of the efforts. In general, the results during and after dredging indicated that in the main channel, significant amounts of targeted sediment remained, and the irregular nature of the river bottom with boulders and rock outcrops in some areas limited the effectiveness of the hydraulic dredges. Further, post-capping surveys indicated some irregularity of cap thicknesses that were not detected during the surveys conducted while cap materials were being placed. These results will be used to improve cap placement techniques.
- Collecting 28 sediment cores from expanded Work Zone 1 post-dredging via vibracoring to determine PCB levels and the extent of remaining PCB-impacted materials. Based on a detailed examination of physical and chemical characteristics of the cores, most of the post-dredge cores contained relatively low density residual disturbed sediments overlying higher density untouched inventory. The residual disturbed sediments in these areas averaged approximately 6 inches, overlying an average of approximately 10 inches of untouched inventory (i.e., an average total residual thickness of about 16 inches). The average sediment PCB concentration of the disturbed residuals (approximately 205 ppm) compared favorably with the depth-weighted average PCB concentration of the baseline sediment cores (about 228 ppm). Based on PCB mass balances, approximately 16% of the targeted PCB mass remains in expanded Work Zone 1.

Collecting samples for the monitoring program

- Collecting more than 800 water samples for PCB and solids analysis. While action levels for turbidity and total suspended solids (TSS) were never exceeded during the project, PCB action levels were exceeded on 8 of 128 days of in-river activities. In response to these exceedances, which occurred during removal activities, additional samples were collected near the dredge area to better understand the situation, and changes in operations (such as slowing the debris removal rate, altering debris removal methods, and limiting times of operations) were implemented to address the issue. Water monitoring data also revealed that approximately 102 kilograms of PCBs – about 3% of the total PCB mass removed from the lower Grasse River during the ROPS – were released and transported downstream, primarily during debris and sediment removal activities, with the majority of the water column PCB concentrations occurring in soluble form. At the downstream transect, dissolved PCBs comprised 69 to 89% of the total PCBs. Although the TSS and turbidity action levels were never exceeded, releases of solids were higher during cap placement than during dredging.
- Collecting more than 100 air samples for analysis of PCBs, particulate matter, and other compounds. There were no exceedances of the action levels for PCBs or other compounds. Some elevated levels of particulate matter were measured, but further assessment revealed the exceedances were not related to the ROPS.
- Collecting 144 fish samples for PCB analysis. PCB levels in the species sampled – smallmouth bass, brown bullhead, and young-of-year spottail shiner – increased relative to previous years as a result of resuspension-derived PCB releases associated with the dredging and debris removal operations. PCB levels in the young-of year spottail shiner near the river mouth were the highest ever recorded. Future monitoring will be conducted to support an assessment of long-term trends in the fish and determine if the previously observed downward trend in PCB concentrations will be re-established.
- Monitoring was also carried out to gauge impacts associated with odor, noise, and lighting impacts on the community. No issues associated with the project were identified.

As described above, results of the monitoring efforts indicated, in some cases, the need to make changes to operations or processes – for example surface water quality measurements resulted in the development of new equipment and adjustments to operational practices. From an overall perspective, the results confirmed that implementation of the ROPS did cause a number of short-term environmental impacts. In addition to monitoring to assess the performance and stability of the caps, the longer-term post-construction monitoring includes a variety of efforts to determine if the impacts noted during and immediately following construction are sustained or if the river returns to pre-ROPS conditions within a relatively short period of time.

Costs

The total cost to implement the ROPS was approximately $20.2 million, not including the cost for construction of Cell 3 at the Secure Landfill. This overall cost included approximately $19.9 million related to dredging and capping efforts in the main channel and northern near shore (including all mobilization/demobilization, containment, monitoring and project-management related costs), approximately $333,000 for placing the armored cap, and $40,000 for placing the thin-layer cap in the southern near shore area. Considering these costs in terms of each area addressed results in the following approximate unit costs:

- Main Channel (dredging, dewatering, and disposal): $760/cy (in-situ)
- Main Channel (post-dredge capping): $160,000/acre
- Armored Capping: $458,000/acre
- Southern Near Shore (thin-layer capping): $150,000/acre

Note: Northern near shore unit costs for dredging/capping are still under development.

An estimated area-based unit cost for the main channel dredging can also be developed from the ROPS cost information based on the volumetric unit cost presented above, the volume of sediment removed from expanded Work Zone 1 where the majority of the dredging activity was focused, and the approximate 4.1-acre footprint for expanded Work Zone 1. This calculation provides a per acre dredging, dewatering, and disposal cost of approximately $3.8 million/acre during the ROPS inclusive of mobilization/demobilization, monitoring, and project management. This estimate would vary depending on the depth of sediment targeted for removal in conjunction with other factors such as opportunities to increase production rates and the level of effort employed to address PCB residuals. Further refinement of these costs will be conducted in support of the revised AA Report.

Findings

Key technical findings of the ROPS can be summarized as follows:

- Site conditions did not allow for accurate characterization of the thickness of soft sediments at the site using remote sensing based sub-bottom profiling techniques and sediment probing. Vibracoring was employed as a measure to more accurately characterize the depth of PCB-containing sediments within the study area; however, the types of site conditions encountered coupled with the variability in the elevation of the interface between clean and PCB-containing sediments represent limiting factors that must be recognized as they relate to the level of certainty that can be developed with respect to the depth of contamination at the site.
- Multibeam surveys provided accurate estimates of the volume of sediments removed during the dredging project. However, a process mass balance also provided a reasonable estimate of removal volume.
- Dredge production rates achieved using the horizontal auger averaged about 38 cy/hr prior to encountering hard bottom obstructions. Once these obstructions were encountered, the production rate declined to an

average of about 20 cy/hr and was lowest during the last two weeks of operation. The swinging ladder cutterhead dredge achieved similarly low production rates when applied to the hard bottom areas. Given performance objectives similar to those applied during the ROPS (e.g., similar water column PCB action levels), similar dredge production rates would be anticipated under full-scale dredging in ROPS-like sediments.

- Site-specific factors, such as the irregular hard bottom, limited the ability of the dredge equipment to effectively remove contaminated sediments near the bottom of the dredge prism. As a result, an average of about 16 inches of PCB-containing sediment and about 16% of the PCB mass targeted for ROPS dredging remained in Work Zone 1 as a combination of undisturbed inventory and residual disturbed sediment. Site-related conditions are expected to present similar difficulties for other types of available dredging equipment as tested on a limited basis during this work.
- The average PCB concentration of residual disturbed sediment remaining on the surface of the dredge prism was similar to the average PCB concentration within the dredge prism, and roughly 50 times greater than pre-dredge surface concentrations.
- Silt curtains achieved localized reductions in TSS concentrations, but did not appear to be necessary to achieve TSS-based water quality criteria. However, because of unique site conditions, the silt curtains were difficult to anchor and maintain. Moreover, the silt curtains did not appear to be effective in controlling downstream transport of dissolved PCBs attributable to debris removal and dredging operations (see below).
- During debris removal and dredging operations, approximately 3% of the total PCB mass removed from the lower Grasse River was transported downstream, the majority of which was in the dissolved form. The increase in downstream PCB concentrations in the water column during such operations, which periodically exceeded water quality action levels, was reflected in observed increases in fish tissue PCB concentrations.
- Post-dredge caps placed over the post-dredge residuals, along with thin-layer caps placed in un-dredged areas, were effective in reducing pre-ROPS surface sediment PCB concentrations by approximately 93 to 99%.
- Considering expanded Work Zone 1 and applying unit costs, the cost of ROPS dredging was approximately $3.8 million/acre, roughly 24 times greater than the cost of the post-dredge cap (approximately $160,000/acre).

Conclusions

The ROPS was successful in a variety of ways despite the numerous difficulties encountered during the work. First, significant information was developed regarding the uniqueness and complexity of the site conditions as they relate to the implementability and effectiveness of long-term remedial options. The additional site-specific knowledge gained during 2005 will be important in the development and assessment of potential long-term remedial options.

Second, progress was made in the river, as a significant quantity of PCB-containing sediments was removed from an area of the river that is prone to ice jam-related scour. Residual PCBs were effectively isolated under caps, and a wealth of new site-specific monitoring data was collected.

Third, a wide variety of response actions were undertaken in an effort to both understand and address new project-related issues as they were identified. This included efforts related to maintaining the silt curtains, developing a better understanding of site bottom conditions, increasing dredging productivity while continuing to remove remaining PCB-containing sediments in the work area, and optimizing the sediment dewatering process. Even though many of these actions met with limited success, the information developed will be useful in formulating and evaluating long-term remedial options for the river.

Fourth, it is clear that potential remedial options that include a dredging component will need to be developed considering the tradeoffs that exist among issues such as:

- production rates and resuspension control;
- dredging productivity and level of effort necessary to address residual PCBs, particularly in view of the site bottom conditions;
- cost and effort to maintain a complex containment system, considering its effectiveness in preventing (or minimizing) downstream releases of soluble PCBs during removal activities;
- environmental benefits and impacts of dredging, particularly related to residual PCB levels in the surface sediments and observed PCB levels in fish; and
- the impacts of many of these factors as they relate to maintaining a safe work environment while balancing the project goals, efficiency, schedule, and cost.

Finally, it appears that a variety of cap configurations can be placed successfully in different areas of the river. The implementation of capping operations on the lower Grasse River was not affected by any of the tradeoffs that were identified above associated with the dredging operations. There is room for improvement with respect to achieving the targeted cap thickness across the entire cap area, and longer-term monitoring efforts will be used to verify that the caps continue to effectively isolate PCB-containing sediments. The assessment of potential remedial options involving capping as part of the revisions to the 2002 AA Report will need to include consideration of the issue of ice jam-related scour for the section of the river that is prone to this phenomenon. In addition to the armored cap evaluated as part of the ROPS, an evaluation of both short- and long-term management options for ice-related impacts is ongoing.

The primary goal of a final remedy for the lower Grasse River is to lower PCB concentrations in the surface sediments to reduce PCB levels in fish. The results of the ROPS program as they relate to the effectiveness of the various remedial approaches employed in achieving this objective will be a primary consideration as the 2002 AA Report is revised and long-term remedial options for the river are developed and evaluated. The substantial site-specific experience gathered to date indicates that efforts to reduce PCB concentrations in surface sediments through removal are inherently difficult due to the unique, complex site conditions in the lower Grasse River coupled with the challenges associated with the construction implementation tradeoffs as described above.

1. Introduction

This Documentation Report describes the activities performed as part of the 2005 Remedial Options Pilot Study (ROPS) conducted by Alcoa Inc. (Alcoa) within the lower Grasse River, Massena, New York (Figure 1-1). The ROPS was designed to provide information pertaining to potential remedial alternatives for addressing contaminated sediments in the lower Grasse River. ROPS construction activities were performed between April and December 2005, and consisted of a combination of dredging and capping activities, including:

- Dredging/capping in the main channel and adjacent northern side slope area;
- Dredging/capping in the northern near shore area;
- Thin-layer capping in the southern near shore area; and
- Armored capping in the main channel.

Intensive monitoring activities were conducted prior to, during, and after construction, and longer-term monitoring activities will be conducted during 2006. A primary objective of the ROPS was to develop information in support of the identification and evaluation of remedial options for the lower Grasse River, with the intention that this information will ultimately be considered in the selection of a final remedy for the site.

1.1 General Description

The Grasse River Study Area is located along the northern boundary of New York in the town of Massena (illustrated on Figure 1-1), and encompasses approximately 8.5 miles of the Grasse River extending from just downstream of the Route 37 Bridge in Massena to the St. Lawrence River confluence, including the Massena Power Canal and Robinson Creek. The ROPS, which was developed in response to the ice jam-related scour event that occurred in spring 2003, was performed in the lower Grasse River which is defined as the portion of the river extending from the confluence with the Massena Power Canal to the confluence with the St. Lawrence River.

An ice jam event which occurred in the spring of 2003 triggered both the need to update the conceptual site model (CSM) for the lower Grasse River, and the need to update the *Analysis of Alternatives Report* (2002 AA Report; Alcoa, June 2002) submitted to the United States Environmental Protection Agency (USEPA) in 2002 to include consideration of ice jam-related scour in the development and evaluation of remedial options. The ROPS was conceived as a means by which to proactively implement measures to mitigate the effects of potential future ice jam events, provide information related to options for managing ice jam-related scour, and address a number of key uncertainties that existed regarding available remedial options for the site. Therefore, the ROPS included measures to mitigate the impacts of ice jam-related scour in the near term and, through a series of closely monitored studies, develop site-specific information related to the implementation and effectiveness of potential remedial options.

The overall objectives, specific components, and scope of the ROPS were determined through extensive discussions with USEPA, New York State Department of Environmental Conservation (NYSDEC), and the St. Regis Mohawk Tribe (SRMT), collectively referred to as the Agencies. These discussions resulted in the development of the Agency-approved *Remedial Options Pilot Study Work Plan* (ROPS Work Plan; Alcoa, February 2005). The ROPS was conducted as described in the ROPS Work Plan and the *Remedial Options Pilot Study Operations Plan* (Operations Plan; Sevenson Environmental Services, Inc. [Sevenson], May 2005), with the exception that the planned installation of an ice control structure (ICS) as described in the ROPS Work Plan was not implemented due to community concerns related to the proposed siting of the structure.

Information generated as a result of implementation of the ROPS will be used to update the 2002 AA Report (Alcoa, June 2002), which was prepared prior to recognition of the occurrence of ice jam-related sediment scour in the lower Grasse River. Therefore the potential impacts of this mechanism were not considered as part of the evaluation of remedial alternatives presented in the report.

1.2 ROPS Background

USEPA's Administrative Order issued in 1989 (and amended in 1995) indicated that historic practices at Alcoa's Massena facility (now known as the Alcoa Massena West plant) contributed to the presence of polychlorinated biphenyls (PCBs) within the Grasse River. As a result of this Administrative Order, Alcoa has conducted numerous investigations of the water column, sediment, and biota in the Grasse River Study Area to evaluate the nature and extent of PCBs in the river system.

In addition to the site investigations, Alcoa completed two pilot projects designed to evaluate the efficacy of dredging and capping within the lower river. The Non-Time-Critical Removal Action (NTCRA) was performed in 1995 and resulted in the removal of approximately 3,000 cubic yards (cy) of materials (including sediment, boulders, and debris) from a one-acre area located directly off-shore from the main wastewater discharge of Alcoa's Massena plant (Figure 1-2). The NTCRA targeted the highest PCB concentrations in the river, which existed at the approximate upstream end of the extent of contamination (BBL, May 1995).

In 2001, Alcoa completed the Capping Pilot Study (CPS), which was designed to evaluate the feasibility and effectiveness of sub-aqueous (underwater) capping in a seven-acre section of the river (Figure 1-2) using various combinations of cap materials and placement techniques (Alcoa, April 2002). Post-placement monitoring conducted through fall 2002 indicated that the cap had remained in place and was functioning as designed (Alcoa, September 2003). However, as part of the routine monitoring work conducted in the CPS area in spring 2003, a loss of cap material, and in some cases underlying native sediments, was observed. As a result of these observations, an extensive follow-up investigation was initiated to understand the cause of the changes in the CPS area, the mechanisms involved, and the overall impacts of the event on the distribution of PCBs in the river. The major findings of this work, which were used to update the CSM, are as follows.

- The fundamental cause of the observed scour of cap materials and underlying sediments was the formation of a significant ice jam in the lower Grasse River in spring 2003. Prior to the spring 2003 ice jam event, the occurrence of ice jams in the river was not known, and thus the cap placed during the CPS was not designed to withstand the forces on the river bottom that are now recognized to exist during significant ice jam events.
- The primary mechanism that caused the observed scour was a combination of increased water velocities and turbulence underneath the toe of the jam, as opposed to physical contact of ice on the river bottom.
- Major ice jam events that can cause significant sediment scour occur, on average, approximately once every ten years.
- The section of the lower river that is vulnerable to ice jam-related scour is the reach between sediment probing Transect (T)1 and approximately T19 (Figure 1-2).
- The spring 2003 ice jam did not result in system-wide changes in PCB concentrations in fish or PCB distribution in surface sediments, although some local effects were observed.
- The spring 2003 event did not cause any system-wide changes to PCB levels in the water column; no data were available to determine whether any short-term impacts occurred.
- The spring 2003 ice jam event did not result in any significant movement of PCBs from the river into the adjoining bank areas.
- The loading of clean sediments from upriver into the lower river may be greater than previously estimated.

Details regarding all investigations, studies, and the associated findings are documented in the *Comprehensive Characterization of the Lower Grasse River* (CCLGR; Alcoa, April 2001) and the *Draft Addendum to the Comprehensive Characterization of the Lower Grasse River* (CCLGR Addendum; Alcoa, April 2004). The CCLGR Addendum and the findings presented above (including the updated CSM) are currently under review by the Agencies.

Consideration of the updated CSM in conjunction with issues identified during discussions with the Agencies while reviewing the site data revealed that several outstanding questions relevant to both the development and evaluation of remedial options for the river remained. The ROPS was designed to provide information to help answer these questions, with the ultimate goal of developing key information to support revision of the 2002 AA Report (Alcoa, June 2002). Specifically, these outstanding questions (identified in conjunction with the specific component of the ROPS designed to provide relevant information) included the following:

- Can ice jams or other operative mechanisms in the lower Grasse River affect the stability of sediments located downstream of the region exhibiting impacts from past ice events (i.e., downstream of T19)? (Monitoring Component)
    - Sediment core data were collected in 2004 as a follow up to the 2003 river ice investigation from locations where previous cores showed unusual physical and/or chemical profiles. These data were used to investigate the stability of sediments in the lower river (i.e., downstream of T19), and are reported in the *2004 Data Summary Report* (Alcoa, April 2005c). These data were not collected as part of the ROPS, and thus are not discussed in this report.
- What is the ability of an armored cap to withstand the stresses that ice jams, like the one in 2003, could impose on the river bottom? (Armored Cap Component)
- What level of PCB residuals (concentration and volume) will remain after dredging? Is there a relationship between dredging residuals and pre-dredging concentrations and production rates for the sub-bottom conditions encountered? (Dredging Component)
- How effective can an ICS be at reducing the severity/occurrence of ice jams in the lower Grasse River? What impacts to habitat and biota would occur as a result of the installation of an ICS? (ICS Component)
- Should the near shore areas of the river be treated differently than the channel areas in the analysis of alternatives? What is the effectiveness of the available remedial options in these areas? (Near Shore Component)
- What is the loading of clean sediments from upstream and the impact on monitored natural attenuation as a component of the remedial options? (Monitoring Component) Water column total suspended solids (TSS) levels were measured during ice breakup in 2004 and 2005 to quantify the solids entering the river from upstream. Data from the 2004 monitoring event are provided in the *2004 Data Summary Report* (Alcoa, April 2005c), and 2005 data will be included in a similar report to be prepared in 2006. These data are not discussed in this report.

The ROPS Work Plan (Alcoa, February 2005) included provisions for installing an ICS upstream of the lower Grasse River. However, based on community concerns with the proposed ICS location, which was several miles upstream from the Grasse River Study Area, a decision was made in coordination with USEPA to re-evaluate possible options for the siting of an ICS as well as potential interim ice management measures. As such, this component was not implemented as part of the ROPS activities and is not discussed in this report. A technical memorandum summarizing the status of this re-evaluation was submitted to USEPA in October 2005 (Alcoa, October 2005a). Any additional analyses, designs, and work plans associated with the ICS and interim ice management options will be submitted as separate documents.

1.3 ROPS Objectives

Based on the questions resulting from the spring 2003 site data and updated CSM, three main objectives were developed for the ROPS. These objectives include:

- Evaluate remedial options to reduce potential risks associated with exposure to buried PCBs that could be mobilized by a future ice jam-related sediment scour event in the lower Grasse River;
- Develop information to address outstanding issues regarding remedy effectiveness, remedy implementation, and the CSM that impact the analysis of remedial alternatives; and
- Make progress in the lower Grasse River to support final remedy development, evaluation, selection and implementation.

In consideration of these objectives, the overall components of dredging and capping in the main channel and near shore areas were developed.

1.3.1 ROPS Components

The four major construction components of the ROPS were designed to be completed in one construction season in select portions of the main channel and near shore areas within the lower Grasse River between T7 and T16 (Figure 1-3). A monitoring component common to all activities was also part of the pilot study. The planned ROPS construction components included:

- Dredging all soft sediments, to the extent possible, in the main channel and adjacent northern side slope area in the vicinity of T7 with a decision process identified to establish the need for cap placement over the dredged areas;
- Dredging one foot (ft) or the complete depth of soft sediment in the northern near shore area (i.e., areas with less than 5 ft of water) between T6 and T7 with cap placement over the dredged areas (to return the area to its pre-dredging elevation);
- Thin-layer capping (i.e., placement of 3 to 6 inches [in] of cap) in the southern near shore area between T8.5 and T9.5; and
- Placement of an armored cap in the southern portion of the main channel between T15 and T16.

An overview of the ROPS construction components is presented on Table 1-1. A general overview of the actual schedule for construction activities includes:

- Mobilization: April to June 2005;
- Dredging and debris removal in the northern near shore and main channel: June to October 2005;
- Northern near shore and main channel capping: September to November 2005;
- Armored capping in the main channel: September to October 2005;
- Thin-layer capping in the near shore: November 2005; and
- Demobilization: October to December 2005.

Details on the actual construction schedule are discussed in Section 2.6.

An extensive monitoring program was conducted to assess the effects of the ROPS activities on the river system and surrounding communities and to evaluate achievement of the objectives listed in Section 1.3. Monitoring activities included baseline (pre-construction), during-construction, and post-construction surveys. In addition, a longer-term component is scheduled to begin in 2006. In general, monitoring included the following

activities: water column, sediment, and cap material sampling; air, noise, dredge operating parameters, and ecological monitoring; bathymetry; and photographic documentation.

The locations for each of the ROPS components are shown on Figure 1-3; the component-specific objectives used to develop the construction and monitoring activities are described in Section 1.3.2. Construction activities associated with each component are discussed in detail in Section 2.3, and information obtained from the monitoring activities is discussed in Section 3. Details regarding the scope of the monitoring program are presented in Appendix A; data are contained in Appendix B.

Materials removed from the river were disposed in Alcoa's Secure Landfill (SLF) Cell 3. Construction, management, and closure of SLF Cell 3 were not conducted as part of the ROPS. These activities are referred to as necessary in this document; however, a separate report entitled *Certification Report for Secure Landfill Cell 3 Operation and Interim Capping in 2005* (Camp Dresser & McKee [CDM], February 2006) fully documents activities associated with the SLF.

1.3.2 Component-Specific Objectives

To guide development, design, and the implementation of each ROPS construction component and the associated monitoring activities, component-specific objectives were developed that took into account the updated CSM, overall ROPS objectives, and the details of construction. The specific objectives for each ROPS component are presented below. Achievement of these objectives is discussed in Section 4.

Dredging/capping in the main channel and adjacent northern side slope area was conducted to:

- Evaluate dredging as a remedial option to reduce the potential risk that may be posed by future ice jam-related sediment scour events by removing a targeted area of sediments with elevated PCB concentrations in an area of the river that is known to be subject to ice jam-related scour;
- Develop site-specific information related to dredging effectiveness, dredging residuals, dredging production rate, and sediment resuspension that can be used in the development of the revised AA Report;
- Evaluate construction issues pertaining to placement of a cap over the dredged area; and
- Evaluate the potential for incoming clean sediments from upstream of the lower river to provide containment for any residuals that may remain after dredging.

Dredging/capping in the northern near shore area and thin-layer capping in the southern near shore area were implemented to:

- Develop site-specific information on the effectiveness and implementability of removal in near shore areas for use in the development of the revised AA Report;
- Develop information on the effectiveness and implementability of thin-layer capping in the near shore areas for use in the development of the revised AA Report; and
- Evaluate habitat impacts and recovery in near shore areas which have been dredged and/or capped.

Placement of an armored cap in the main channel was conducted to:

- Evaluate constructability issues related to placing an armored cap in the river channel; and
- Evaluate the ability of an armored cap to withstand estimated forces from potential future ice jam events.

1.4 Site Conditions

A detailed discussion of site conditions is provided in the CCLGR (Alcoa, April 2001) and CCLGR Addendum (Alcoa, April 2004). A summary of site-specific considerations related to conduct of the ROPS is presented below.

The lower Grasse River was deepened in the early 1900s to accommodate the diversion of water from the St. Lawrence River through the Massena Power Canal to the lower Grasse River. This deepening resulted in a unique bottom profile throughout much of the lower river; the river typically contains steeply sloped banks that extend from the shorelines to a relatively flat channel that is underlain by a hard bottom comprised of bedrock, glacial till, or pre-glacial marine sediments. The Power Canal operated until about 1958 when the Moses-Saunders Power Dam was constructed across the St. Lawrence River. When flows from the Power Canal ceased, velocities in the now oversized river channel decreased significantly. In fact, the velocity in the lower Grasse River under typical summer flow conditions is generally so low that it can be difficult or impossible to measure with conventional velocity meters. Even under extreme flow conditions, velocities are fairly low. As a result of the enlarged cross-section and low flow velocities, the lower river has functioned as an efficient trap for sediment transported from upstream.

The start of PCB usage at the Alcoa facility roughly coincided with the cessation of operations in the Massena Power Canal in 1958. Peak PCB usage at the facility was estimated to occur in the early 1960s, based on the general coincidence of PCB and cesium-137 (^{137}Cs) peaks in high-resolution sediment cores collected from the river. During this time, the facility's waste by-products were disposed in on-site lagoons and landfills; a practice that, at the time, was common and generally accepted. In 1985, NYSDEC determined that select areas throughout the facility posed a potential threat to the surrounding environment. Upon issuance of two Records of Decision by NYSDEC in 1991 and 1992, Alcoa initiated an extensive investigation/remediation effort at the plant to mitigate off-site migration of chemical constituents, especially to the lower Grasse River. The source control actions completed between 1991 and 2001 dramatically reduced PCB discharges from Alcoa's facility to the lower Grasse River.

The decline in PCB discharges from the facility and ongoing sedimentation in the river resulted in relatively thick sediment deposits (3 to 5 ft thick) with PCB concentrations that are highest at depth (peak PCBs are generally found in the bottom 6 to 12 in of the sediment column) in most locations and are typically overlain by cleaner, coarser sediments. The soft sediments found in the lower river are believed to have been deposited since about 1958, when operation of the Massena Power Canal ceased and velocities became low enough to allow sediment to deposit on the river bottom. Available information indicated that beneath these post-1958 sediments existed hard bottom conditions that were present as a result of the historic dredging. This was based on the general consistency of sediment depths measured via probing to refusal and sediment thicknesses recorded during manual coring in the river, and other related data which indicated the presence of bedrock and/or hard glacial till in the vicinity of the project (New York State Department of Transportation [NYSDOT], 1998; Alcoa, April 2001; Alcoa, April 2004). The presence of rocks and cobbles was also anticipated based on the results of the NTCRA activities in 1995, which were conducted just upstream of the removal area targeted during the ROPS. Several attempts to characterize the sub-bottom conditions with various electromagnetic and acoustic technologies were unsuccessful due to variable sub-surface conditions.

Work conducted since the 2003 ice jam event has indicated that the sediments in this upper reach of the lower river are periodically vulnerable to ice jam-related scour and, thus, a portion of these sediments were targeted for removal during the ROPS to investigate the implementability and effectiveness of dredging in this area of the river. Sediment core data collected in 2003 and 2004, and consideration of the available construction season in Massena (mid-April through mid-November), were used to size the removal component of the program with the goal of removing as much sediment from this reach of river as possible within a single construction season.

A thorough review of the site conditions in the ROPS area, experience gained during the 1995 NTCRA and other nearby sediment removal projects were used in the project planning phase as described in Section 1.5. One site-specific challenge identified during the planning phase was the force impacts of pressure waves that propagate into the lower Grasse River as a result of water releases from the Snell Lock during ship passage through the St. Lawrence Seaway.

1.5 Project Planning

A significant level of effort was employed in the project planning phase in view of the magnitude and complexity of the ROPS coupled with the agreement that the duration of the river work would be limited to a single construction season. Specific considerations in this regard included the following.

- Environmental Health and Safety (EHS): Extensive efforts were directed in the project planning phase to project safety. A detailed discussion of these efforts is provided in Section 1.7.

- Contractor Selection: A rigorous process was followed by Alcoa for the identification and selection of potential contractors to conduct the ROPS. This process included an initial screening of potential contractors based on qualifications and experience in conducting similar work, contractor safety performance, a formal bidding process, interviews with a short list of potential contractors, and final interviews with the top contractors that emerged from the interview process. This process took approximately eight months to complete. Potential contractors were provided all available information from the site relevant to the conduct of the ROPS as part of the bidding process. The request for proposals specified the objectives and constraints for the ROPS, but did not specify methods or equipment types. A list of criteria used in the evaluation of potential contractors and equipment was developed and shared with the Agencies in a meeting on May 13, 2004. The selected contractor's (Sevenson) capabilities and direct relevant experience (e.g., significant sediment remediation project at the General Motors site in Massena, New York [along the St. Lawrence River], sediment cleanup projects for both USEPA [New Bedford Harbor and the Housatonic River] and NYSDEC [Cumberland Bay]) were reviewed in an Agency meeting on January 10, 2005. This process is further detailed in Section 1.5.1.

- Treatability Studies and Baseline Monitoring: Site-specific treatability studies were conducted in support of final development of process related parameters. These studies are discussed in Section 2 and associated appendices. A number of pre-construction field/monitoring activities were conducted in support of the ROPS, including: baseline sediment elevation and probing measurements (2004 and 2005); sediment core collection in the ROPS dredging area (2004); baseline ecological monitoring (2004 and 2005); and geotechnical coring in the armored cap area (2004). A detailed discussion of baseline monitoring efforts is provided in Appendix A.

- Silt Curtains: Extensive interactions occurred between Alcoa and its ROPS team members (Section 1.6), Sevenson, and the silt curtain vendor in an effort to design a containment system capable of addressing the pressure wave phenomenon associated with the release of water from the St. Lawrence River. These efforts and resulting configuration are further described in Section 2.3.

- Project Deliverables: A significant number of deliverables were developed by Alcoa and reviewed by the Agencies during the planning phase, including:
    - ROPS Work Plan (Alcoa, February 2005);
    - Permit equivalency related documents (Section 1.10);

- *Remedial Options Pilot Study Stormwater Pollution Prevention Plan* (SWPPP; Sevenson, March 2005a);
- *Remedial Options Pilot Study Secure Landfill Operations and Maintenance Manual Amendment* (ROPS O&M Amendment; Sevenson, March 2005b);
- *Independent Quality Assurance Team Plan – Remedial Options Pilot Study* (IQAT Plan; Alcoa, March 2005a);
- *Remedial Options Pilot Study Operational Health and Safety Plan and Addendum No. 1* (Operational HASP; Alcoa, March 2005b);
- *Remedial Options Pilot Study Contingency Plan* (Contingency Plan; Sevenson, March 2005c);
- *Remedial Options Pilot Study Community Health and Safety Plan* (CHASP; Alcoa, April 2005a);
- *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (2004 ROPS Summary Report; Alcoa, April 2005b);
- Operations Plan (Sevenson, May 2005); and
- *Additional Air Monitoring Activities Associated with the Operation of Secure Landfill Cell* (SLF Cell 3 Air Monitoring Plan; Alcoa, June 2005).

- Project Milestone Meeting: In recognition of the agreement that the ROPS would be limited to a single construction season, it was established, in coordination with USEPA, that a project milestone meeting would be held in the August timeframe to assess the status of the work completed to date. The results of this assessment would be used to determine what additional work could realistically be accomplished in the remaining construction time with the objective of leaving surface PCB sediment concentrations at a level approximating pre-project conditions in the instance that the intended scope of the ROPS could not be completed. Additional information regarding this meeting is presented in Section 2.1.3.

- Community Relations: Pre-construction information sessions were held with both the Massena community and Akwesasne in June 2004 and April 2005 to inform and educate the public regarding the project as well as address any community concerns related to conduct of the work. These were in addition to the regular meetings held with the Community Advisory Panel (CAP) for the Grasse River. An expanded discussion of ROPS-related community relations efforts is provided in Section 1.8.

- Technical Advisory Team: A technical advisory team was assembled by Alcoa to provide expertise in critical project areas through the conduct of the work. The team members, all of which have extensive background and experience in dealing with contaminated sediment sites and related issues, included:
    - Mark P. Brown, Ph.D., Senior Vice President, Blasland, Bouck & Lee, Inc. (BBL);
    - John P. Connolly, P.E., Ph.D., President, Quantitative Environmental Analysis, LLC (QEA);
    - Dawn S. Foster, P.E., Vice President (retired), BBL;
    - Gregory L. Hartman, P.E., Principal, Dalton, Olmsted, & Fuglevand, Inc. (DOF); and
    - Michael S. Schultz, P.E., President, Geotechnical Division, CDM.

These extensive pre-project planning activities were conducted in an effort to provide the best opportunity to meet the overall project objectives detailed in Section 1.3.

1.5.1 Contractor and Equipment Selection

As indicated in Section 1.5, during the bidding process, potential contractors evaluated available site information and determined the appropriate equipment for dredging sediments targeted as part of the ROPS. Hydraulic dredging through the use of a horizontal auger equipped with an environmental shroud was recommended by the contractor selected to conduct the work (Sevenson). The contractor also indicated that

they would be capable of providing mechanical removal equipment for areas where hydraulic dredging was not feasible.

Relevant factors in the contractor and equipment selection included:

- Significant prior experience with implementation of major environmental dredging projects;
- Pre-dredge understanding of the ROPS work area;
- Review of equipment used and results achieved during the NTCRA;
- Experience with other dredging projects conducted in the St. Lawrence region using similar equipment;
- Ability to meet sediment removal volume targets;
- Ability to minimize dredge residuals;
- Ability to meet resuspension criteria
- Ability to limit community impacts;
- Ability to successfully dewater dredged sediments;
- Ability to meet sediment processing discharge water quality criteria;
- Project costs; and
- Direct prior experience in working for both USEPA and NYSDEC on sediment remediation projects.

A horizontal auger dredge was utilized during the NTCRA to remove material from the targeted area. Following completion of the NTCRA, an average of 4 in of sediments, underlain by hard bottom materials, remained in the one-acre work area. Most of the area was subject to a single dredge pass (dredge to depth of hard bottom materials); a portion of the area was subject to one additional dredge pass. The NTCRA also demonstrated the ability of a horizontal auger dredge to maintain compliance with the downstream PCB corrective action trigger of 2 micrograms per liter (µg/L), despite the work being conducted in an area with very high sediment PCB concentrations. Although elevated sediment PCB concentrations (average 75 ppm) remained at the conclusion of the work, this must be viewed in context of the pre-dredge PCB concentrations (up to 11,000 ppm PCBs) coupled with the presence of hard bottom conditions and the presence of rock/cobble, which are now understood to be significant limiting factors in the dredging of contaminated sediments (USEPA, December 2005).

A key consideration in the implementation of a project that includes environmental dredging is that each of the factors listed above must be given consideration in the project planning and contractor and equipment selection phase, and that tradeoffs can exist between the various factors involved. Specific examples in this regard include the relationship between dredging production rates and resuspension, and the relationship between dredging production rates and level of effort employed to address dredge residuals.

A detailed evaluation of performance-based criteria and their applicability to hydraulic dredging were included in the Operations Plan (Sevenson, May 2005). A summary of this evaluation is provided below.

- <u>Removal equipment capabilities</u>: The hydraulic dredge has the ability to loosen and remove most material types under variable conditions in horizontal layers, and typically generates materials with a solids content of 8 to 12 percent (%) by weight (for transport). It is capable of removing mass quantities due to efficient maneuverability (i.e., dredge can be positioned easily using anchor cables to maintain control) and, on average, can remove 40 to 60 cy per hour (cy/hr). It can be operated in a range of water depths. In addition, it promotes efficiency and maneuverability in removing and transporting solids as pipeline transport can be used as a direct route from the hydraulic dredge to the processing area.

- <u>Ability to meet targeted removal depth and minimize volume of post-dredging residuals including proposed mode of residuals dredging operation</u>: Hydraulic dredging was expected to meet the targeted removal depths within inches, thus allowing accurate achievement of desired dredge elevations. Clean-up pass dredging would be performed using the hydraulic auger dredge for efficient operation through

real-time adjustments of operating parameters (e.g., rotational speed, pumping rate, etc.) as field conditions dictate.

- Ability to maximize segregation of sediments with PCBs less than 50 parts per million (ppm): In the event that an alternative disposal option for PCB-containing materials less than 50 ppm was selected, hydraulic dredging allowed sediment removal to take place in "lifts," thus allowing materials that may be less than 50 ppm PCBs to be removed separately from materials containing PCBs greater than 50 ppm. In addition, sand removed from the dredged slurry by the desanding operation was anticipated to contain PCB concentrations less than 50 ppm. As a result, dredging and the associated processing system would provide the ability to segregate sediments with PCBs less than 50 ppm from sediments with PCBs greater than 50 ppm.

- Proposed sediment processing system/physical characteristics of material to be delivered for disposal: The proposed dredging operation was expected to generate slurry at a rate of 1,500 to 2,500 gallons per minute (gpm) containing 8 to 12% solids by weight (on average). The primary objectives of the sediment dewatering process were to maximize the removal of sediments from the dredge slurry while minimizing the volume of material that must be disposed through use of recessed chamber filter presses. The proposed dewatering system would provide dewatered sediments that would not require any further treatment and/or processing prior to being placed in the SLF.

- Type and mode of debris removal and management: The hydraulic dredge is not well suited for removal of rock or debris, and therefore such material would be removed through a mechanical clamshell with a perforated bucket to limit the impact of rock/debris on auger effectiveness. This mechanical/hydraulic dredge combination has been used successfully on previous hydraulic dredging projects with similar conditions as were anticipated for the Grasse River. Debris removal would be performed prior to and during hydraulic dredging operations to complement the efficiency of the hydraulic dredge. These operations were performed with the silt containment system in place and in a manner that would mitigate and control resuspension.

- Methods to address "pressure wave" effects: Experience gained during the 2001 CPS as well as site-specific velocity data were used to develop a silt curtain system suited for the anticipated wave forces. This included ballasts anchored to the turbidity curtain float via a buoy to allow the curtain tail to move freely with the flow of the river rather than attempting to anchor the curtain tail to the river bottom (as in the 2001 CPS). Under this anchoring scenario the curtain skirt does not "hold back" the river current, but rather moves with it.

- Ability to meet resuspension criteria: The operational characteristics of a hydraulic dredge can be adjusted to minimize resuspension and release of sediments. By controlling the speed at which the horizontal auger is moved through the sediments, depth of cut, pumping rate, and rotational speed of the auger, a trained operator can maintain a continuous movement of water in the dredge suction area to the intake pipe to capture resuspended sediments. The dredge pump is located immediately behind the auger, minimizing problems associated with maintaining adequate suction line pressures and loss of sediments resuspended by the auger. Resuspension of sediments is further mitigated through the use of an environmental shroud over the horizontal auger. Control of suspended sediments would be enhanced through use of a silt containment system around the dredge area. Water column monitoring would also be conducted outside of the dredge area.

- Schedule: Use of the proposed equipment would result in completion of all dredging and related activities (e.g., processing, disposal, etc.) and capping activities in 2005. Mobilization of more than one

dredge, as well as redundancy in the processing/treatment system design was incorporated into the ROPS in an effort to further maintain the schedule.

- Management of community impacts (e.g., noise, truck traffic, river navigability): Noise and lighting generated from the hydraulic dredging activities were monitored throughout the ROPS. If necessary, as discussed in the Contingency Plan (Sevenson, March 2005c), procedural modifications to the work being performed would be implemented to minimize impacts. In addition, use of hydraulic dredging would mitigate air-related impacts associated with dredging since the removed sediments would be suspended in a slurry form and transported via pipeline.

  County Route 42 in the vicinity of the entrance to Alcoa's plant and Outfall 001 would require vehicular and pedestrian traffic controls during the ROPS, and a flag person would be utilized to direct vehicular and pedestrian traffic as necessary. Truck traffic would be significantly minimized by pumping hydraulically dredged sediments under County Route 42 to the staging area located on Alcoa's plant site. River navigability would be maintained by allowing an area of the river along the southern shore to remain unrestricted during dredging and capping work.

- Safety: Safety is a top priority. Dredging activities would be performed by experienced and trained personnel. Community air monitoring would be conducted in association with dredging and processing operations. The work areas (both in-river and land-based) would be well marked and maintained. Full-time safety personnel would be on-site throughout the duration of construction activities related to the ROPS.

- Recommended equipment and capabilities for placement of cap/armor materials: Equipment selected for capping activities included equipment successfully used during implementation of the CPS performed in 2001.

1.6 ROPS Team Members

Implementation of the ROPS was performed by several different organizations. The general responsibilities of each organization are presented below, and the organization chart is included as Figure 1-4.

- Agencies – Provided regulatory oversight throughout the ROPS. USEPA served as the lead oversight agency, and representatives from USEPA, NYSDEC, and SRMT were on site during the ROPS. TAMS, an EarthTech Company, served as USEPA's oversight contractor and was present on site for the duration of the ROPS. In addition, representatives from the National Oceanic and Atmospheric Administration (NOAA), New York State Department of Health (NYSDOH), and United States Army Corps of Engineers (USACE) also participated through document reviews and site visits.

- Alcoa, Inc. (Alcoa) – Responsible for the overall management of pilot study activities including construction, monitoring, and coordination with the Agencies. All organizations involved in implementation of ROPS activities (e.g., construction, monitoring, and data management) reported directly to Alcoa. In addition, the Alcoa Massena ChemLab (ChemLab) was responsible for analysis of water column samples, water collected from the waste water treatment train, ex-situ dredge materials, and Geotube samples. Aquatec conducted analyses on samples collected from the water treatment effluent train. Northeast Analytical, Inc. (NEA) directly contracted to Alcoa to conduct laboratory analyses of the sediment, cap material, and wipe samples.

- Blasland, Bouck & Lee, Inc. (BBL) – Served as the construction manager for the overall pilot study; conducted environmental monitoring activities before, during, and after ROPS construction; and was a member of the Independent Quality Assurance Team (IQAT; described in Section 1.6.1). BBL's subcontractors included: Chadwick & Associates, Inc. (Chadwick) to conduct the assessment of benthic invertebrate samples; Con-Test Analytical Laboratories (Con-Test) to conduct analyses of air samples; Ocean Surveys, Inc. (OSI) to conduct bathymetric, hydrodynamic and geophysical surveys of the ROPS areas (Appendix A); and The Louis Berger Group, Inc. (Berger) to perform the Phase IA Cultural Resources Assessment (CRA; Section 1.10);

- Camp Dresser & McKee (CDM) – Responsible for EHS and served as the Alcoa Responsible Person (ARP) for safety oversight; conducted construction oversight and field engineering; and was a member of the IQAT (Section 1.6.1). The CDM Soils Laboratory in Cambridge, Massachusetts conducted grain size analyses of sediment and cap material samples during the ROPS. CDM's subcontractors included: All-Fab, Inc. to fabricate two man-cages for SLF man-hole work; Atlantic Testing Laboratories (ATL) to perform physical analyses of the capping material for the SLF; Burgh Schoenenberger Corporation to provide technical support and equipment controls during setup of the effluent monitoring equipment; Collins-Hammond Electrical Contractors, Inc. (Collins-Hammond) to provide general and electrical contracting support during setup of the trailers; Penski, Inc. to provide additional laboratory analysts and administrative support personnel; Richard Esterline (retired Alcoa employee) to serve as a technical consultant for the project; Steve Frost, an independent marine safety specialist, to conduct a health and safety inspection of dredging operations; and Wilhelm Chattelle & Towne (WCT) to perform survey work.

- Dalton, Olmsted, & Fuglevand (DOF) – Provided technical input regarding the implementation phase of the dredging operations, dredge reports, and hydrographic surveys for quality control.

- Envirocon, Inc. (Envirocon) – Served as the primary contractor for construction of Cell 3 at Alcoa's SLF. Envirocon's subcontractors included: Geo-Synthetics, Inc. (GSI) to install the geosynthetic liners; Perras Environmental & Excavating (Perras) and S&L Electric (S&L) to conduct mechanical/electrical work for the SLF; and WCT to perform survey work.

- Quantitative Environmental Analysis, LLC (QEA) – Responsible for data compilation, management and interpretation, and was a member of the IQAT (Section 1.6.1).

- Sevenson Environmental Services, Inc. (Sevenson) – Served as the primary contractor for all ROPS construction activities. Sevenson's subcontractors included: Allen Marine Services (AMS) to provide divers and perform silt curtain installation and repairs; Atlantic Lining to install the liners at the processing area and Cell 3 of the SLF; ATL to conduct physical analyses of the cap materials; Barrett Paving Materials, Inc. (Barrett Paving) and Curran Logging, Inc. to provide the capping materials; Brockton Equipment/Spilldam, Inc. to provide the silt curtains; Butler Fence to install the gate at the trailer compound parking area; Collins-Hammond to perform all electrical installation, installation of phone and internet service to office trailers, and all electrical disconnects for demobilization; Mac Gregor Crane to perform miscellaneous lifts with a 100-ton crane; Optech Services to complete miscellaneous high density polyethylene (HDPE) liner repairs; Perras to construct two observation areas and set up office trailers; and Waste Stream Technologies (Waste Stream) to conduct chemical analyses of the cap materials. Sevenson also set up an on-site laboratory to conduct physical parameter analysis for some sediment samples and the Geotube sediments.

1.6.1 Independent Quality Assurance Team

Alcoa established an IQAT, consisting of BBL, CDM, and QEA, to be responsible for implementing all environmental monitoring and construction oversight activities and properly documenting data obtained from these activities. The IQAT operated in accordance with the *Independent Quality Assurance Team Plan* (IQAT Plan; Alcoa, March 2005a), and was charged with documenting four general categories of activities: environmental monitoring data documentation; operational documentation; disposal documentation; and corrective action documentation. Each organization was responsible for completion of these forms as follows: BBL – environmental monitoring data documentation; CDM – construction oversight documentation (i.e., operational, disposal, and corrective action documentation); and QEA – data compilation, management and distribution of select data summary forms.

The IQAT Plan (Alcoa, March 2005a) included all the documentation forms. During the ROPS, completed forms were made available for ROPS team review as either electronic documents (distributed via email) or hard copies (stored in the main ROPS construction trailer). Completed forms are included in various appendices to this report; IQAT forms are further discussed in Section 2.1.4. As the ROPS progressed, the need for additional documentation developed (e.g., ex-situ dredge material analysis, dredge return water monitoring, additional turbidity measurements, silt curtain inspection log, etc.). This additional documentation and associated forms are described further in Section 2 and Appendix A.

In addition, IQAT members worked directly with Alcoa and Agency representatives to make real-time decisions regarding the ROPS, and had the authority to stop work in the event of potential endangerment to public health or the environment.

1.7 Environmental Health and Safety and Project Controls

Safety was a critical consideration in the design and implementation of the ROPS. Each ROPS component was developed to provide for the health and safety of personnel involved with construction and monitoring activities and maintain adequate protection of the community and surrounding environment. This section focuses on the health and safety measures incorporated into the implementation of construction and monitoring activities to protect on-site personnel. Specific measures designed to protect the community and surrounding environment are described in Sections 1.8 and 1.9. Appendix C contains site-specific EHS information and forms utilized during the ROPS.

All health and safety components were developed consistent with applicable Occupational Safety and Health Administration (OSHA) regulations, Alcoa's EHS standards and requirements, and the corporate health and safety programs of each organization on the ROPS team. Throughout the ROPS, safety was maintained as the highest priority.

ROPS-specific safety measures were continually reinforced with site personnel throughout the ROPS planning and implementation stages. Key elements of the EHS program included project planning and the identification and assessment of hazards and control measures associated with activities to be performed as part of the ROPS. Prior to implementation of the ROPS, an Operational Health and Safety Plan (Operational HASP; Alcoa, March 2005b) was developed to provide a mechanism for establishing safe working conditions. Hazards and control measures were also identified during the ROPS through Project Environmental, Health and Safety Reviews (PEHSRs), Safety Observation Reports (SORs), EHS audits, and independent marine safety reviews. Safety requirements were further reinforced via site orientation training and daily safety meetings. Each of these EHS controls is described in further detail below.

1.7.1 Health and Safety Plan

Prior to the start of on-site activities, one comprehensive Operational HASP (Alcoa, March 2005b) was prepared for the ROPS to provide a mechanism for establishing safe working conditions during implementation of the pilot study. This comprehensive Operational HASP incorporated all the individual safety plans prepared by ROPS team members working on site (i.e., BBL, CDM, and Sevenson) for their specific tasks. USEPA accepted the Operational HASP on April 1, 2005 following completion of Addendum No. 1, developed to address Agency comments. The Operational HASP included the following information.

- Overall project organization and roles and responsibilities, with a focus on the health and safety of personnel.
- Identification of physical, chemical, and biological hazards associated with the site and implementation of ROPS activities. In addition, ROPS team members prepared unique task-specific hazard analyses – BBL completed Job Safety Analyses (JSAs) and Sevenson completed Activity Hazard Analyses (AHAs). Example JSA and AHA forms are included in Appendix C.
- Identification of control measures to mitigate hazards, including determination of appropriate personnel protection equipment (PPE).
- General discussion of safety practices and considerations to be implemented at the site (e.g., electrical precautions, hand and power tool use, ladder safety, etc.), including daily safety meetings held at the beginning of each work shift with all ROPS personnel.
- Air monitoring associated with worker safety.
- Work zone identification and control.
- Required training and medical surveillance for all on-site personnel.
- Emergency procedures and response plan.

All ROPS personnel were required to review and sign an acknowledgement form indicating that they understood the information presented in the Operational HASP. The ARP was the single point of accountability (SPA) to Alcoa for all EHS protocol, and assumed responsibility for verifying implementation of the approved Operational HASP. The Operational HASP was a "working document" that was updated over the course of the ROPS as necessary, depending on site conditions encountered, changes in construction or monitoring activities, and/or if adjustments were necessary to provide protection to workers and/or visitors. Changes were discussed with all personnel and made available for review at all times throughout the ROPS.

A separate HASP (Health and Safety Plan; AMS, April 2005) was prepared by AMS for underwater diving tasks associated with the ROPS. This HASP was prepared separate from the Operational HASP, since the tasks to be performed by AMS included hazards and control measures specific to diving activities. As part of this HASP, Job Hazard Analyses (JHAs) were completed for the diving task, and a daily dive plan was completed prior to entering the water. An example JHA and daily dive plan is included in Appendix C. All other subcontractors operated under the provisions of the Operational HASP (Alcoa, March 2005b).

In addition, to establish parking areas and traffic flow patterns within the working areas (i.e., within the Alcoa plant limits and river area), a vehicle/pedestrian separation plan was developed. This plan is included in Appendix C.

1.7.2 Project Environmental, Health and Safety Reviews

The PEHSR is an Alcoa-specific project review process developed to identify and resolve potential EHS issues and hazards that may occur during implementation of a project. A PEHSR was completed for each major ROPS work task (e.g., river dredging, material processing, SLF operation, monitoring activities) or when a significant

change was made to a work task. The PEHSRs involved the completion of an 11-page checklist that addressed the following topics: lock/tag/try; machine guarding; electrical; controls and displays; fall prevention; mobile equipment; confined space; ergonomics; noise, lighting and ventilation levels; combustion systems; overhead and pendent operated cranes; radio frequency cranes; hoists; fire prevention; hazardous chemicals/materials; chlorine; environmental; PPE; training; housekeeping; and other miscellaneous concerns. After working through these topics, any items identified as deficient or not meeting appropriate health and safety standards were identified on a "punch-list" at the end of the PEHSR form. This punch-list included the items to be corrected, the person responsible for the correction and the date the correction would be achieved, and the actual date of correction. An example of a completed PEHSR form is included in Appendix C.

Each ROPS team member completed a PEHSR form for its respective tasks. Once complete, each PEHSR was reviewed in a meeting with the ROPS team and ARP to reinforce the steps necessary to maintain compliance with appropriate health and safety measures and verify that all team members were aware of the hazards and control measures to be implemented. In general, the PEHSR served as a "kick-off" health and safety meeting for new or revised tasks. PEHSRs were also periodically reviewed throughout the task to update the form based on the activities actually being conducted, and to verify that all activities were in compliance with appropriate health and safety measures.

1.7.3 Site Orientation Training and Daily Meetings

Prior to beginning work activities, each site worker participated in site orientation training. This orientation training provided information to all workers regarding Alcoa Massena West specific policies and expectations as well as a review of the Operational HASP. The site orientation video outlined Alcoa corporate and site-specific policy regarding the following topics, among others: emergency action response; buddy system; entry and egress; radio communication; on-site driving requirements; cell phone use; jewelry; PPE; power lines; hazard communication; spills; lock, tag, and try; confined space; etc. The Operational HASP was reviewed with each worker with a focus to the specific task(s) they would be responsible for performing. Each trained individual completed forms indicating successful completion of this training, as well as provided personal information for use in the event of an emergency.

From the first day of mobilization activities, daily safety meetings were held for all site personnel, including contractors, consultants, Agency personnel and Alcoa site management. The intent of these meetings was to present safety-related information pertinent to the work that was scheduled to be performed during that shift. As applicable, these meetings covered new work processes as well as revisiting and reinforcing safety issues related to general daily work practices. Once operations transitioned to 24 hours per day, these safety meetings were held at the beginning of each shift. Daily safety logs were completed to document the work activities, PPE utilized, condition of workers, accidents or breach of procedures, and descriptions of air samples collected. An example daily safety log is presented in Appendix C.

In addition, safe standard operating procedures (SSOP) were developed to provide additional instruction for each major task. The SSOP include text related to health and safety, operating procedures, and environmental concerns. An example SSOP is included in Appendix C.

1.7.4 Safety Observation Report Process

The SOR process was a safety tool implemented by all ROPS team members to document concerns and/or positive observations on specific EHS conditions and behaviors observed in the field during ROPS implementation. The observations were logged on an SOR form and submitted to Sevenson's site health and

safety officer (SHSO) for review and evaluation. If necessary, the SHSO would take the appropriate steps or actions to correct the condition or behavior resulting in the SOR, or would recognize the positive observation. SORs and corrective actions (as necessary) were shared with all personnel during scheduled daily safety meetings. The SOR process provided a positive method for engaging all members of the ROPS team in the EHS program by reviewing their own and others' work activities for safety. An example SOR report and the SOR cumulative tracking log are provided in Appendix C.

1.7.5 Environmental Health and Safety Audits

Throughout the pilot study, multiple EHS audits of the ROPS construction and monitoring activities were conducted. These audits included weekly and monthly ROPS team audits, Alcoa-specific internal audits, review of operations by an independent consultant, and an Alcoa Corporate EHS audit. Each of these audits is described below.

Weekly and Monthly Audits

The ROPS team performed self scored audits of activities on a weekly and monthly basis. Supervisors from each on-site ROPS team member and the ARP walked the site and observed all operations to assess the need for potential improvements in health and safety measures. All auditors used an audit form that was developed specifically for the ROPS to document general standards and specific river, processing pad, and SLF activities. The self audits were evaluated, and any deficiencies observed were recorded for future corrective action. The items identified for corrective actions listed the SPA and a date by which the corrective action would be completed. An example of a completed self scored audit form is included in Appendix C.

Alcoa Internal Audits and Independent Audit

Due to the size of the ROPS, Alcoa assigned internal health and safety personnel, and an independent marine safety specialist (Steve Frost) was retained to review and verify EHS compliance of the ROPS program. Alcoa's health and safety personnel provided oversight and assistance throughout the ROPS to all site contractors regarding health and safety compliance by conducting contractor-specific audits for each ROPS team member at the start of and during site activities. An example of Alcoa's internal audit form (i.e., Safety and Health Evaluation of Contractors) is presented in Appendix C. In addition, Steve Frost reviewed the field operations, project documents, and the overall safety program in August 2005. This audit was performed to identify any significant deficiencies in the nature or implementation of required health and safety controls for the dredging work. In addition, the audit included a review of the dredging operations through the application of industry-specific loss control techniques, and review of the United States Coast Guard (USCG) and other health and safety regulations applicable to dredging. The submitted inspection audit reports (included in Appendix C) indicated a positive implementation and comprehensive health and safety program.

Alcoa Corporate Audit

From July 12-14, 2005 an Alcoa Corporate EHS audit was conducted for the ROPS with a focus on EHS compliance with regulatory agency laws, regulations, and applicable Alcoa standards and requirements. The results of the corporate audit were recorded in a major and minor findings report. In general, results from the health and safety audit were positive, and the report indicated that the health and safety review was satisfactory for all portions of the ROPS. Some areas for improvement were noted to increase overall project health and safety. These were discussed with the ROPS team members, corrective actions and points of accountability were identified, and the deficient items were resolved. Two programs with the ROPS health and safety process

were recognized as best practice – the SOR program (Section 1.7.4) and the Grasse River website (Section 1.8). The audit report is included in Appendix C.

Note that a correction action log was maintained throughout the ROPS. This log included: audit or inspection deficiencies, incidents, or injuries; the corrective action taken; SPA; target date for implementation of the corrective action; and actual date the corrective action was in place. This log is provided in Appendix C.

1.7.6 Marine Safety

Marine safety was a critical component of the EHS program since an extensive amount of work was performed on the Grasse River. Tasks on the river included construction, monitoring, and oversight activities. For all river work tasks, AHAs, JSAs, and JHAs were completed prior to initiation of work on the water, and daily safety meetings were conducted for all personnel to discuss tasks to be completed, potential hazards, and control measures.

Navigability of the river for the public was maintained by allowing an area of the river along the southern shore to remain unrestricted during dredging and capping work. Lighted buoys were placed to alert boaters per USCG and New York State (NYS) regulations, and all work vessels on the river were lit in accordance with USCG regulations. Notifications of river work tasks were provided to the USCG and the United States Border Patrol, as well as state and local authorities. Buoy markers were placed along the channel both up and downstream of daily field activities. A "Notice to Recreational Boaters" was posted at local marinas and on community bulletin boards prior to the pilot study start. In addition, on July 9, 2005, an article was published in the local newspaper entitled "Be Careful of Dredging" alerting the community to the ongoing work in the river (White, July 2005).

The captains of all ROPS-related work boats were properly trained and licensed to comply with basic navigational safety. All boat operators received training from an experienced boater on NYS navigational laws and USCG regulations. Boater safety on the river was enforced by the USCG. In addition, all work boats operated under the provisions of the NYS Navigation Law regarding fuel storage and spills, and the amount of extra fuel on each vessel at any one time was kept to a minimum to minimize spills in the event of an accident. Any spills were reported immediately and the Release Response and Notification form was completed. An example of this form is included in Appendix C.

1.7.7 Health and Safety Performance

As evidenced by the actions and processes summarized in the previous sections, Alcoa and the ROPS team members were committed to the health and safety of the workforce and surrounding community. The health and safety goal for the ROPS was zero incidents. Despite the focus on safety and extensive safety processes in place, there were four recordable injuries during the ROPS. Each recordable injury was thoroughly investigated (i.e., root cause analysis was conducted) to assess and implement corrective actions necessary to prevent a similar injury in the future. The results of the investigation and corrective actions to be implemented were presented to all ROPS team members and workers. A brief summary of each incident follows.

- March 1, 2005 – Individual suffered knee strain as a result of a same level fall; corrective action included relocating staging area for this work.
- June 6, 2005 – Individual suffered a very serious finger injury while installing a coupler; corrective action included placement of cribbing beneath installation location, lifting coupler into position by two workers, and once in place, one worker will hold coupler while other attaches bolts.

- June 30, 2005 – Individual suffered a broken hand while walking towards the front of a boat; corrective action including welding stairs to dock and barges to allow better access from boat to work area and increasing housekeeping requirements for boats and barges.
- September 8, 2005 – Individual suffered an ankle injury as a result of a slip while stepping down from a ladder; corrective action included installation of steel grating beneath the bottom rung of the ladder for workers to step onto a level surface.

1.8 Community Relations Efforts

Alcoa, working in coordination with USEPA, has initiated and maintained a community relations program for the Grasse River project to keep the local community informed about the status of site work, provide opportunities for community members to ask questions about current and future activities, and gather feedback from interested parties related to the project. To this end, Alcoa has held public meetings and availability sessions, developed community updates and fact sheets, formed the CAP, and maintained the project website (www.thegrasseriver.com). Each of these forums allow for community members to interact with Alcoa and obtain information regarding the river studies, including the ROPS.

Community relations activities conducted in support of the ROPS included a series of meetings and availability sessions with the local community to provide an overview of the project and address questions or concerns related to the conduct of the work. Communications efforts related to the ROPS program were initiated with a series of public availability sessions in Massena and Akwesasne in June 2004. A meeting was held at the Massena Rotary Club on February 1, 2005 to provide an overview and introduction to the ROPS. Public availability sessions were held twice daily for the community at Akwesasne on April 11, 2005 and the St. Lawrence Centre Mall on April 12, 2005. Alcoa also met with the local residents along the southern shore of the Grasse River in closest proximity to the ROPS activities in May 2005 to provide an overview of the pilot study and an opportunity for residents to ask questions. In addition, CAP meetings were held February 23, July 20, and November 9, 2005. The CAP was formed in 2001 to provide a formal venue for the community to express interests and concerns regarding the Grasse River project. Members of the CAP include representatives from a cross-section of the community such as individuals from local government, local business, public education, healthcare, labor and the SRMT.

In conjunction with the April 2005 public availability sessions, Alcoa developed a Community Update for widespread distribution to the community. The update described the overall pilot study, including the specific location of project activities and construction operations to be conducted as part of the ROPS. A second fact sheet was available at the April public availability sessions, and included an outline of the measures to be implemented as part of the ROPS to evaluate and control potential impacts to the surrounding environment and community.

Alcoa continues to maintain the project website designed to provide the public with information about the Grasse River project. This website was updated during the ROPS to include progress reports and photos from the project.

In addition, Alcoa provided tours of the ROPS work site to several interested parties (e.g., university groups) upon request. Alcoa constructed three observation areas to give community members an opportunity to safely view ROPS activities. Observation areas were constructed on Alcoa property adjacent to the river, SLF, and processing pad area. The observation deck located adjacent to the main channel dredging area along Route 42 was the most accessible to the community. The other two observation decks were located within the Alcoa plant fencing and access required the accompaniment of Alcoa and/or ROPS team personnel. At each area, ROPS

component figures (such as Figure 1-3) were posted to orient visitors and provide additional detail on the layout of the construction activities.

Alcoa also prepared a *Community Health and Safety Plan* (CHASP; Alcoa April 2005a) that outlined actions to be taken to protect the community during implementation of the ROPS, and described steps to be taken to address potential concerns. The ROPS construction and monitoring activities had the potential to cause a variety of impacts to community health and safety, including:

- Potential air quality issues associated with sediment removal and processing activities;
- Potential impacts to the water column during ROPS activities;
- Traffic concerns due to ground transport of debris and/or capping materials (or other necessary construction materials);
- Boating concerns for recreational (or other) boaters resulting from reduced river passage;
- Nuisance noise associated with operation of mechanical equipment such as dredges, trucks, sediment processing equipment, etc.;
- Nuisance light due to work on the river at night; and
- Site security requirements to protect the community from site activities.

The CHASP presented several monitoring and potential control measures that were implemented to mitigate these potential impacts. Where possible, implementation of project controls included in the CHASP was coordinated with the EHS-based controls discussed in Section 1.5. As described in the CHASP, Alcoa monitored water and air quality, as well as noise and light levels. CHASP-related monitoring activities are described further in Appendix A.

1.8.1 Community Concerns

During ROPS dredging and landfilling activities, Alcoa was made aware of two citizen complaints regarding odors; these occurred on August 18 and October 21, 2005. Once notified, Alcoa contacted USEPA, NYSDEC, and NYSDOH to make them aware of the issue and worked with the Agencies to investigate the complaints the same day to assess if the odors could have resulted from any ROPS-related activities. Alcoa's investigation included an assessment of current site activities, review of air monitoring data, evaluation of the typical prevailing wind direction, and a determination of any non-compliance issues during the time frame of the complaint. NYSDEC and NYSDOH were provided the data and supported Alcoa by presenting the information to citizen(s) lodging the complaint. All collected data were reviewed and it was determined that due to the direction of the wind at the time of the complaints, the ROPS activities could not have been the source of the odors detected. There were no other community complaints during implementation of the ROPS.

1.9 Compliance Overview

In the interest of environmental protection as well as community health and safety, extensive monitoring was conducted before and during the implementation of the ROPS, and results were compared to pre-determined action levels to assess compliance. Alcoa monitored air, water column, effluent from the water treatment system, spills, and light and noise levels in accordance with procedures described in the following documents:

- Air monitoring was performed in consideration of monitoring programs specifically defined in the Operational HASP (Alcoa, March 2005b), *Additional Air Monitoring Activities Associated with the Operation of Secure Landfill Cell 3* (SLF Cell 3 Air Monitoring Plan; Alcoa, June 2005), CHASP (Alcoa, April 2005a), and Operations Plan (Sevenson, May 2005).

- Water column monitoring for compliance was performed as defined in the Operations Plan (Sevenson, May 2005) and the CHASP (Alcoa, April 2005a).
- Monitoring of wastewater discharge was performed as defined by NYSDEC in their May 2005 Memorandum from Shayne Mitchell (New York State Division of Water [NYSDOW]) to Larry Alden (NYSDEC). This memorandum provided final recommended effluent criteria for the ROPS on-site wastewater treatment plant that was identified by NYSDEC as the "Alcoa Grasse River Dredge Return Water" (NYSDEC, May 2005).
- Spills and/or other unanticipated incidents were reported to Alcoa and the appropriate regulatory entity using appropriate forms and reporting mechanisms (e.g., Release Response and Notification Form; Appendix C).
- Light and noise monitoring were performed to assess the community impacts described in the CHASP (Alcoa, April 2005a).

Alcoa and the Agencies agreed upon action levels for each medium during the development of the ROPS-related work plans and documents. In general, action levels were developed based on regulatory limits (e.g., ambient dust levels, New York State Pollutant Discharge Elimination System [SPDES] permit equivalency levels, etc.) and/or in consideration of background/baseline levels. The monitoring program implemented for each medium and the corresponding action levels are described in detail in Appendix A.

In summary, no action level exceedances requiring corrective action were observed for air. Eight action level exceedances were observed during water column monitoring, and as a result, corrective actions were implemented. During operation of the on-site wastewater treatment plant, two separate compliance issues involving effluent from the water treatment system occurred. These compliance issues involved pH and flow measurements, and after investigation, corrective actions were taken to resolve the issues. A total of five petroleum spills were identified and immediately addressed by notifying the appropriate Agencies, then containing and cleaning the spill and surrounding area. No community complaints were received regarding noise and lighting levels.

Details regarding the monitoring, exceedances, and corrective actions implemented are presented in Section 2 and Appendix A.

1.10 Permit Equivalency Evaluation

ROPS activities were conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and were subject to the permit exclusion of CERCLA Section 121(e). Due to the scope of the ROPS and the activities proposed, USEPA requested that Alcoa complete certain permit applications and comply with potential Applicable or Relevant and Appropriate Requirements (ARARs), to the extent practical, during implementation of the ROPS. The potential ARARs identified by USEPA involved coastal resources, floodplains, wetlands, cultural resources, and the New York State Environmental Conservation Law (NYS ECL) Article 15 Use & Protection of Waters. The NYS ECL was only applicable to the ICS and, since the ICS was not completed during the ROPS, is not discussed further.

Consistent with the approach taken during the CPS, Alcoa completed permit applications that would have been required in the absence of the CERCLA permit exception, and submitted them to USEPA for distribution as appropriate. Completion of the following permit applications demonstrated fulfillment of the substantive requirements associated with the ROPS:

- Joint Application for Permit;
- Short Environmental Assessment Form (EAF);

- Federal Consistency Assessment Form; and
- Visual EAF Addendum.

In addition to completing permit applications, Alcoa evaluated the ROPS with respect to the requirements of programs included in each category of potential ARARs identified by USEPA. These program assessments and permit applications were included in a permit equivalency evaluation package that was submitted to USEPA (Alcoa, January 2005). The assessments relative to the identified ARARs are presented below.

Coastal Resources

The NYS designated coastal zone extends from the confluence of the Grasse and St. Lawrence Rivers upstream beyond the Alcoa Bridge. Since the ROPS was conducted in this zone, components of the study were covered by the NYS Coastal Management Program (CMP). Therefore, a Federal Consistency Assessment Form and coastal zone consistency assessment (CZCA) were completed. These assessments included a discussion of the site location/setting, site history, proposed remedial action(s), and consistency of the proposed remedial action with the applicable NYS coastal management program/policies, as dictated by the completion of the Federal Consistency Assessment Form. Based on the results of the assessment, activities proposed as part of the ROPS were consistent with the NYS CMP.

Floodplains

An initial floodplain assessment was performed for the individual ROPS components to determine the effects of the study on the floodplain. For each component, it was determined that ROPS activities would not have any adverse effects on the floodplain, since dredging/capping in the main channel would result in a lower overall sediment bed elevation compared to pre-ROPS conditions; dredging/capping in the northern near shore would return the sediment bed to its original pre-ROPS elevation (within reasonable tolerances); thin-layer capping would result in negligible changes to the cross-sectional area of the river; and based on the results of the CPS, armored capping would not cause changes to the floodplain (the CPS did not affect the floodplain, and the ROPS armored cap is smaller in areal extent and similar in thickness to the CPS cap). Therefore, no additional assessments were required and no measures to mitigate potential harm to the floodplain were necessary.

Wetlands

An initial review of the proximity of wetlands to the ROPS component locations was conducted using the National Wetlands Inventory mapping. Based on this mapping, none of the ROPS components were located within, or adjacent to, an identified wetland. As a result, no further wetland assessment was necessary.

Cultural Resources

Prior to conducting the ROPS, a Phase IA CRA was performed in April 2005 by Berger. The purpose of the Phase IA CRA was to determine if the ROPS area of potential effects (APE) may have contained properties of historic significance (i.e., archaeological resources). As designated by the New York State Office of Parks, Recreation, and Historic Preservation (State Historic Preservation Office, or SHPO), a Phase IA assessment is intended to gather information regarding the physical and cultural setting/environment of a particular project area primarily through background research and a site walkover (Berger, May 2005). The ROPS Phase IA CRA was conducted in compliance with Section 106 of the National Historic Preservation Act of 1966, and conformed to the Cultural Resource Standards Handbook, the New York State Environmental Quality Review Act, and the Standards for Archaeology and Historic Preservation (Berger, May 2005).

The APE for the ROPS included: the equipment and material staging area located adjacent to Alcoa's Outfall 001; the area traversed by the dredge slurry pipeline; and the processing pad located on the Alcoa plant. The in-river portion of the ROPS components was not included as part of the APE since the riverbed has been dredged over the past century, eliminating the potential for the river sediments to contain archaeological resources (Berger, May 2005). The results of the Phase IA CRA indicated no previously identified or potential archaeological sites within the APE. The Phase IA CRA concluded that, as long as ROPS activities were confined to the APE, no further archaeological investigations were required (Berger, May 2005).

The results of the Phase IA CRA are detailed in a report entitled *Remedial Options Pilot Study (ROPS) Grasse River Study Area, Town of Massena, Saint Lawrence County, New York – Phase IA Archaeological Assessment* prepared by Berger dated May 2005. Further, as indicated in a letter dated July 25, 2005, the State Historic Preservation Office concurred that the ROPS "will have No Effect upon cultural resources in or eligible for inclusion in the National Registers of Historic Places" (SHPO, July 2005).

1.11 Document Organization

The remainder of this Documentation Report is divided into four sections. Implementation of the ROPS, including an overview of ROPS management, detailed descriptions of the construction activities, and discussion of schedule is included in Section 2. Section 3 contains a summary and evaluation of the monitoring activities conducted in association with the ROPS. A summary of project findings, including an assessment of the overall project and achievement of objectives is presented in Section 4. Section 5 contains the list of references cited in the document.

2. Implementation of the Remedial Options Pilot Study

This section details the project management and construction activities that occurred in association with the ROPS, as well as a brief overview of monitoring performed, compliance and corrective action activities, and project schedule. Photographic and video documentaries of the ROPS are presented in Appendices D and E, respectively, and Appendix F contains ROPS operational data and construction-related information.

2.1 Overview of Project Management Activities

Several mechanisms were established to manage and successfully document progress of the ROPS real-time in the field. Key elements of this effort included: weekly meetings; change management; milestone review and progress meeting; IQAT documentation; and quality control procedures. These elements are detailed in the following sections.

2.1.1 Weekly Meetings

ROPS progress meetings were held on site to provide an overview and discussion of project-related activities between all parties involved. Meetings were led by the construction manager and were held weekly starting April 19 and continuing through November 22, 2005, for a total of 32 meetings. Participants typically included personnel from Alcoa, BBL, CDM, EarthTech, NYSDEC, QEA, SRMT, Sevenson, and USEPA.

The agenda typically followed for each meeting included discussion of the topics listed below:

- Health and safety;
- Past week's site activities;
- One-week and two-week look ahead for construction activities;
- One-week and two-week look ahead for monitoring activities;
- Updates/discussion of the project and work schedule;
- Updates to previous meeting discussions items (old business);
- New topics or issues;
- Status and summary of submittals; and
- Agency/stakeholder concerns.

Minutes were prepared following each meeting and distributed electronically to all parties. Appendix F.01 contains all ROPS weekly progress meeting minutes.

2.1.2 Change Management Process

ROPS activities were conducted in accordance with the ROPS Work Plan (Alcoa, February 2005) and the Operations Plan (Sevenson, May 2005). As part of the ROPS Work Plan, Alcoa developed a process for change management, anticipating that some aspects of the ROPS would be determined in the field or require revision as results of the construction and monitoring activities were evaluated during field activities.

Proposed modifications to the ROPS were documented for USEPA approval through the use of an Engineering Change Notice (ECN; Alcoa, February 2005). The ECN form contained information regarding the requested change, basis for change, schedule impacts, and documents affected. ECNs were presented to USEPA and/or its on-site representative for discussion and subsequent approval. Once an ECN was approved, it was distributed to the Agencies and other ROPS team members as appropriate.

In addition, Alcoa developed a Design Clarification Form (DCF) to provide additional information and clarification on already-approved ROPS components. This form was distributed to the appropriate parties for informational purposes and use as appropriate.

Throughout implementation of the ROPS, a total of 33 ECNs and 11 DCFs (not including revisions) were prepared. These change forms are referenced throughout this document as appropriate. The ECNs and DCFs are included in Appendix G and summarized in Table G-1.

2.1.3 August Milestone Review and Progress Meeting

As described in the ROPS Work Plan (Alcoa, February 2005), construction activities were limited to what could be accomplished in one construction season. Given this schedule constraint and the inherent dynamics associated with completing an in-field pilot study, Alcoa and the Agencies established that a milestone meeting would be held in mid-August to review and assess the progress of ROPS construction activities. The purpose of the meeting was to determine whether the scope of the remaining work (including demobilization) could be accomplished in the remaining construction season, so as to leave adequate time to restore surface PCB sediment concentrations to a level approximating pre-project conditions.

This meeting was held on site on August 23, 2005 and was attended by representatives of the following organizations: Alcoa; BBL; CDM; EarthTech; NOAA; NYSDEC; NYSDOH; QEA; Sevenson; SRMT; USACE; and USEPA. Agenda and discussion topics included ROPS project status, monitoring data update, preliminary ROPS findings to date, a community relations update, and other pertinent topics. The findings and recommendations from this meeting resulted in modifications to the construction schedule and scope of construction activities to be completed in the remaining construction season. These modifications were documented and approved in various ECNs discussed throughout Section 2.3. Plans were made during this meeting to ensure that, prior to the onset of winter and ice formation on the river, the contractor would be sufficiently demobilized from the water and river bottom conditions would be appropriately addressed. The results of this meeting are further discussed in Section 2.3.2.3.4.

2.1.4 IQAT Documentation and Data Availability

As discussed in Section 1.6.1, Alcoa established an IQAT consisting of personnel from BBL, CDM, and QEA who were responsible for implementing all environmental monitoring and construction oversight activities and properly documenting and distributing data obtained from these activities. The availability of project information was critical for maintaining communication and quality throughout the project. The IQAT operated in accordance with the IQAT Plan (Alcoa, March 2005a), which provided guidance on four general categories of documentation: environmental data; operational; disposal; and corrective action. Completed IQAT forms are included in Appendix H.

In addition, as the ROPS progressed, there was a need for additional documentation beyond that captured on the IQAT forms. New forms were developed, including silt curtain inspection logs, daily dredge reports, and

process logs. In addition, field notes, photos, and survey information were compiled. These additional forms and information are discussed throughout Sections 2 and 3, and completed forms are included in Appendix F.

All forms were maintained at the field trailer and/or distributed electronically. Table 2-1 provides a summary of the forms used to document various processes, along with the mechanisms through which the forms were compiled and distributed.

2.1.5 Quality Control Procedures

Throughout the ROPS, procedures were implemented to maintain a safe and effective work environment while ensuring quality performance of tasks by the responsible parties. These quality control procedures focused on providing standard methods for communicating; implementing changes to construction or monitoring activities; and tracking, recording, and reporting the progress of work. These procedures included, but were not limited to, construction lead team meetings, silt curtain inspections, submission of dredge reports, process log reporting, stormwater pollution prevention inspections, and river work observations. These quality control procedures are discussed briefly below.

Construction Lead Team Meetings

During the early stages of mobilization activities, Alcoa established a lead team consisting of the site management personnel from each of the companies performing field activities on the job (i.e., BBL, CDM, and Sevenson). Each company's site manager, health and safety personnel, and select technical field personnel met at least three times a week with the Alcoa project manager and the construction manager to discuss the specifics of the current site operations and look ahead to future activities. Visitors such as technical experts and other interested parties also attended as necessary. During the meetings, lead team members discussed safety issues, current construction and monitoring activities, future work, and any other project related issues and concerns. The meetings promoted open sharing of information, facilitated effective planning, and were crucial in updating project personnel on aspects of the project outside of their specific duties.

Silt Curtain Inspections

During the initial weeks of dredging, inspections were periodically performed to check the integrity of the silt curtain containment system. These initial inspections indicated that continual maintenance of the silt curtains was necessary, as multiple areas needing repair were identified. Daily inspections were implemented starting June 27, 2005. Inspections were performed by IQAT members, who were often joined by the USEPA oversight contractor (from TAMS, an EarthTech Company). The inspections were performed by navigating a boat immediately adjacent to all curtains deployed in the river. Any missing tie-offs or connections, holes or tears in the floats or skirts of the curtain (that could be seen below the water surface), and out of place or misaligned curtains were noted. Observations of damage were recorded on the silt curtain inspection log. Details of the inspection were provided to the construction manager and contractor, and a remedy was developed and implemented. The silt curtain inspection log is provided in Appendix F.02.

Submission of Dredge Reports

Dredge reports were submitted daily by Sevenson and were readily accessible by all ROPS team members. The reports contained information and data relevant to dredging and processing of the in-situ material, including estimates of the volume of material removed and volume processed, data logs from the dredge and process equipment operators, and lab results relevant to the processed material. It was intended that dredge position and track lines dredged each day would also be reported daily. However, due to lack of experience with the

Dredgepack system and initial difficulties with on-board electronics, this information was not generated on a daily basis (ECN 008). Dredge cut data were obtained during the project, and were reviewed when generated. The daily dredge reports were important for tracking progress; quantifying project variables such as dredge effective time, weather impacts, production rates, and operational issues; and providing necessary information to make changes to operations. The final dredge report is provided in Appendix F.02.

Process Log Reporting

To keep the large volumes of data organized and readily available, the lead team developed a process log to tabulate operational data in one location. This process log was used by the lead team to evaluate the operation of the dredge and solids handling system, and understand the factors influencing dredge production rates. Information was gathered from the daily dredge reports, real-time monitoring results, lab results, and Construction Daily Reports (IQAT Form 10; Appendix H) and input to the process log. Specific information included: estimated volumes of dredged and processed sediment; volume of water treated; and water column results for PCBs, TSS, and turbidity. The process log was also used to communicate operational and environmental data to off-site personnel involved in the ROPS. The process logs are provided in Appendix F.02.

Stormwater Pollution Prevention Inspection

In accordance with the SWPPP (Sevenson, March 2005a), after each rain event greater than 0.5 in or at a minimum of once per week, the IQAT performed a stormwater pollution prevention inspection. The materials processing pad (MPP; described in Section 2.3.1.3) perimeter berm was checked to make sure the liner was intact and water was not migrating outside of the pad. Sump pumps were inspected and verified to be operating correctly. Silt fences were checked to make sure they were intact and that a significant amount of runoff was not entering the river. All issues and areas of concern were identified and corrective actions were immediately taken as necessary. Once the inspection was complete, a stormwater pollution prevention inspection report (checklist) was completed and filed. These reports are provided in Appendix F.02.

River Work Observations

To allow river access for oversight personnel while maintaining the highest level of safety for all parties, arrangements for inspections of the work areas via boat were made through the construction manager. Alcoa made a boat available to Agency oversight personnel or other interested regulatory parties on a daily basis. IQAT members piloted the boat adjacent to the work areas allowing for close observation of the river work activities. The boat inspections were an effective way to allow the Agencies to observe field conditions, thus assuring that the ROPS was being performed consistent with their expectations. Following the boat inspections, any issues or questions identified were discussed with the construction manager to assure timely resolution.

2.2 Baseline Monitoring Activities

Baseline monitoring was conducted in summer/fall 2004, and spring 2005 to obtain information necessary to refine the scope of the ROPS activities, establish baseline conditions as a point of comparison for future monitoring results to assess achievement of objectives, and consider seasonal variation in biological characteristics of the targeted areas. In general, baseline monitoring activities included: sediment sampling in the main channel and near shore areas; sediment surface elevation and probing measurements along a 25-ft by 25-ft grid throughout the main channel and a more refined 25-ft by 10-ft grid in the side slope and near shore areas (Figures 2-1 and 2-2); geotechnical investigation in the armored cap area; ecological monitoring in the near shore areas, water column monitoring along three transects; and air monitoring at six locations. A

summary of the activities performed and information generated during each of the baseline monitoring events is included in Appendix A, and data resulting from these activities are presented in Appendix B.

2.3 Remediation Field Activities

Construction activities for the ROPS project began on April 11, 2005 and ended on December 16, 2005. ROPS construction components included:

- Mobilization and site preparation;
- Dredging and debris removal;
- Dewatering/solids processing, material handling, and stabilization;
- Wastewater treatment;
- Disposal in SLF Cell 3;
- Capping; and
- Demobilization and site restoration.

Site mobilization was initiated on April 11, 2005 and completed on June 6, 2005. Dredging and debris removal activities were initiated on June 10, 2005 with the onset of production dredging, and stopped October 21, 2005. Solids processing and wastewater treatment started during the dredging system shake-out period on June 6, 2005. These two activities ended with the final placement of solid waste in the SLF on November 8, 2005 and final dismantling of wastewater piping on November 11, 2005. Since capping activities in the northern near shore area and armored cap areas were not dependent on the completion of the dredging activities occurring in the main channel area, these activities were initiated on September 12 and 23, 2005, respectively. Capping within Work Zones 1 and 2 commenced on October 22, 2005 and was completed November 10, 2005. Site demobilization and restoration work activities were conducted concurrently beginning October 22, 2005 immediately following the completion of river dredging and debris removal work. Site demobilization was completed with the last shipment of material and equipment from the site December 16, 2005. At the same time, the vast majority of site restoration work was completed however, due to the onset of winter conditions, final activities will be completed in spring 2006 at the project personnel area (PPA), river operations area, MPP, and SLF. An overall project schedule is provided in Figure 2-3.

To complete all site field work in 2005, a 5 day per week (day/week), 24 hour per day (hr/day) work schedule was implemented for dredging, which allowed for 12 hours of maintenance work on Saturday and ideally no site work on Sunday. Capping was intended as a 12 hr/day operation. As the project progressed, it was often necessary to increase work hours to 24 hours on Saturday, and 12+ hours on Sunday in order to maximize the amount of work that could be accomplished in the available timeframe in view of difficulties encountered in the dredging and processing of materials, equipment breakdowns, and weather related delays. Capping operations were also increased to 24 hr/day over a three-week time period to accommodate schedule constraints (ECN 025).

The following presents a detailed description of each ROPS component and associated field work. As applicable, monitoring activities performed in association with each component are briefly described. A detailed account of ROPS monitoring activities and results is contained in Appendix A.

2.3.1 Mobilization and Site Preparation

ROPS mobilization and site preparation activities were performed as described in the Operations Plan (Sevenson, May 2005). These activities were initiated on April 11, 2005 and focused on delivery and installation of equipment and materials in the following four distinct areas:

- Project personnel area (PPA; Section 2.3.1.1);
- Secure Landfill (SLF) Cell 3 (Section 2.3.1.2);
- Materials processing pad (MPP; Section 2.3.1.3); and
- River operations area (Section 2.3.1.4).

The location of each of these four areas is illustrated on Figure 2-4**.**

Mobilization and site preparation activities were completed on June 6, 2005, four days ahead of the schedule presented in the Operations Plan (Sevenson, May 2005). These activities were followed by testing of the equipment and dredge system shake-out (Section 2.3.1.5). Final dredge system checks were completed on June 13, 2005. As planned, mobilization of materials and equipment specifically dedicated to capping operations was performed immediately prior to initiation of these activities.

2.3.1.1 Project Personnel Area

The PPA was established to organize involved personnel into one central location within the Alcoa plant limits. Alcoa provided appropriate office space for the Agency and ROPS team members. In addition, there were a large number of craft laborers on site and individuals working around the clock who required shelter and facilities to perform their responsibilities in a safe and efficient manner. Working closely with Alcoa, the IQAT developed a site plan that identified trailer locations and traffic flow patterns (both vehicular and pedestrian; Appendix C).

Specific PPA mobilization activities included the following.

- Initiating Alcoa health and safety orientation training for all site personnel (required prior to performing any work on site; Section 1.7).
- Installing of office, break, laboratory, storage, and tool trailers. Separate office trailers were set up for BBL, CDM, NYSDEC, SRMT, Sevenson, and USEPA.
- Establishing of parking areas and traffic flow patterns consistent with the project vehicle/pedestrian separation plan (Appendix C).
- Installing of necessary electrical supply to the individual trailers.
- Installing of communications tools, including phone and internet.
- Delivering and staging of restroom facilities (DCF 003).
- Constructing visitor areas at the river, SLF, and near the MPP.
- Installing a vehicle gate on the southern plant fence line allowing trucks to cross 90 degrees to County Route 42 from the river area to the plant.

2.3.1.2 Secure Landfill Cell 3

Disposal of waste materials generated during the ROPS required expansion of the existing SLF at the Alcoa plant. Existing Cells 1 and 2 were constructed, filled, and capped as part of the remedial waste cleanup program conducted at the Massena-West plant between 1994 and 2001. Design and construction of SLF Cell 3 were

initiated in 2004 to provide a location to dispose wastes anticipated from the ROPS and required modification to the original SLF design documents (CDM, January 1993). These modifications were made by means of Design Change Order (DCO) 27 (Appendix G) and included definition of the cell's footprint, berm system details, and the interim cap design. Design capacity of Cell 3 based on the current berm configuration is approximately 85,000 cy.

The design for all cells in the SLF, including Cell 3, includes a double composite liner system with two leachate collection systems: a primary system above the primary liner; and a secondary system above the secondary liner that functions as a leak detection system for the primary liner. The western portion of the Cell 3 liner system extends up the eastern slope of Cell 2, and partially onto the Cell 2 cap. Cell 3 has a separate leachate collection system and transfer pump; Cell 3 leachate transfer piping (to the Alcoa treatment system in Building 79C) is also independent, though transfer piping for all cells is located in the same piping containment systems and access manholes.

The eastern berm of Cell 3 is lower in elevation than the other berms and incorporates a spillway to shed stormwater runoff from the geomembrane cap. The cell design incorporated an interim cap (described in Section 2.3.5.3) to accommodate variations between planned and actual waste volumes generated during the ROPS.

Details regarding construction, operation, and interim closure of Cell 3 are contained in a separate document entitled *Certification Report for the Secure Landfill Cell 3 Operation and Interim Capping in 2005* (SLF Cell 3 Completion Report; CDM, February 2006). NYSDEC and USEPA approved operation of Cell 3 on July 6, 2005 and July 29, 2005, respectively.

2.3.1.3 Materials Processing Pad

The MPP was a 3.5-acre bermed, lined area located within the Alcoa plant site that was used for several different operations during the ROPS (Figure 2-5). The southern portion of the MPP contained the solids dewatering and wastewater treatment systems. Since it was recognized early on that SLF Cell 3 would likely not be completed by the time dredging operations began, a substantial paved area for the storage of processed sediments was created in the northern portion of the MPP. This area would later be used for the Geotube dewatering study (Section 2.3.3.4). A large, open crushed stone area on the eastern portion of the MPP was used as the main lay down area for support equipment and materials. The MPP was designated as an exclusion zone.

Specific MPP mobilization activities included the following.

- Dozing and grading the entire MPP, placing and compacting 2-in crusher run stone (photo MPP1 in Appendix D), and installing and welding a 40-mil HDPE liner (photo MPP2 in Appendix D).
- Placing geotextile fabric and 12 to 18 in of crushed stone in the southern portion of the MPP (approximately 200 ft by 200 ft).
- Placing geotextile fabric, crushed stone, and asphalt in the northern portion of the MPP (photo MPP3 in Appendix D; approximately 400 ft by 200 ft) and eastern portion of the MPP (approximately 200 ft by 150 ft).
- Establishing a perimeter berm (including high visibility fencing) and sump collection system.
- Establishing two access points:
    - A man gate on the southwest corner to direct all personnel through a shed stocked with PPE and adjacent decontamination area (contamination reduction zone [CRZ]); and

  - A vehicle gate 100 ft north of the southeast corner of the MPP to allow for dump truck and heavy vehicle traffic while hauling processed material to the SLF.
- Establishing necessary utilities (water and electric), including constructing of an above ground 6-in HDPE pipe line to carry water from Building 156 to specific areas of the MPP.
- Mobilizing and placing equipment associated with the solids dewatering (Section 2.3.3) and water treatment (Section 2.3.4) systems.

2.3.1.4 River Operations Area

The river operations area consisted of a number of sub-areas with distinctly different operations. This area was located across County Route 42 from the Alcoa plant, near Alcoa's Outfall 001, and was a point of river access established prior to the ROPS. The river operations area consisted of a booster pump area, floating dock area, staging area, and river work zones (Figure 2-4). A detailed description of each of these areas follows, along with a description of dredging and capping equipment set up.

Booster Pump Area

The booster pump area was located at the eastern most extent of the shore-based river operations area as shown on Figure 2-6 (DCF 001). The booster pump area, approximately 80 ft by 80 ft in size, was graded and a 40-mil HDPE liner with crushed stone was installed as a containment system (photo RA2 in Appendix D). The area was contained due to the potential of dredge slurry spillage during normal maintenance of the discharge pipeline or pumps. This area was designated an exclusion zone, and similar to the MPP, workers would enter and exit the booster pump area through a CRZ. Warning signs and rope were used to separate the booster pump area from adjacent areas.

As discussed in the Operations Plan (Sevenson, May 2005), booster pumps were placed in the discharge pipeline to provide additional horsepower to maintain slurry velocity. Two 275-horsepower (HP) booster pumps were placed and assembled in line (specification sheet included in Appendix F.04; photo RA8 in Appendix D). Only one pump was used at any one time, and the second served as a back up in the case of equipment problems. The pumps were electronically controlled so that the flow received in the discharge line from the dredge pump matched the flow discharge from the booster pump, thus preventing cavitation and solids settling in the pipeline. The pipeline distance from the dredge to the booster pump was approximately 1,500 feet. The pipeline length from the booster pump to the water treatment system at the MPP was 3,000 feet with a lift of 75 ft above the river water surface elevation.

Floating Dock Area

The floating dock area was constructed to function as the river access point, load out facility, CRZ area, maintenance location, and dock to tie off several work boats and a tug boat. The dock was constructed of two 30-ft by 50-ft flexi-float barges that were secured in place with spuds in the river and by cables and pins to shore (photo RA3 in Appendix D). A heavy metal ramp and timber mats bridged the transition from the shore to the dock. Warning signs were posted indicating that personal flotation devices (PFDs) were required in this area.

Staging Area

The river support staging area was located between the land-side end of the floating dock and booster pump area immediately adjacent to the river (photo RA1 in Appendix D). This elevated open area required little development during mobilization other than installation of silt fence and erosion controls, since this area was used for staging during previous river activities (i.e., NTCRA and CPS).

This area was used as a lay down yard for discharge pipe, silt curtain material and anchors, and to support the dredging operations. A craft break trailer and a conex box for secure storage of miscellaneous equipment and materials were also placed in this location. In addition, this area contained a permanent storage building used for staging of sampling equipment and processing of sediment cores. Starting in August 2005, cap materials were stockpiled in this area, and a 100-ton crane was mobilized to load the cap material from the stockpile to the material barges.

River Work Zones

As identified in the Operations Plan (Sevenson, May 2005), work on the river took place in the main channel area (dredging/capping), northern near shore area (removal/capping), southern near shore area (capping only), and armored cap area (capping only; Figure 2-6). These areas were established in the river via installation of silt containment system as shown on Figure 2-7.

The main channel and northern near shore silt curtain system configuration was developed based on previous river work and a study of the river currents, pressure wave phenomenon induced by lock operations on the St. Lawrence River, and fluctuating river flows. The silt curtain system design included the use of permeable and impermeable curtain materials (intended to submerge under high river flows), an anchoring system, and submerged baffle curtains. Information on the main channel containment system configuration is presented in Section 2.3.2.1; additional detail regarding the system design and performance is contained in Appendix I.

The southern near shore and armored cap areas were locations where only cap material was placed, and as such did not require any specific mobilization work other than installation of silt curtains. L-shaped sections of silt curtain were easily deployed at each of these areas the day prior to the initiation of capping. Additional information on the capping area containment systems is presented in Section 2.3.6.1. In comparison, the northern near shore and main channel dredging/capping areas were fully enclosed in a silt curtain containment system that required a substantial mobilization effort to properly establish.

Dredging Equipment Set Up

Dredge equipment set up included two main components: 1) placement of the dredges into the river; and 2) installation of the dredge discharge pipeline. The auger head hydraulic dredges were transported to the site by tractor and trailer. Per ECN 003, two ESG Manufacturing Model MDS 210 dredges (ESG dredges; Appendix F.04) were initially mobilized. A crane was used to off-load each dredge and set it in the river near the floating dock (photo RA9 in Appendix D). The only required assembly was installation of the pilot house (disassembled for road transport) on the dredge barge. Once assembly was complete, the dredge was pushed into position in the river by a work boat. Per ECN 001, due to the large quantity of woody debris in the northern near shore relative to that found in the main channel during the pre-dredging survey, dredging would be initiated in Work Zone 1. As such, one ESG dredge was staged in Work Zone 1 and the other in Work Zone 2.

Concurrent with this activity, the HDPE dredge discharge line was assembled (photo RA7 in Appendix D) and placed into position. In the river, the HDPE discharge pipe was assembled with floats and flexible joints. The floats kept the discharge line from sinking once filled with dredge slurry, and the flexible joints allowed the pipe line to "follow" the dredge as it maneuvered throughout the work zone. The floats were comprised of 20-ft sections of 10-in HDPE pipe with caps welded at each end. Two floats were secured to each length of the dredge discharge pipe. The in-river dredge discharge pipeline extended approximately 500 ft from the dredge to the north shore. On shore, the pipeline extended approximately 1,000 ft to the booster pump station. From the booster pump station, the pipeline ran up the embankment to a steel culvert beneath County Route 42. With approval from the NYSDOT, the 10-in slurry line ran through the culvert to the north side of County Route 42 on Alcoa property. From here, the discharge pipeline ran west, parallel with the road, to the V-bottom tank at

the MPP. The total length of the discharge pipeline from the dredge to the MPP was approximately 4,500 ft. Figure 2-6 illustrates the location of the HDPE dredge discharge pipeline and the booster pump(s).

Capping Equipment Set Up

As noted previously, equipment and materials associated with capping activities were mobilized immediately prior to initiation of capping activities. Additional equipment mobilized in preparation for capping operations included: two 100-ton cranes and buckets; two material barges; and an additional land-based loader.

2.3.1.5 Dredge System Shake-out

Mobilization activities were completed approximately one week ahead of schedule with completion of the silt curtain installation. On June 6, 2005, the first full dredge system test runs were initiated with the intent of initiating production dredging on June 8, 2005. Over the next four days, each of the two ESG dredges was tested with little success in delivering dredged solids to the MPP. Problems encountered included debris clogs at the auger head, solids settling in the discharge pipeline, and various mechanical issues. Several evaluations were performed to identify the pump capacity on the dredge and booster pump, and to confirm the solids content of the dredge slurry. After significant troubleshooting efforts, it was concluded that the ESG dredges were not capable of providing the required discharge velocity to transport the slurry flow between the dredge and the booster pumps necessary to maintain the solids in suspension.

In response, a MudCat model MC 2000 hydraulic dredge (MudCat dredge) with increased pump horsepower was mobilized and tested, as described in ECN 007 (Appendix G). Results of this testing indicated that the MudCat dredge pump system was capable of delivering the dredge slurry to the sediment processing system at the MPP.

Following final system checks, the dredge shake-out period was completed on June 13, 2005 and production dredging was initiated on June 14, 2005 with the MudCat dredge. A second MudCat dredge was later mobilized to the site for use as a back up dredge; the two ESG dredges remained on site, but were not used (ECN 015).

2.3.2 Dredging and Debris Removal

The following presents a detailed description of the dredging and debris removal activities that were performed in the northern near shore and main channel areas during the ROPS. These sections describe the silt containment system, equipment and positioning systems used, details of the construction activities, and monitoring. Variances from the ROPS Work Plan (Alcoa, February 2005) and the Operations Plan (Sevenson, May 2005) are also discussed herein. An evaluation of information and data obtained during dredging and removal operations is contained in Section 3.

2.3.2.1 Silt Containment System

Prior to commencement of in-river dredging related activities, a silt containment system was installed around the northern near shore and main channel dredge areas as described in the Operations Plan (Sevenson, May 2005). A substantial effort was spent analyzing and designing the containment system, and the design incorporated information gathered from previous capping and dredging work performed in the river (i.e., NTCRA and CPS). An overview of the containment system is presented below, and a detailed account of silt curtain design, installation, operation, and maintenance is provided in Appendix I.

General Description

The layout of the silt containment system is illustrated on Figure 2-7. The entire perimeter of the main channel dredge area was enclosed within silt curtains; a bypass channel (approximately 100 ft in width) remained along the southern shore of the river to allow passage of recreational boats.

The curtain sections placed perpendicular to the river flow (upstream and downstream ends of the main channel area) were permeable to allow a fraction of the river current to flow into the work zones, thereby decreasing the stresses on the curtain containment system. Permeable curtains were constructed of a porous polypropylene fabric with a 6% open area. These curtains had 12-in Styrofoam floats at the top, were deployed to within 2 ft of the river bottom (13-20 in as confirmed by diver observation), and were held in place by an anchoring system (detailed in Appendix I).

As an added measure, at the upstream and downstream ends of the main channel area, a submerged baffle curtain was installed to further contain solids. The baffle curtains were deployed on the river bottom on the interior of the floating perimeter curtain. The curtains were held in place by heavy chains stitched into the bottom edge of the curtains which laid directly on the river bottom. The curtains extended 4 ft up from the river bottom and were suspended by Styrofoam floats.

Curtain sections placed parallel to the river flow were impermeable and constructed of polyvinyl chloride (PVC)-coated polyester fabric for improved containment of suspended solids. These curtains were also held in place by an anchoring system (detailed in Appendix I). The perimeter curtains were designed to submerge under extreme high flows, thereby relieving the force on the curtain, allowing it to remain intact during high river flows.

Four spud barges were placed in the river to further support and anchor the containment system. The spud barges were anchored at the upstream and downstream extents of the main channel area and at two intermediate locations along the perimeter curtain. The spud barges also served as floating work platforms providing safe places on the river to tie off work boats, secure platforms for setting light plants necessary for night time river activities, and perform general maintenance activities.

Interior curtains were used to divide the main channel area into the three work zones. These curtains were made of permeable material, held in place with anchors, secured to the shore at the north, and tied off to a spud barge on the south end of the main channel area.

Silt curtains surrounding the northern near shore area were impermeable, and were draped from the water surface to the river bed due to the shallow water in the area. The curtains were anchored on the shore at the upstream and downstream extents. A large portion of the northern near shore area was further encompassed by the Work Zone 1 curtain in the main channel area (Figure 2-7).

Installation of Containment System

Installation of the containment system commenced on May 20, 2005 and was completed on June 4, 2005 (photos RA4 and RA5 in Appendix D). Daily turbidity monitoring was conducted during the containment system anchor installation to assess any effects of these activities on turbidity levels in the water column. Measurements were conducted at one transect upstream and two transects downstream of the main channel area. Results of these monitoring activities indicated no significant increases in turbidity levels at the downstream transects as a result of anchor installation or curtain deployment. Data obtained during these monitoring activities are included in Appendix B. Specific details regarding curtain installation and associated monitoring are described in Appendices I and A, respectively.

Maintenance Activities

As dredging progressed, the silt curtains required full time maintenance. This was provided by a three-man dive team and supported by additional manpower and equipment as needed (photo RA15 in Appendix D). The curtains were inspected daily to note and initiate any necessary repairs as described in Section 2.1.5. Typical curtain damage included ripped seams, broken anchor lines, damaged floats, tears in the skirt, and general misalignment (photos RA12 and RA23 in Appendix D). Damage occurred almost on a daily basis in different areas of the curtains, and repairs were routinely completed with minimal disruption to dredging. Ripped seams and tears were typically repaired by installing a temporary saddle made of geotextile filter fabric that was draped over both sides of the existing curtain using anchor chain to secure the saddle in place. These saddles were placed until the tear could either be stitched or the section of curtain replaced. High-strength permeable curtains were used as replacements along portions of the containment system, and additional anchors were placed on the downstream curtains (ECN 016 Revision #3).

More severe damage occurred during high flow events in the river. Damage from these events included metal joint failure, broken cables, extensive curtain failure, spud barge movement, and lost anchors (photos RA18, RA29, and RA30 in Appendix D). This type of damage delayed dredging until the containment system was completely repaired, and resulted in a significant amount of down time for the dredging operation. This occurred on September 2-7, September 19-23, September 30-October 1, and October 15-17, 2005. These repairs could only be performed by replacing damaged sections of curtain and using work boats, barges, and excavators to realign the curtain and/or the spud barges serving as anchor points.

Other contributing factors to curtain damage likely include pressure waves (discussed briefly below) and direct impacts by work boats and dredges. Early in the project, there were isolated areas of damage to the curtains observed to be caused by contact with work boat propellers. It was common practice for the work boats to traverse over the curtain floats as they moved between the work zones and the dock facilities. This approach was adjusted such that boats could move in and out of the work zones without the propellers coming in direct contact with the curtain. In addition, the spud barge located at the upstream corner of Work Zone 1 moved several times. This resulted in the perimeter curtain on the south side of the work area impeding sediment removal at the southern limit of Work Zone 1. This spud barge was repositioned such that dredging in Work Zone 1 could be completed.

Pressure Wave/Velocity Study

Pressure waves in the Grasse River are the result of water releases from the Snell Lock, located on the St. Lawrence Seaway immediately upstream of the mouth of the Grasse River. The release of water from the Snell Lock causes a temporary increase in water elevation in the St. Lawrence system, inducing a wave that propagates up the Grasse River and causes a temporary increase in the water levels and flow reversal (i.e., upstream currents). The wave is generally observed in the upper portion of the lower Grasse River (i.e., in the vicinity of the Alcoa plant) about 20 to 30 minutes after water is discharged from the lock, and persists for about 5 minutes before reflecting off upstream obstructions and returning back downstream. This process can be repeated more than 10 times daily, depending on the volume of ship and pleasure crafts using the lock. This phenomenon was first documented during the 2001 CPS, when silt curtains were dislodged and damaged during the occurrence of these pressure waves (Alcoa, April 2002).

In response to the recurring damage to the silt containment system, a river velocity study was performed from July 21-24, 2005 to better understand circulation patterns through and around the containment system and investigate the effects of the pressure waves on velocities in the vicinity of the work area. The study consisted of the collection of current velocity measurements along transects located upstream of, adjacent to, and downstream of the containment system. Additional velocity information was also collected at discrete locations

along the perimeter of the containment system. Influences from the pressure waves were clearly observed in the velocity study data. Although the current velocities measured during this study were generally below the design considerations for the containment system, the pressure waves do impose a short-term, impulse force on the silt curtains that was not accounted for and was likely responsible for a portion of the damage and difficulties encountered during the ROPS. Details regarding the pressure wave and velocity study are included in Appendix I.

Silt Curtain Gates

Scow and barge traffic into and out of the work zones was frequent during the debris removal operation and northern near shore excavation work. The buoyant force of silt curtain floats made it impossible for scows and barges to pass over the silt curtains, so the curtains had to be temporarily opened to allow traffic to pass through. Opening the silt curtains allowed additional flow to enter the work area. Controlling the curtain while it was open was difficult, and closing the curtain was a very labor intensive operation. As such, ECN 010 provided for the use of silt curtain gates designed to allow the scows and barges into and out of the work zones quickly while maintaining the integrity of the containment system.

The gates were designed based on a rope and pulley system. However, the gates did not operate as intended in the field. The buoyant force on the silt curtain gate floats coupled with constant fluctuation of the river flow caused the ropes to tangle and the anchor blocks to move out of alignment, making operation of the gates ineffective and time consuming. Considerable time was spent adding additional weights and untangling the ropes, without improvement in system operation. As a result, use of the silt curtain gates was discontinued, and scows and barges were moved into and out of the work zones by opening and closing upstream silt curtains. However, with USEPA approval, an upstream section of the perimeter silt curtain was left open during dredging and capping activities for an extended period of time to facilitate movement of the scows between the work area and the dock. While this portion of the silt curtain was open, additional turbidity monitoring was performed at the silt curtain opening. Turbidity monitoring was conducted during scow transport out of the silt curtained area on June 16, 17, and 22, 2005. Measurements were consistent with those collected at an upstream station on these same days, indicating that scow transport did not result in increased turbidity levels outside of the curtained area. Turbidity measurements obtained during this monitoring are summarized in Appendix A, and results are included in Appendix B.

Daily Water Column Monitoring

Daily water column monitoring was conducted to assess the performance of all silt containment systems. On three instances, water column samples were collected and analyzed for both unfiltered (whole water) and filtered (dissolved) PCBs within and adjacent to the silt curtain to supplement the daily water column data. Details regarding the monitoring program are described in Appendix A (with data provided in Appendix B). Results of this monitoring indicated that the corrective action trigger for PCBs (2 micrograms per liter [µg/L]) was exceeded on eight days during debris/sediment removal in the main channel, but was not exceeded during capping. The corrective action triggers for TSS and turbidity were not exceeded at any time during the ROPS. These results are further discussed in Sections 2.5.2 and 3.

2.3.2.2 Northern Near Shore

As shown on Figure 1-3, the northern near shore area spans approximately 700 ft along the northern shore of the lower Grasse River from approximately T6 to T7. The removal area extended from the shoreline into the river approximately 30 ft at its widest point. The maximum water depth in the area was approximately 5 ft. As described in the Operations Plan (Sevenson, May 2005), removal of 1 ft of sediment was targeted across the

area, resulting in an estimated 800 cy of sediment targeted for removal. The following sections detail the general area characteristics, equipment used, positioning system, operations, and monitoring associated with excavation and debris removal in the northern near shore area.

2.3.2.2.1 Area Characteristics [Northern Near Shore]

The northern near shore area was initially selected for removal based on a sediment grab sample collected during the 2003 sampling event that contained elevated levels of PCBs (i.e., surficial [0 to 3 in] concentration of 31.3 ppm), and considering its close proximity to the main channel dredging area. As part of the baseline monitoring effort in 2004 (Appendix A), eight sediment cores were collected within the northern near shore area to characterize the area. Approximately 1 to 3.5 ft of sediment was recovered in each of these cores, with average compositions of 56% fines, 36% sand, and 3% gravel. Surface PCB concentrations averaged 19.0 ppm; six of the eight cores contained less than 15 ppm and the other two cores (located in the middle of the area) contained 48.8 ppm and 73.1 ppm. Peak PCB levels were generally observed in the top 6 to 18 in (range of 0.2 to 234 ppm), and concentrations at the bottom of the cores were low. Additional details on results of the 2004 sampling event are presented in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b).

2.3.2.2.2 Equipment Used/Positioning System [Northern Near Shore]

Since there was heavy vegetative growth across the northern near shore embankment and the dredge pipelines (associated with the main channel dredging activities) ran along the majority of the bank, the removal area was only accessible from the water.

The Operations Plan (Sevenson, May 2005) originally proposed that removal in this area be performed using the hydraulic horizontal auger dredge. However, as noted in ECN 001, based on probing and further field reconnaissance which revealed the presence of a substantial amount of primarily woody debris, a long stick mechanical excavator (Komatsu 220 Long Stick) was selected to perform the material removal. The equipment was secured on the deck of a floating spud barge (photo RA11 in Appendix D). Due to the shallow water (typically less than 5 ft) within the area, the barge and excavator had to be positioned outside the silt curtain. As a result, the excavator selected had an extended section of boom (i.e., the “long-stick”) that increased the operational reach. The excavator barge was maneuvered into position adjacent to the work area using small work boats. All excavated sediment and debris were loaded directly into 10 cy material scows (10 ft by 40 ft) that were also pushed into position by work boats. Once filled, the scows were pushed to the loading dock, and off loaded by another excavator into a tandem dump truck with a sealed tailgate positioned on the floating dock (photo RA19 in Appendix D). The sealed tailgate prevented water and sediment from spilling into the roadway during transit to the MPP. On occasion, it was necessary to use a vacuum truck to remove collected water from inside the material scows. This water was transported in the vacuum truck to the MPP and treated in the wastewater treatment system.

Determinations of the depth of sediment removed and location of the excavator during northern near shore area removal activities were initially achieved through the excavator operator and surveyor working together. Initial depth (vertical) control during removal was accomplished visually by the operator. The entire area was surrounded by silt curtains that clearly identified the limits of the area. The curtains were positioned with assistance from a survey field crew. Once the initial excavation pass was completed, the area was surveyed using real-time kinematic (RTK) techniques.

2.3.2.2.3 Excavation and Debris Removal Operations [Northern Near Shore]

Removal work was initiated in the upstream end of the northern near shore area on June 21, 2005. Because both debris and sediment removal activities were being performed concurrently using an excavator bucket, there was no distinction between operations. Due to changing topography and embedded debris (rocks, timbers, and logs), depth control was difficult to maintain.

The first excavation pass across the entire area was completed on June 24, 2005, after which work efforts shifted to focus on dredging operations in the main channel area (Section 2.3.2.3.3). Excavation and debris removal were also performed in the northern near shore from July 25-29, 2005. As detailed in Appendix A, the area was surveyed on August 3 and 4, 2005 to provide information regarding the depth of material excavated at each node along the 25-ft by 10-ft grid established in the northern near shore area. Results of this survey identified 42 grid nodes where 1 ft or more of material had been removed, and 46 grid nodes where less than 1 ft had been removed. To achieve the target of removal to 1 ft across the entire area, additional excavation work was necessary.

The second excavation pass in portions of the northern near shore area was performed starting on August 12, 2005. To efficiently perform follow-up excavation in the area, sediment elevations within the area were surveyed real time as the excavator proceeded, to confirm that the required depth of removal was achieved at each grid node. The sequence of removal operations in the northern near shore is illustrated in Appendix F.03. Removal efforts in the area were completed on August 22, 2005.

SRMT requested that detailed records be kept of the volume, location (to the extent possible), and material type removed from the northern near shore area. As a result, the IQAT kept detailed records based on visual observation as material was off loaded from the scows. This information was provided to Agency representatives following completion of the sediment removal, and is included in Appendix F.03.

In general, the northern near shore area contained sediment interspersed with debris consisting of rocks, loose timbers, and logs. A large timber structure believed to be from an old dock was identified in an area bound by grid nodes 22, 24, 27, and 32 (Figure 2-8). During mechanical removal in the northern near shore, most of the timbers were removed. However, part of the dock was embedded into the river bed at a depth greater than 1 ft. With concurrence from the USEPA, this portion of the structure was left in place with timbers protruding from the river bottom (photo RA24 in Appendix D).

Due to the presence of significant debris and varying topography, a total of approximately 1,600 cy of debris and sediment were removed from the area. Final removal depths at each grid node are shown on Figure 2-8.

2.3.2.2.4 Monitoring [Northern Near Shore]

During-construction monitoring associated with removal activities in the northern near shore area primarily included water column monitoring (note that since main channel and northern near construction activities occurred concurrently, quantitative water column information was not obtained because of the dominance of the main channel activities on downstream water quality), sediment surface elevation measurements, sediment sampling, and air monitoring. These monitoring activities were conducted to obtain timely information on the effects of removal activities in this area, as well as performance information related to removal operations, such as depth of excavation. Details on the monitoring activities performed and the associated results are presented throughout Section 3 and in Appendix A.

2.3.2.3 Main Channel

As previously described, the main channel area was divided into three work zones from upstream to downstream. Each work zone was further divided into 100-ft by 100-ft subunits to facilitate operational tracking and sampling. As described in the Operations Plan (Sevenson, May 2005), based on the typical distribution of PCB concentrations in the sediment column (i.e., relatively low in the top 18 to 24 in and increasing to a peak in the bottom 6-12 in), an approach to dredging was developed that focused on removal of the top 2 ft of sediment across each work zone area with the intent of separating sediment containing high and low PCB levels. In general, the Operations Plan described an approach where removal activities in the main channel area would begin with debris removal in Work Zone 1, followed by hydraulic dredging of the top 2 ft across the work zone, and then dredging in several passes to remove the remaining soft sediment to "hard bottom," which was determined based on 2005 ROPS baseline probing efforts. Once hard bottom had been reached and the sediment removed, as verified by probing and sampling, Alcoa would provide these data to USEPA and, with concurrence of the Agencies, dredging operations would shift from production dredging to cleanup passes. The cleanup passes were designed to remove as much of the PCB-containing sediments remaining in the dredged area after the majority of the overlying sediments had been removed. This cleanup pass effort would be coordinated with the initiation of debris removal and production dredging in Work Zone 2. The intent was to continue across the three work zones in this manner until all work zones were completed.

As described in the ROPS Work Plan (Alcoa, February 2005) and ECN 012, a detailed sampling program was to be integrated among the production and cleanup passes in accordance with a Phases 1 and 2 decision tree. This decision tree approach was intended to evaluate the effectiveness of additional cleanup passes following the completion of production dredging. Phase 1 dictated that two additional cleanup passes would be performed in approximately 30% of the 100-ft by 100-ft subunits initially dredged in Work Zone 1 regardless of the sediment depth remaining. Data generated from the Phase 1 subunits would be assessed to confirm the proposed Phase 2 decision criteria for residual sediment depth and necessary number of cleanup passes for the remaining subunits. The Phase 2 decision process was developed to address the necessity of cleanup pass(es), specifically the need for cleanup passes if the Phase 1 data showed no statistically significant benefit to additional passes based on residual sediment depth. As discussed in Section 2.3.2.3.4, the planned progression of the main channel dredging activities as described above could not be followed due to the difficulties encountered in removing the remaining sediments from the work area even after a significant level of effort had been expended.

The following sections detail the general area characteristics, equipment used, positioning system, operations, and monitoring associated with dredging and debris removal in the main channel area, including discussions of variations from the original project scope.

2.3.2.3.1 Area Characteristics [Main Channel]

This portion of the main channel was selected for removal during the ROPS based on sediment sampling conducted in 2003 and January 2004 that indicated significant PCB concentrations at depth in this area, coupled with the fact that it is located within an ice scour prone area of the river (i.e., upstream of T19). Based on data collected through January 2004, measured PCB concentrations in the targeted area ranged from non-detect to 3,668 ppm (maximum PCB concentration observed at a depth of approximately 3.5 ft below the sediment surface).

Additional sediment sampling was conducted in August/September 2004 to further characterize the area. A total of 30 sediment cores were collected from the main channel and northern side slope (19 and 11 cores, respectively). Approximately 3 to 5 ft of sediment was recovered in each of the cores collected from the main channel. The top 18 in of sediment within the cores was coarser than the deeper sediments. PCB levels were

relatively low at the surface (i.e., 0 to 3 in) with levels ranging from 0.1 to 9.0 ppm in most cores; one core had a concentration of 29.9 ppm. At-depth PCB concentrations ranged from 238 to 3,859 ppm and were generally found 3 to 4 ft below the surface.

Approximately 2 to 6 ft of sediment were recovered from cores collected along the northern side slope. Cores contained 62% sand, 34% fines, and 4% gravel. PCB levels in the three most upstream side slope cores were relatively low ranging from non-detect to 17.4 ppm. The eight downstream cores exhibited profiles similar to the main channel cores with generally low surface PCB concentrations (less than 7 ppm) and peak PCB levels of 153 to 1,578 ppm observed approximately 1 to 5 ft below the sediment surface.

Additional details on results of the 2004 sampling event are presented in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b).

2.3.2.3.2 Equipment Used/Positioning System [Main Channel]

Dredging and Debris Removal Equipment

Two ESG dredges were mobilized to the site. During the dredge system shake-out described in Section 2.3.1.5, a MudCat dredge was mobilized and used during the ROPS (a second MudCat dredge was also mobilized as a back up dredge and neither ESG dredge was used). Both the ESG and MudCat dredges were horizontal auger hydraulic dredges that operate in a similar manner; specification sheets for each of the dredges are provided in Appendix F.04.

The 8-ft wide horizontal auger MudCat dredge was initially positioned at a depth approximately 8 in below the top of the sediment bed. With the assistance of tines attached to the auger, the spinning action of the auger loosened and stirred the sediment creating a water and sediment slurry mix. The blades of the auger moved the loosened material toward the center of the auger head where the solids became suspended in the high flow rate stream (2,000 gpm) being drawn into the suction line. This dredge slurry was transported via a 12-in HDPE pipeline (10.3 in inside diameter) to the MPP for dewatering and processing. The booster pump placed in line provided additional horsepower to maintain the velocity of the dredge slurry, thereby preventing the solids from settling in the discharge pipeline.

Late in the ROPS (October 12-21, 2005), a 10-in discharge swinging ladder dredge with a 3-ft diameter basket cutterhead (swinging ladder cutterhead; photos RA33 and RA36 in Appendix D) was brought to the site to test the effectiveness of a different dredge type at removing sediment that the horizontal auger dredges were not capturing (ECN 030). The specification sheet on this dredge is provided in Appendix F.04. The cutterhead was passed over the sediment bed from side to side in an approximate 60-ft arc. Mechanical excavation was also tested using a 0.5-cy hydraulically-actuated clamshell bucket mounted to the Komatsu long stick excavator (ECN 021; photo RA28 in Appendix D).

For debris removal operations, Sevenson initially used the Komatsu 220 long stick excavator, placed on a barge platform, with a perforated bucket (photo RA13 in Appendix D). As detailed in Section 2.3.2.3.2, in an effort to maximize production and decrease turbidity during the ROPS, two different rakes were developed to perform the debris removal operation in place of the perforated bucket. The first rake was field-fabricated using a stone rake intended for use with a bulldozer (photo RA17 in Appendix D). Based on the success of this rake, a "second generation" rake was developed specifically for the debris removal operation (photo RA20 in Appendix D). Each of these rakes was mounted on the excavator in place of the perforated bucket. Consistent with debris removal in the northern near shore area, debris was loaded into scows that were positioned using small work

boats. All removed debris (and mechanically excavated sediment) was transported by scows to the loading dock, loaded into dump trucks, and hauled to the MPP for processing.

Positioning System

Each hydraulic dredge was equipped with a digital global positioning system (DGPS) manufactured by Hypack to provide real-time documentation of the precise x-y location of dredging operations (an example of the Hypack output is included in Appendix F.05). In addition, the dredge had a depth sounding system to check bed elevation measurements, as a real-time supplement to periodic checks using traditional survey methods. The baseline probing data from spring 2005 was input to the system to provide a baseline elevation for the top of sediment as well as the expected elevation of hard bottom. A monitor was stationed within the cab of the dredge that provided the operator with a pictorial view of the dredge head relative to the sediment bed surface as well as a second view that provided the dredge location within the work zone.

The MudCat dredge position within the work zones was maintained by a cable system. Two parallel cables were run perpendicular to the channel, at the upstream and downstream extents of each work zone. These cables were anchored on shore on the north end and tied off to spud barges in the river on the south end. A traveling cable was attached to these cables running parallel to the channel. This traveling cable was threaded through a windlass system on the deck of the barge that propelled the dredge forward and back along the length of the travel cable. After the dredge completed several passes on a given cut line, the travel cables were moved 6 ft north or south along the cables perpendicular to the channel to position the dredge for the next cut. This 6-ft movement was to allow a 2-ft overlap with each repositioning of the dredge (since the auger was 8-ft wide).

The cable system was not needed for either the swinging ladder cutterhead dredge or mechanical excavator. The swinging ladder cutterhead dredge positioned itself by moving along its intended path using a traveling spud (equipped with a hydraulic ram) in the middle of the dredge that is centered on the intended path. Two working spuds on the side of the barge were put down to hold the barge in place while swinging the ladder and dredging. These spuds were then raised to allow the traveling spud to advance the dredge forward approximately 3 ft.

The excavator was moved into position using work boats. Once in position, the excavator dredge barge was equipped with spuds that were used to anchor the barge during dredging or debris removal operations. Once an area was complete, work boats would then push the excavator barge to the next location and repeat the operation.

2.3.2.3.3 Debris Removal [Main Channel]

As described in the Operations Plan, the original approach for the main channel area was to perform debris removal activities in advance of the dredging operation. A pre-dredge survey conducted by Sevenson did not indicate the presence of a substantial volume of debris in Work Zone 1, and as a result ECN 001 was approved to allow dredging operations in Work Zone 1 to begin prior to removal in the northern near shore area. However, during the dredge system shake-out, debris interfered with dredging and it became clear that pre-dredging debris removal was necessary. As such, debris removal operations with the perforated bucket were initiated in Work Zone 1 on June 10, 2005, prior to the start of production dredging.

Debris removal operations were initiated at locations where debris was identified during the pre-dredge survey. Once those locations were addressed, the debris removal operation was moved to the southern limit of Work Zone 1 and worked through the entire work zone in an upstream to downstream and south to north fashion. Initially, debris removal operations followed the same procedures and used the same equipment as employed in the northern near shore. However, increased visual turbidity was observed as debris removal operations

progressed in the main channel. In an effort to reduce resuspension, several operational adjustments were made, including an assessment of the bucket contents prior to lifting it out of the water. If there was no indication of debris present in the bucket, the bucket would be moved back near the bottom and the contents emptied, rather than bringing the bucket out of the water where the contents could pour out of the perforated holes back into Work Zone 1. Other minor operational adjustments were attempted during the work; however, none of them clearly resulted in a decrease in visual turbidity.

As detailed in Appendix A, daily water column monitoring was performed outside the silt containment system. On June 15, 2005, a PCB concentration of 2.3 µg/L was recorded at sample location D4 (just downstream of the perimeter silt curtain surrounding the work zones; Figure 2-7) and a PCB concentration of 0.572 µg/L was recorded at ROPS-WCT14 (transect located approximately 2,000 ft downstream of the main channel dredging area). The water quality action level established for the project was 2.0 µg/l PCBs as measured at ROPS WC131 (as described in Section 2.5.2; Alcoa used ROPS-WCT14 as a corrective action trigger location as well). Elevated PCB concentrations at location D4 continued, and exceeded 2.0 µg/L on June 16, 17, 22, and 23, 2005. Although corrective actions were not triggered by these levels at D4 , Alcoa proactively instituted operational changes to reduce PCB releases during dredging and debris removal operations.

Starting on July 7, 2005, a field-fabricated debris rake was used for debris removal operations as described in ECN 013. The rake was designed to sift through the sediment as it was pulled across the river bottom capturing only debris, and allowing the sediment to remain on the river bed. The field test of the rake seemed to show an improvement in turbidity levels as well as more efficient debris collection, thus a "second generation" rake was manufactured to incorporate improvements identified in the field test. Such improvements included adding curvature to the tines, lengthening the tines, and adding an opposing grate to assist in capturing the debris on the rake (ECN 017). In spite of these adjustments, water column sampling typically showed elevated PCBs when dredging and debris removal activities were being performed. Water column PCB levels typically declined in the absence of in-river activity (e.g., over the weekend).

On July 8, 2005, a PCB level of 2.2 µg/L was recorded at ROPS-WCT14 and 2.5 µg/L was recorded at ROPS-WC131, marking the first exceedances of the 2.0 µg/L corrective action triggers. Additional exceedances, ranging from 2.4 µg/L to 4.4 µg/L, were recorded at ROPS-WCT14 on July 21, 2005 and at ROPS-WC131 on July 19, 20, 21, and 22, 2005. In response to the exceedance on July 21, 2005, the duration of debris removal was reduced to no more than 6 hours per day. The corrective action trigger level was exceeded on three occasions after this change in operation: July 26; August 25; and September 10, 2005. The contributions of debris removal, dredging, and other factors to elevated PCB concentrations at the monitoring stations is further discussed in Section 3.2.4.

Following the August 25, 2005 exceedance, USEPA requested that all material brought up by the rake, whether debris or sediment, be placed into the scows rather than being placed back in the work zone. This created an unexpected large volume of very wet sediment that had to be handled at the dock and transported to the MPP by dump truck. This method was used until the last day of debris removal on October 14, 2005. A total of approximately 1,500 cy of debris was removed from the main channel area (Dredge Report; Appendix F.02). The average rate of debris removal was 38 cubic yards per day (cy/day).

2.3.2.3.4 Dredge Operation [Main Channel]

Production Dredging

Production dredging commenced on June 14, 2005 in Work Zone 1. Early in production dredging, Sevenson requested approval to make dredge cuts from downstream to upstream, parallel to flow, to better manage the

dredge discharge line and prevent it from "snaking" around in front of the dredge. This was approved in ECN 006 under the condition that dredging during cleanup passes would be required to be conducted in an upstream to downstream manner. Dredging was initiated in the southwest corner of Work Zone 1 and progressed with several passes across the entirety of Work Zone 1 until, according to Hypack surveys, the top 2 ft of sediment was removed.

Over the next several weeks, dredging to remove sediment beyond the top 2 ft continued in Work Zone 1. However, there were instances when dredging of the top 2 ft of sediment in Work Zone 2 was conducted by the second MudCat dredge as repairs were made or blockages removed from the primary dredge in Work Zone 1 (ECN 005). Once the dredge in Work Zone 1 was back on line, all work activities shifted back to Work Zone 1. From June 14 to August 11, 2005 production dredging continued, but was hampered by down time due to equipment breakdowns and maintenance, dredge discharge line clogs, inclement weather, and treatment capacity issues as described below.

Impacts to Production Dredging

Dredge equipment maintenance was a continuous issue, often requiring substantial time to complete. Typical dredge breakdowns included augers, gear housings, tine replacements, and slurry line flex joint failure. Mechanical problems were occasionally encountered with the hydraulic and main pumps and electronics system. Typically, minor repairs were implemented within 3 to 6 hours since spare parts were kept on site. However, there were instances when major repairs required parts to be ordered and delivery required more than one day. While the dredge in Work Zone 1 was down, the dredge in Work Zone 2 would be brought on line to continue delivering solids to the MPP.

In spite of the debris removal effort ahead of the dredge, jamming of the auger head by debris occurred periodically during the conduct of the work. This was easily remedied most of the time by raising the dredge head and simply removing the blockage (e.g., tree branch or tire) from the auger. Plugging of the dredge slurry line was also an issue during the first several weeks of the ROPS and addressing the problem was time consuming and often involved non-routine higher risk activities (e.g., back water flushing). Procedures were put in place to proactively address safety and compliance issues inherent in these non-routine tasks. In addition, a procedure was developed to limit the amount of backflush water and sediment that would feed back from the MPP through the discharge pipeline during these shutdowns.

Additionally, capacity issues associated with the sediment processing area impacted effective dredge time as a result of the sediment dewatering system at the MPP not being capable of processing solids at the rate delivered by the dredge. The primary constraint in the sediment dewatering process was the rate at which the fine sediments could be processed through the filter press operation. The lower than anticipated feed rate through the filter presses was due to the filter cloths blinding and periodically necessitated a stoppage of dredging (and delivery of slurry to the MPP). In response, numerous tests of polymer dosages were conducted, diatomaceous earth (DE) was used to improve the quality of the filter cake, and a filter press expert was employed on site to troubleshoot the operation. Several operational adjustments were also made in an effort to increase the percent solids of the dredge slurry including: reorienting the dredge; adjusting auger head speed; reorienting/removing the shroud; and removing the auger tines. In spite of these changes, negligible increases in percent solids of the dredge slurry were attained. A percent solids of 8 to 12% (by weight) was intended (Sevenson, May 2005), while a dredge slurry percent solids of approximately 6% was attained (Dredge Report; Appendix F.02). In September the pilot testing of the Geotubes was initiated as a measure to further provide capacity in the sediment processing train and alleviate impacts on the dredging operation. Use of the Geotubes was successful in alleviating this constraint, but also resulted in a high water content solids stream that required significant additional processing prior to placement in Cell 3.

Dredging productivity was also hampered by weather-related issues including: lightning; high winds; and high river flows resulting from heavy rains. Safety procedures required an immediate shutdown of all operations after any sighting of lightning, and constant surveillance until 30 minutes had passed without lightning before activities could resume. High winds out of the east (against the flow of the river) would create an irregular surface wave on the river, making it unsafe for work boats to be on the water. River flows typically ranged from about 2,000 cubic feet per second (cfs) during the early stages of mobilization in May to less than 200 cfs in early August. Several times during the ROPS, storms produced elevated flows that peaked between 5,000 and 6,000 cfs and took one to two days to subside. Following the impact of the remnants of Hurricane Katrina in September, river flow increased in excess of 10,000 cfs and took several days to return to below 3,000 cfs. Flows exceeding 3,000 cfs typically caused areas of silt curtain failure.

Site procedures required that when river flow rates exceeded 3,000 cfs, personnel were to assess potential impacts and determine when work could safely resume. Following elevated flow events, it often took one to three days to repair the silt curtains before dredging or debris removal activities could be restarted. On several instances, the spud barges were pushed out of position. Weather-related events shut down dredging operations on 5 occasions (July 13, September 2-7, September 19-23, September 30-October 1, and October 15-17, 2005). In an effort to minimize down time and avoid repetition of similar problems, Alcoa responded by installing curtains made of stronger material, deploying new curtain in areas of repeated failure, repositioning spud barges, and inspecting and evaluating the anchoring system for potential improvements. This reduced, but did not eliminate, these issues and associated delays. Issues associated with the silt containment system are further detailed in Appendix I.

Notification of Production Dredging Completion

On August 12, 2005, based on reports from the dredge operators, continual damage to the dredge equipment, declining productivity, and the results of a Hypack survey Sevenson notified Alcoa that production dredging was complete in Work Zone 1. Alcoa assessed the available information regarding the depth of remaining sediment, level of effort completed, diminishing dredge production rates (average production rates dropped from about 410 cy/day to about 135 cy/day), and feedback from the dredge operators, and met with the USEPA to discuss the dredging status. Since "hard bottom" had not been reached in all locations and sediment that could be probed remained, USEPA concluded that production dredging was not complete and additional dredging efforts were needed. Over the next several weeks Alcoa focused on understanding the remaining volume of PCB-containing sediment and the site conditions that were making sediment removal challenging.

On August 16, 2005, additional probing and sampling was conducted at eight locations within Work Zone 1 where there was a clear discrepancy between the Hypack survey data and recent probing. These additional data indicated that sediment penetrable by a probing rod remained in these locations even though the originally understood "hard bottom" elevation (i.e., the elevation at which the probing rod could no longer be advanced using reasonable human force during the 2005 baseline survey) had been achieved. As such, additional probing was conducted across Work Zone 1 at approximately 45 grid node locations on August 17, 2005 for comparison with the Hypack survey data. The results are presented on Figure 2-9, and confirmed that even though the 2005 baseline "hard bottom" elevation had been reached in the vast majority of Work Zone 1, a substantial amount of sediment that could be identified using probing techniques remained across much of Work Zone 1. This probing work is detailed in Appendix A.

Based on this information, Alcoa developed a plan of action to better understand conditions in Work Zone 1. Production dredging was resumed in certain areas of Work Zone 1, and probing data were gathered directly in front of the dredge and immediately behind the dredge following a dredge pass. Diver video inspections were also performed by sending the divers to specific areas where significant sediment had been probed (Figure 2-10) but the Hypack survey results indicated achievement of the targeted depth and dredge operators continued to

report encountering "hard bottom" with the horizontal auger. The operators' reports were supported by evidence of damaged equipment (e.g., damaged auger, sheared tines), diver observations, and declining productivity. Several rounds of vibracore sampling were also performed to better understand the subsurface bottom conditions. Development and findings associated with these additional investigations are discussed below.

Revised Strategy for Completion of Main Channel Dredging

At the August 23, 2005 milestone review and progress meeting (Section 2.1.3), Alcoa and the Agencies discussed the discrepancy between probing and Hypack survey data in Work Zone 1, and Alcoa presented a preliminary path forward to address these issues. The path forward was refined over the next several days considering: 1) manual coring performed on August 24-25, 2005 at ten locations in Work Zone 1 to understand post-dredging conditions in areas exhibiting variable success as additional dredge passes were performed; and 2) vibracoring performed on August 30, 2005 at 12 locations (6 each in Work Zones 1 and 2) to further investigate the physical and chemical characteristics of the sediment remaining in these areas (Figures 2-10 and 2-11). These efforts are detailed in Appendix A and indicated that at many locations, the sediment probes penetrated into material that had low level or non-detect PCB concentration, and that in many cases PCB-containing sediments were identified below the elevation of hard bottom estimated from the baseline probing measurements. This indicated that sediment probing was not sufficient in some areas to provide a reliable estimate of the elevation of the interface between PCB-containing and clean sediments as previously believed based on manual coring and probing results (further described in Section 3.2). An example cross-section illustrating these results is included as Figure 2-12.

A concurrent assessment of volume estimates indicated a much lower daily production rate and total volume removed than had been previously understood. The daily dredge report provided by the contractor presented an in-situ volume removed as of August 30, 2005 in excess of 35,000 cy, with an average daily production rate of nearly 670 cy/day. However, survey data from the SLF and an initial subsequent review of the information contained on the daily dredge reports indicated that the actual volume of in-situ material removed was approximately 24,500 cy (total volume of main channel and northern near shore sediment and debris removed through August 30, 2005), with an average production rate of 388 cy/day. This information was further reviewed and refined over time. Additional detail on this recalculation is included in Appendix F.02. In general, the initial volume estimate was based on a percent solids, however that percent solids was never achieved during the ROPS. This information was significant in evaluating work that could be completed in the remaining construction season.

The August 23, 2005 meeting, subsequent sampling efforts, removed volume assessment, reduced production rates, equipment damage, and the decisions made to address the discrepancy between probing and Hypack survey data resulted in several adaptations to the original scope of the ROPS. A fundamental consideration in the development of this revised approach was the need to demobilize from the river prior to the onset of weather conditions that could compromise project safety. It was determined that dredging would extend beyond the originally proposed date of September 16, 2005 to the October timeframe. As such, dredging would be limited to Work Zones 1 and 2 only; no work would be performed in Work Zone 3. As discussed below, once the discrepancy in the actual dredging production rate was identified after the August 23rd meeting, the proposed scope of work for the remaining construction season was further reduced to primarily focus on Work Zone 1. In addition, some capping operations would be performed concurrent with dredging. Key components of the revised approach are as follows:

Work Zone 1:

- The major focus of dredging operations during the remaining construction season would be to reduce the volume of residual PCB-containing sediment in Work Zone 1, to the extent practical. Activities to be conducted included additional hydraulic dredging passes in Work Zone 1 and mechanical excavation of areas containing a significant volume of soft sediments with high residual PCB concentrations.
- The silt curtain at the downstream end of Work Zone 1 was repositioned 75 ft to the east expanding Work Zone 1, and the dredge in Work Zone 2 was relocated to "expanded Work Zone 1" to allow progress in this area.
- Additional vibracore samples were collected in the expanded Work Zone 1 on September 12-13, 2005 to better understand the remaining depth of PCB-containing sediments and the PCB concentration profiles within those sediments (Figure 2-10). A multibeam bathymetric survey over the entire area of expanded Work Zone 1 was also completed on September 12-13, 2005 (Figure 2-13). The data from this survey were used to focus activities going forward in an effort to reduce PCB-containing residual sediment volumes in expanded Work Zone 1. In addition, divers were mobilized to Work Zone 1 to provide observations related to conditions in this area.
- The entire expanded Work Zone 1 was to be capped with a one-foot sand/topsoil cap at the completion of dredging activities.

Work Zone 2:

- Recognizing it would not be possible to complete dredging initiated in Work Zone 2 in the remaining 2005 construction season, PCB samples were to be collected from this area to provide an understanding of current conditions (Figure 2-11). A multibeam bathymetric survey was conducted by OSI in this area on September 30, 2005.
- Work Zone 2 was to be capped with a one-foot sand/topsoil cap.

Northern Near Shore Area Capping, Armored Capping, and Thin-Layer Capping:

- No operational changes were proposed. Armored capping was moved up on the schedule to make best use of remaining time in view of the delay in completing the Work Zone 1 activities.

Geotubes:

- Geotube testing would be conducted in an effort to reduce dredging down time associated with delays in sediment/water handling; this is detailed in Section 2.3.3.4.

Modifications to the work zone boundaries and scope of work efforts in each work zone were approved via ECN 028.

Expanded Work Zone 1 Dredging Efforts

As discussed in ECN 028, remaining efforts were focused on dredging in expanded Work Zone 1 to gain a better understanding of the factors impacting dredge production and to attempt different removal approaches for the remaining sediment. To ensure adequate time for capping in Work Zones 1 and 2, the last day of dredging was identified as October 21, 2005 considering worker health and safety and anticipated weather conditions.

On September 8, 2005, following completion of the silt curtain relocation and repairs resulting from the September 2, 2005 high river flow event, dredging started at the downstream extent of expanded Work Zone 1. Until this point, there had been limited dredging in this area, but a debris removal pass had been performed.

With significant volume of sediment in the area, dredge production immediately improved and increased to nearly 330 cy/day (considering dredging from September 8-16, 2005), compared to the previous week's average of about 240 cy/day (considering dredging from August 25-September 1, 2005). However, once the first lift in this area was dredged, production rates in expanded Work Zone 1 decreased to approximately 130 cy/day (considering dredging from September 26-October 11, 2005). Additional debris removal operations were also performed concurrent with dredging activities in this area.

As discussed above, additional vibracoring was performed at 12 locations in Work Zone 1 on September 12-13, 2005 to further investigate physical and chemical characteristics of the sediment column after completion of multiple dredge passes and correlate elevation within the sediment column between dredge passes; this also supplemented the cores collected in Work Zone 1 as part of the August 30, 2005 effort (Figure 2-10). Sediment surface and probing measurements were conducted continuously during this timeframe. Alcoa also began a series of multibeam bathymetric surveys (performed by OSI) to provide additional data to understand bottom features and identify areas of remaining sediment. The first of these surveys was completed on September 12-13, 2005. In addition, an underwater video camera was fastened to the auger head of the dredge in an attempt to capture the dredge in operation along the river bottom; however, coverage obtained was not useful due decreased visibility from suspended solids.

Weather-related impacts also continued to have a significant effect on the work efforts in expanded Work Zone 1. On September 18, 2005, river flow crested above 10,000 cfs, the highest river flow experienced during the ROPS. A site inspection revealed obvious silt curtain damage; however, all equipment and barges remained in place. It was not until September 22, 2005 that flows decreased enough to allow silt curtain repairs to begin. Probing and elevation measurements, core collection (using manual techniques), and a bathymetric survey (September 30, 2005) were performed to assess any potential changes in bottom elevation as a result of the higher flows. A review of these data revealed that the high flows did not significantly change the bottom bathymetry; the results of these surveys are further detailed in Appendix A.

Bathymetric data collected throughout the ROPS identified high ridges in the dredge area. Divers were employed to obtain underwater video coverage of the bottom conditions in these ridge areas on September 25, 2005 (approximate location illustrated on Figure 2-10). Reports indicated the presence of jagged rock outcroppings, large boulders, and hard bottom features at or near the sediment surface in the area covered by the survey. Representative coverage is included in Appendix J.

Since additional efforts with the horizontal auger dredge provided diminishing returns, Alcoa pursued the use of alternative removal equipment to evaluate effectiveness in removing additional sediment. Mechanical excavation was performed using the hydraulic clamshell (0.5-cy bucket) on October 3-5 and 10-11, 2005 focusing on four grid nodes (179, 183, 381, and 418). These locations were chosen due to elevated levels of PCBs and significant depth of sediment remaining after several dredging attempts. This removal approach focused on the removal of all sediment, to the extent practical, in an approximate 10- to 20-ft area around each grid node. Approximately 15 to 30 cy of sediment was removed from each of these areas (i.e., total of approximately 100 cy).

A swinging ladder cutterhead dredge was also mobilized to the site on October 11, 2005, and the horizontal auger dredge was taken off line. ECN 031 specified a number of targeted dredging locations within expanded Work Zone 1 that were set in order of priority to remove the sediment in areas with high PCB concentrations and relatively significant sediment volume. The dredge was put online October 12, 2005 and shake-out procedures were performed on October 12 and 13, 2005. Swinging ladder cutterhead dredging was performed over a 10-day period (including shake-out procedures) in expanded Work Zone 1. Dredging was completed in the four areas presented on Figure 2-14. On October 21, 2005, all dredging activities were discontinued at the site. Water was passed through the dredge slurry line for several minutes to ensure no solids remained in the

line prior to shutting the system down. Sediment sampling and elevation measurements were performed prior to and after removal in areas where mechanical excavation and dredging with the cutterhead occurred.

A final multibeam survey, sediment elevation measurements, and vibracore sampling were performed on October 22-24, 2005 to document post-dredge conditions prior to cap placement. These efforts are detailed in Appendix A. An analysis of the post-dredge perimeter slope was also performed; details are presented in Appendix F.08.

Work Zone 2

Since no additional work was performed in Work Zone 2 after the August milestone meeting, sediment cores were collected from a total of 13 locations via vibracoring on September 30, 2005 to understand PCB concentrations in Work Zone 2 prior to cap placement (Figure 2-11). A multibeam survey was also performed on September 30, 2005 and final surface elevation measurements were collected on October 4-6, 2005. These efforts are detailed in Appendix A.

Dredge Performance

The average daily production rate during the ROPS was approximately 330 cy/day, or 33% of the anticipated average production rate of 1,000 cy/day. During the last two weeks of operation, the horizontal auger production rate averaged approximately 135 cy/day. Production rates over time for the horizontal auger are shown in Figure 2-15. The swinging ladder cutterhead dredge was field tested in areas where relatively significant volumes of PCB-containing sediment remained. A concentrated effort by the cutterhead dredge resulted in the removal of approximately 210 cy/day for the final 4 days it operated in expanded Work Zone 1 (overall production averaged 130 cy/day). As a result of the lower than anticipated production rates, the total volume of sediment removed from the main channel was 27,100 cy (Dredge Report; Appendix F.02), significantly less than the 49,500 cy originally targeted in Work Zones 1 and 2.

The effective dredge time (i.e., actual time spent dredging) for the horizontal auger dredge was 37.5%. Factors that reduced productivity of the dredge included: inclement weather (16.8%); delays due to the processing system ("Tanks Full;" 13.3%, this was 0% during implementation of the Geotube study); fouling of the dredge by debris (13.6%); repositioning of the dredge (11.1%); and other (e.g., shift change, line clogged, etc.; <5%). Details are provided in the Dredge Effective Time Analysis tables included in Appendix F.07. Additional discussion regarding dredging productivity is included in Section 3.2.3.2.

2.3.2.3.5 Monitoring [Main Channel]

Monitoring activities conducted during dredging in the main channel included water column and air monitoring, sediment surface elevation/probing measurements, bathymetric measurements/remote sensing surveys, sediment sampling and ex-situ dredge material sampling, water treatment effluent discharge monitoring, and Geotube sampling. Additional details on the monitoring activities performed and the associated results are presented throughout Section 3 and in Appendix A.

2.3.3 Dewatering/Solids Processing, Material Handling, and Stabilization

As described in the Operations Plan (Sevenson, May 2005), a solids handling system with a capacity of 1,500 to 2,500 gpm of dredge slurry with a solids concentration of 8 to 12% was installed. The size of the system was determined based on the bench treatability tests that were performed by Sevenson prior to the ROPS to verify

the design and operating characteristics of the system. The dewatering system was intended to be operated 24 hours per day at an 85% operating efficiency.

The sediment/water slurry from the hydraulic dredge operations were sent to the MPP via the dredge slurry transport pipeline. Once at the MPP, the slurry was treated to separate the solids and water. Following separation, solids were stockpiled and eventually sent to the SLF. Water from the slurry was treated and subsequently discharged to the river (as described in Section 2.3.4). All debris and sediment removed by mechanical dredging and excavation were also transported to the MPP where it was stockpiled prior to placement in the SLF. The following sections present the details of the system and Figure 2-16 presents the layout of the system components.

Additionally, two studies were conducted during the ROPS associated with solids dewatering processes. These included a hydrocyclone operations study and a field-scale Geotube study. These studies are described in Sections 2.3.3.3 and 2.3.3.4, respectively, and detailed in Appendix K.

2.3.3.1 Dewatering/Solids Processing System Layout and Operation

General Description

The initial step in the dewatering/solids processing system was the removal of sediment in a slurry form by the hydraulic dredge. The slurry material was then carried via a 10.3-in inside diameter HDPE pipe line to the MPP. The dredged slurry was pumped through a vibrating shaker screen with ¼-in screens to remove debris, stones, large wood chips, and some gravel from the slurry. Screenings were discharged onto the staging pad before being transported to the staging area on the MPP. The screened dredge slurry then was gravity fed into a V-bottom tank, drawn off the bottom, and sent through two hydrocyclone desander units (photo MPP9 in Appendix D). The underflow from the hydrocyclones was then directed over dual vibrating linear motion shakers with 200 mesh screens (74 microns [μm]) for further sand removal.

Overflow from the hydrocyclone units, which primarily consisted of the fines fraction of the dredge slurry, flowed into a 20,000-gallon agitated pump tank. From the agitated pump tank, the dredge slurry was pumped into eight 20,000-gallon agitated feed mix tanks (photo MPP6 in Appendix D). In the feed tanks, DE was mixed with the slurry as a filter aid for the filter presses. Fast feed centrifugal pumps drew from the agitated mix tanks into six 219-cubic foot filter presses (photo MPP8 in Appendix D). Each filter press had a dedicated centrifugal fast feed pump (photo MPP7 in Appendix D). In addition, two stand-by fast feed centrifugal pumps were available in the event of a mechanical problem.

Upon transfer from the eight 20,000-gallon agitated feed tanks, polymer was added to the dredge slurry to improve filterability of the solids. The anionic polymer (MSDS [Material Safety Data Sheet] included in Appendix F.09) was fed from a 250-gallon chemical tote via a PolyBlend system through an in-line static mixer. The amended slurry was then pumped to one of the six 219-cubic foot recessed filter presses. Once individual filter plates were filled to capacity with solids, flow to the filter press was temporarily stopped (flow continued to other filter presses not at capacity). The resulting filter cake was manually removed from the filter plates by scraping the plates and letting the filter cake fall on to a conveyor belt below the filter press. Conveyors for all six filter presses were then directed to a single conveyor belt that transported filter cake to a stockpile on the MPP (photo MPP11 in Appendix D).

Filtrate from the filter presses was discharged to the filtrate tank feeding the wastewater treatment plant. At the end of each filter run, a core blow was conducted on the filter press to remove residual solids from the press feed lines. Any discharge from this process was returned to the agitated mix tanks.

Operational Issues

During dredging, the rate at which the dewatering/solids processing system was able to process the dredge slurry had to be coordinated with the rate at which the slurry flow was received from the hydraulic dredge. When these components were not coordinated, the dredging operation was interrupted as illustrated on the Dredge Effective Time tables in Appendix F.07. The column labeled "Tanks Full" presents data showing that the dredge was down nearly 14% of the time as a result of the dewatering system not being able to process the dredge slurry fast enough to continue to accept flow from the dredge. During these times, the dredge would shut down for approximately 30 to 60 minutes while the dewatering/solids processing system gained free board at the tanks.

As discussed above in "Impacts to Dredging Production," the rate limiting step in the slurry processing train was the filter press operation. Numerous corrective actions were pursued to address this issue including addition of DE, optimization of the polymer feed system, and engagement of a filter press expert. While each of these measures improved press operation, they did not remedy the capacity problem. A complete report following the review of the operation by the filter press expert is provided in Appendix F.09. One modification made as a result of this review was changing all filter cloths to a similar type of material to promote equalized flow through the presses; note that there was no noticeable difference in the processing rate. As discussed in Section 2.3.3.4, the use of Geotubes late in the ROPS did address the capacity constraints of the filter press system, but the resulting solids required stabilization with Quicklime before placement in the landfill due to high water content of the solids.

2.3.3.2 Debris and Mechanically Removed Sediment Handling

Per the Operations Plan, all solids from the river were delivered to the MPP prior to shipment to the SLF. All debris and sediment removed by mechanical methods from the main channel and northern near shore area were transported by tandem axle dump truck and off-loaded on to the asphalt staging pad. While most of this material was large rock and debris, there was a smaller volume of very wet sediment. Material was allowed to dewater on the pad before being mixed with the processed solids and transported to the SLF for disposal (photo MPP16 in Appendix D). A total of approximately 3,200 cy of debris and sediment was brought to the staging pad to eventually be loaded out for disposal (i.e., 1,500 cy of debris from main channel, 100 cy of mechanically dredged sediment from the main channel, and 1,600 cy of debris and sediment from the northern near shore area).

As a result of the adjustments made to the debris removal operation in the main channel discussed in Section 2.3.2.3.2, a substantial volume of wet sediments were mechanically removed and transported by truck to the staging pad to dewater. After several days, the sediment remained too wet to be landfilled, so the material was stabilized using Quicklime, a white crystalline material composed primarily of calcium oxide. Quicklime reacts with the moisture in the material to form calcium hydroxide, thus reducing the water content of the material. Quicklime was available on site primarily for enhancing the dewatering of the material in the Geotubes (as discussed in Section 2.3.3.4; ECN 020), but approval was obtained to add up to 10% Quicklime to the mechanically removed material before landfilling to expedite transport of the mechanically dredged sediment to the SLF. A material silo was used to store the material until it was needed.

2.3.3.3 Hydrocyclone Operations Study

Two desander units (hydrocyclones) were used for size separation of the solids in the dredge slurry. The goal in using the hydrocyclones was to optimize solids removal and assess the PCB concentration of the separated

solids (i.e., fine-grained and coarser-grained materials). If the hydrocyclones could be effectively operated to separate the solids into fine-grained materials with high concentrations of PCBs and sand-size particles (i.e., coarser-grained materials) with low concentrations of PCBs, these separated components could potentially be managed differently (i.e., sand materials with lower PCB concentrations could be managed as a non-TSCA waste). Separation of TSCA and non-TSCA materials was not essential to the ROPS, since all materials were disposed in the SLF (TSCA-regulated landfill); however, the ability to separate these materials is a consideration that could impact the cost of disposal options for removal alternatives included in the revised AA Report.

The hydrocyclone operations study was conducted to assess optimum performance and effectiveness of the hydrocyclones in separation of the fines and sands over a range of operating parameters. This assessment also included an evaluation of resulting PCB concentrations in the sand fraction. This section presents a brief overview of the hydrocyclone operations study. Additional details regarding the hydrocyclone study and associated results are presented in Appendix K.

Hydrocyclone Operations Study Description

A series of six Krebs Cyclones (Model D15LB-S2463-SRC) were used in the sediment dewatering process for particle size separation. The process train included a battery of three shaker units (in series) with two hydrocyclones in each unit (i.e., total of six hydrocyclones). Each hydrocyclone had the capability of applying a vacuum and a cycle wash to enhance separation of the finer-grained particles from the coarser fractions. As such, these parameters were evaluated as part of the operations study.

Prior to implementing the study, the hydrocyclones were operated to optimize solids removal. Pressures ranged from 12 to 15 pounds per square inch (psi) with the vacuum closed (in use) and the cycle was varied from 10 to 20 gpm. The operating parameters for the study included varying the vacuum (full or closed positions) and the cycle wash flow (low [3-9 gpm], standard [10-20 gpm], and high [40-50 gpm]) to test six operating conditions.

Since the river bottom within the dredge area was fairly heterogeneous, the inlet sediment slurry to the hydrocyclones was variable. As a result, in an effort to capture desanding operations under different dredging conditions, two rounds of testing were performed: one round on August 19, 2005 while dredging in the top two feet of sediment (which tended to be relatively coarse); and a second round on September 14, 2005 while dredging below the top two feet of sediment (which tended to be relatively fine).

Hydrocyclone Operations Study Results

Considering the limited data set obtained, the overall results of the study indicated the following:

- During the study, the optimum operating conditions in order to achieve low concentrations of PCBs in the sand fraction appear to be operating the hydrocyclone with the vacuum on and the cycle wash flow at standard or high flow. When those operating parameters were achieved during the optimization study, all sand effluent samples had measured PCB concentration less than 10 ppm. This observation corresponds with the success of hydrocyclones at these standard operational conditions throughout the ROPS, where ex-situ dredge material measured less than 50 ppm for effluent sand with only one exception out of 32 samples.
- The highly variable nature of the dredged material may mask stronger correlations between effluent PCB concentrations and operational conditions. If this is the case, particle size distribution would be a more important metric for effectiveness. There appears to be a correlation between vacuum setting and percent passing a #40 sieve, where there is any variation at all in effluent characteristics between operational conditions. Furthermore, those samples taken under standard operational conditions

resulted in the lowest percent fines for each sample round (3.3% and 2.6%), with the exception of two conditions where the influent percent solids were abnormally low (0.70% and 0.50%).

- A comparison of data for four cases with relatively constant influent of 1.3 to 1.7% solids suggest that the standard operating condition (vacuum on, 10-20 gpm) provided the best separation and lowest percent fines.
- The results suggest that the hydrocyclone could be used in the future as one process in the dewatering and treatment processing of the dredge sediments.

Additional details regarding these conclusions and the overall study are presented in Appendix K.

2.3.3.4 Geotube Study

A Geotube study was conducted as part of the ROPS in accordance with the Geotube Dewatering Pilot Test Work Plan provided in DCF 011. The study was performed to provide additional dewatering capacity and evaluate the effectiveness of the geotextile tubes in dewatering sediments both before and after hydrocyclone separation. Geotubes were also evaluated as an alternative dewatering approach for consideration in the development and costing of removal alternatives for the revised AA Report.. The primary objectives of the sediment dewatering processes were to maximize the removal of solids from the dredge slurry, produce a solids stream that was suitable for landfilling, produce an effluent stream that could be processed effectively through the wastewater treatment system, and minimize the volume of material generated for disposal.

The performance of this technology is dependent on: filtration compatibility between the sediment and geotextile that comprises the Geotubes; chemicals added to enhance dewatering and maximize solids recovery; and the design, configuration, and operational parameters of the system. As a result, these variables were evaluated during initial treatability studies and field tests performed during startup, and were considered in planning efforts to develop the approach and objectives for the Geotube Dewatering Pilot Test. The results of the initial bench-scale treatability studies, details regarding the field-scale study, and associated results are contained in Appendix K.

Geotube Study Description

The field-scale study was initiated on September 12, 2005 with the installation of four 60-ft circumference, 203-ft long Geotubes and associated piping on northern portion of the MPP. The Miratech Division of Ten Cate Nicolon of Commerce, Georgia, was chosen as the vendor for the Geotube design, fabrication, delivery, and installation support. Each Geotube was manifolded together to allow for individual filling, optimal settling, and consolidation between fillings. Three injection ports were incorporated in each Geotube for attachment of the dredge discharge line. These ports were located approximately 50 ft from each end and in the center of the Geotube (Figure 2-5).

The Geotube study was initiated using a 6-in feed line at a flow of 100 gpm, which was sequentially increased to 300 gpm, 900 gpm, and finally to a maximum average flow of 1,300 gpm. Increase of flow from 900 gpm to 1,300 gpm was accommodated with 10-in feed lines. Initial filling of the Geotubes was conducted by pumping dredge slurry through the vibrating shaker screens to remove debris (e.g., stones, large wood chips, etc.) that were eventually transported to the SLF for disposal. After the debris was sorted out, each Geotube was continuously filled multiple times until the design height of 6 ft was achieved to provide adequate pressure within the tube for dewatering (photo MPP22 in Appendix D). As pumping progressed, the height of filling was incrementally increased to 7 ft, maintaining the necessary design factor of safety. After the dredged slurry was adequately dewatered, the Geotubes were filled again, and the process repeated. Characteristics of the slurry feed were varied throughout the study to test dewatering of unscreened and ¼-in screened desanded dredge

slurry along with polymer addition. Vibratory compacting was also conducted for a portion of the study to expedite the dewatering process. Pumping of the slurry to the Geotubes was completed on October 21, 2005.

Geotube Study Results

A total of 16,268,721 gallons of slurry was pumped to the four Geotubes during the study. Once all of the Geotubes were completely filled and allowed to dewater, they were cut open, the materials stabilized (per ECN 020), and removed by a mechanical excavator for disposal in the SLF (photo MPP25 in Appendix D).

The final estimated volume of material placed in the Geotubes and transported to Cell 3 was 1,100 cy, which was lower than the volume projected based on the expected slurry characteristics in the feed. Observations of the materials in the Geotubes once opened showed the presence of coarse grained materials directly proximate to the feed ports but materials with a much lower solids content in the bottom of the Geotubes between the feed ports. A total of approximately 6,000 pounds (lbs) of polymer was used and, as discussed earlier, the material had to be stabilized with Quicklime prior to placement in Cell 3 of the SLF. Results of the study indicated that Geotubes warrant further consideration as a potentially viable system for the dewatering of hydraulically dredged sediments from the lower Grasse River and will be further evaluated in the development of the revised AA Report. Additional details regarding the study are presented in Appendix K.

2.3.4 Wastewater Treatment

Consistent with the Operations Plan (Sevenson, May 2005), the wastewater treatment system was designed to properly treat and discharge all water generated during the ROPS including: water remaining following the solids processing operation; stormwater from the MPP; and all other incidental water (e.g., water from pressure washers and dust suppression operations). The following sections describe the permitting process and system layout and operation, including contingency measures and compliance monitoring.

2.3.4.1 Permitting

The wastewater treatment system was designed, operated, and monitored in accordance with NYSDEC permit equivalency requirements as set forth in the Effluent Limitations and Monitoring Requirements (ELMR; Appendix F.10). Based on NYSDEC input, the number of granular activated carbon (GAC) vessels was increased to six (from the original design of four) so the empty bed contact time (EBCT) requirement of 18 minutes could be met (the original design assumed an EBCT of 13 minutes).

In addition, all discharges to the Grasse River via Outfall 004, which was used to provide supplemental treatment capacity, were monitored in accordance with SPDES permit number NY0001732. Among other parameters, these permits established criteria for the concentration of PCBs and TSS in the effluent discharges. Associated monitoring activities and results are summarized below, and are detailed in Appendix A.

2.3.4.2 System Layout and Operation

System Components

The wastewater treatment system included an equalization/filtrate tank, filtration process, GAC vessels, and effluent tank/secondary bag filters. Figure 2-17 illustrates the process flow diagram for the system. The primary treatment concerns were PCBs and TSS. Since PCBs are largely associated with solids, removal of

suspended solids was the focus of the wastewater treatment train prior to carbon adsorption polishing of PCBs. Appendix F.10 contains the specifics of the wastewater treatment system process design including equipment characteristics and capabilities.

The basis of design for the wastewater treatment system included an average process water flow rate of 1,964 gpm, with a peak flow of 2,000 gpm.

The influent characteristics forming the basis of design were:

- TOC: 2.0 milligram per liter (mg/L) or 40 pounds per day (lbs/day);
- PCBs: 0.50 mg/L or 10.2 lbs/day; and
- TSS: 50 mg/L or 1,002 lbs/day.

The effluent characteristic forming the basis of design were:

- TOC: 0.10 mg/L or 2.0 lbs/day (95% removal required);
- PCBs: 0.30 µg/L per Aroclor or 0.0060 lbs/day (99% removal required); and
- TSS: 0.010 mg/L or 2.0 lbs/day (99.8% removal required).

A description of each component is presented below, with additional detail presented in Appendix F.10.

Equalization/Filtrate Tank: Filtrate from the filter press operations was discharged into a single 75,000-gallon equalization/filtrate tank. The tank also served to equalize flow and load variations from the filter presses as well as accept stormwater from the MPP and water from other miscellaneous sources (e.g., scows).

Filtration: Water from the equalization/filtrate tank was pumped through a filtration process designed to remove suspended solids and PCBs. Water was pumped first through four 10-µm bag filter units, and then to four sand filters, each with 4 ft of mono-media filter sand. Each bag filter unit (photo MPP5 in Appendix D) was equipped with six filter bags to lengthen the runs of the downstream sand filters, thereby reducing the amount of backwash water to be recycled. Sand filters were backwashed to remove solids buildup and "fluff up" the sand media to reduce head loss through the filters. Backwash water was returned to the equalization/filtrate tank for eventual treatment and discharge.

GAC Vessels: Following the sand filters, the flow was pumped through six GAC vessels, each filled with approximately 20,000 lbs of activated carbon (photo MPP4 in Appendix D). The purpose of the GAC vessels was to remove remaining PCBs and other carbon-compatible organics that may be present. Sufficient carbon was provided so that at expected organics loadings, the carbon would last the entire duration of the ROPS. As with the sand filters, GAC vessels were periodically backwashed to remove trapped solids and "fluff up" the carbon media, thereby reducing head loss. Backwash water was returned to the equalization/filtrate tank for eventual treatment and discharge.

Effluent Tank/Secondary Bag Filters: After passing through the GAC vessels, water flowed by gravity into an effluent storage tank. Overflow from this storage tank was pumped through four bag filters with 0.5-micron filters before being discharged back to the lower Grasse River. The purpose of the secondary bag filters was to remove any carbon fines and adsorbed PCBs that may have carried over from the GAC vessels.

Effluent Discharge

During mobilization, two options for effluent discharge were installed. Under normal operating conditions, water was discharged downstream of Alcoa's permitted Outfall 004 in Building 156 (Figure 2-6). In the event

the system flows increased above the allowable flow rate of 2,000 gpm (as dictated by the required EBCT at the GAC vessels), excess flow was re-directed to Alcoa's Outfall 004/005 surface impoundment (Outfall 004/005 Impoundment; Figure 2-6) as outlined in ECN 011 and DCF 002. Water directed to the Outfall 004/005 Impoundment was subsequently treated through Alcoa's existing Outfall 004 treatment system.

Use of the Outfall 004/005 Impoundment required two safeguards to maintain the operating capacity of the system: 1) the water elevation in the impoundment could not exceed 185 ft (top elevation of the intermediate berm based on United States Lakes Survey [USLS] 1935); and 2) the current stormwater contribution had to be negligible. If the water level was above 185 ft, water could not be sent to the impoundment until the water level dropped below the top of the berm. If water was below the top of the berm, wastewater in the filtrate tank was run through the first set of bag filters in the ROPS treatment system and subsequently diverted to a manhole located to the east of the MPP. Water collected in the manhole flowed by gravity to the Outfall 004/005 Impoundment through an existing 54-in concrete pipeline. A pump station adjacent to the impoundment pumped water to Alcoa's Outfall 004 wastewater treatment system located in Building 156, where it was treated using dual-media sand filters and activated carbon filters before being discharged into the lower Grasse River.

The Outfall 004/005 Impoundment was also used during periods of heavy precipitation and/or intermittent flow. During periods of heavy precipitation, the ROPS wastewater treatment system was unable to treat both processed and rain water collected on the MPP while maintaining flow below the maximum 2,000 gpm rate. The Outfall 004/005 Impoundment was also used during periods of intermittent flow. For instance, during the dredge system shake-out procedures from June 6-13, 2005, flow from the dredging operation was sporadic and unpredictable, and as such created a difficult scenario under which to meet monitoring requirements. By discharging to the Outfall 004/005 Impoundment, discharge and monitoring requirements were met and dredge shake-out procedures were not further complicated by adding another operation requiring close coordination. In addition, during demobilization activities, piping at the MPP was reconfigured to direct water (e.g., stormwater and snow melt) from the remaining asphalt pad and crushed stone area (at the MPP) to the Outfall 004/005 Impoundment.

Compliance Monitoring

Operation of the wastewater treatment system was closely monitored. In order to meet the monitoring requirements of the NYSDEC and confirm proper system operation, an ISCO automatic sampler was installed on the discharge line following final treatment. Wastewater treatment sampling and monitoring was conducted per the Treated Water Effluent Monitoring Plan developed in June 2005 (Appendix F.10). Details regarding the monitoring and associated results are presented in Appendix A. In summary, two compliance issues occurred, each regarding EBCT, as further summarized in Section 2.5.3.

The only operational change made to the system as a result of monitoring included placement of tarps over the effluent tank to restrict sunlight after an algae bloom occurred in the tank. Algae was determined to be the cause of an elevated pH reading which occurred on July 19, 2005 as a result of contaminating a sampling tube within the automatic sampler.

2.3.5 Disposal in SLF Cell 3

As described in Section 2.3.1.2, construction of SLF Cell 3 was completed in spring 2005 to receive materials removed from the river and miscellaneous waste generated during the ROPS. Approval to operate the cell was provided by NYSDEC and USEPA in July 2005.

Management, operation, and closure of SLF Cell 3 were not conducted under purview of the ROPS but rather within the regulatory framework established by NYSDEC for the land based cleanup efforts at the Massena West plant. An overview of these activities is presented in this section; additional details regarding operation and interim capping of Cell 3 are presented in the SLF Cell 3 Completion Report (CDM, February 2006).

DCO 27 described the design for Cell 3, and several additional DCOs and DCFs were prepared to document specified changes in the design, operation, and interim capping of Cell 3 identified during ROPS activities. These DCOs/DCFs are summarized in Table G-2 and are included in Appendix G.

2.3.5.1 Operation and Waste Placement

Operation of Cell 3 was initiated on August 8, 2005 following regulatory approval of the liner system certification report from NYSDEC (July 6, 2005) and USEPA (July 29, 2005). Before operation began, exclusion zone fencing was established around the perimeter of Cell 3 and background air monitoring was initiated. Air monitoring (for community and worker protection) continued throughout landfill operation as described in Appendix A.

Materials were transported from the MPP to Cell 3 in 15-cy capacity dump trucks (photo SLF2 in Appendix D). Initially, one ramp was constructed over the east berm. As waste filling progressed, an additional ramp was constructed north of the first ramp. Figure 2-18 shows the SLF Cell 3 and access roads/ramps used during operations. Since the trucks never entered the exclusion zone (i.e., interior of Cell 3), full decontamination was not required after dumping. Visual inspection and cleaning of waste materials from the exterior of dump bodies and tailgates was conducted, as necessary, before trucks left the ramp. During most of the operating period, three 15-cy capacity dump trucks hauled waste to the cell, and two bulldozers spread the waste to the required locations within the cell. Waste was compacted by the bulldozers within the cell (photo SLF3 in Appendix D). The waste delivery summary is included in Appendix F.11.

A control grid consisting of 50-ft by 50-ft subgrids was established to track initial placement of waste materials and provide field reference for bearing strength testing. Load tickets were generated for each truckload of material to document the waste source, grid location of initial waste placement, and estimated volume. Each load was checked for the presence of free (liquid phase) water; free water was never observed. Waste was generally placed and compacted in 2-ft lifts. A 3-ft lift was allowed for the first lift placed directly onto the liner system or at the transition between the bottom of the cell and side slopes.

For the waste materials that would not meet the bearing strength criterion (16 pounds per square foot [psf]), the waste was solidified at the MPP using no more than 10% Quicklime (by volume) in accordance with the provisions of DCF 74 (issued in association with Cell 2). Some waste from the Geotubes that had been stabilized with Quicklime did not meet bearing strength criterion for Cell 3. This material was bulked by mixing in common fill or sand within the limits of Cell 3 until the required bearing strength was achieved.

Waste was initially placed in the cell to conform to the final grading plan in DCO 27, which was developed assuming that up to 85,000 cy of material would be placed in the cell. When it became apparent that less material would be disposed in the cell, a final volume for disposal was estimated and a revised grading plan was prepared and issued as DCO 30. This grading plan optimized placement of waste materials from south to north and along the berms to minimize the amount of freeze protection necessary on the sloped surfaces. Waste disposal was completed on November 8, 2005.

Contaminated water generated within Cell 3 was collected by the leachate collection system and pumped to the industrial wastewater treatment facility in Building 79C. Rainfall and runoff that did not contact the waste was managed through the stormwater system in the vicinity of the landfill.

Monitoring of the landfilling operation and waste compaction effort were typically documented on Forms 13 through 19 presented in the IQAT Plan (Alcoa, March 2005a). Some of the forms used in the field to document waste placement and cap construction were adapted from those forms included in the IQAT Plan. Further, four additional forms (i.e., Geosynthetic Material Delivery Log, Destructive Sample Log, 60 mil HDPE Geomembrane Trial Seam Log, and Waste Solidification Summary) were necessary for the documentation required as part of the certification report. All completed forms are presented in Appendix H.

2.3.5.2 Landfilled Waste Volume

Load tickets were completed for each truckload of materials transported to Cell 3. Based on these load tickets, estimated truckload volumes were used to track the approximate waste volume transported/disposed on a daily basis. The total estimated truckload volume was approximately 27,200 cy and represents the quantity of materials placed in Cell 3 before compaction. Of this volume, 25,000 cy was sediment, rock, and debris (reduced during processing from 30,100 cy); the remaining volume consisted of treatment system residuals (e.g., silt curtains, Geotubes, PPE, and containment area stone) and materials brought into the landfill to develop waste bearing strength (bulking materials).

Field surveys were conducted at periodic intervals during operation and after all waste was placed and compacted to obtain an accurate measurements of compacted volume. The final field survey determined a compacted waste volume of approximately 21,700 cy. Comparison of this volume to the estimated volume based on truckloads indicates a 20.3% reduction in volume due to compaction. This is a reasonable volume reduction attributable to compaction based on observations of compaction of loose waste at the SLF. Therefore, the estimated truckload volumes were proportionally adjusted to yield, on a compacted basis in the SLF, 19,900 cy of sediment and debris removed from the lower Grasse River, with the remaining volume consisting of treatment system residuals and bulking materials.

A summary of uncompacted and compacted waste volumes disposed in Cell 3 based on truckload records and final field survey is presented in Table 2-2.

2.3.5.3 Placement of Interim Landfill Cap

The intent of the interim landfill cap design was to provide a low-permeability barrier over the waste material in Cell 3, thus reducing the amount of leachate generated and collected from precipitation and snow melt. This barrier was installed without a vegetative cover to facilitate removal, as required to permit potential future waste disposal in Cell 3.

Components of the interim landfill cap include the following (in order from the waste surface upward):

- A minimum 8-in thick sand layer to provide bedding for the HDPE geomembrane and establish a clean zone over the waste (eliminating the need for an exclusion zone during cap placement; photo SLF4 in Appendix D);
- A 60-mil white textured HDPE geomembrane (photo SLF11 in Appendix D); and
- Hay over those portions of the cap with less than 5 ft of material over the liner system (considering drainage sand, waste and the sand layer beneath the geomembrane; photo SLF12 in Appendix D).

A spillway was installed in accordance with the original design (DCO 27) at the northern end of the east berm to direct stormwater runoff and snowmelt to the SLF storm drainage system (photo SLF9 in Appendix D). In addition, gas vents, hold-down weights, and hay were also installed as part of the interim cap.

Details regarding placement of the interim landfill cap are contained in the SLF Cell 3 Completion Report (CDM, February 2006). Documentation of IQAT and other necessary testing are contained within Appendix H. Installation of the interim cap was completed on December 6, 2005. Figure 2-18 illustrates the overall SLF site plan, including the grading and surface features after all work at Cell 3 was completed.

2.3.6 Capping

Three different types of caps were placed in four areas of the river and included: post-dredging caps in the northern near shore and the main channel; a thin-layer cap in the southern near shore area; and an armored cap in the main channel area. Consistent with the objectives for each component (Section 1.3), capping activities were conducted to evaluate cap construction issues and the effectiveness of each cap in the targeted areas. The following sections present an overview of silt curtain installation, cap material source, equipment and positioning system used, construction details, and associated monitoring.

2.3.6.1 Silt Containment System

The silt curtain system enclosing the northern near shore and main channel area established during dredging operations (Section 2.3.2.1) remained in place during capping operations in these areas. To promote efficiency during capping operations, an air curtain gate was installed at the interior upstream curtain section in Work Zone 1. L-shaped silt curtain configurations were established prior to cap placement in the thin-layer and armored capping areas. These components are described below.

Air Curtain Gates

During debris removal operations and northern near shore excavation work, small material scows had difficulty maneuvering past the perimeter and interior silt curtains. The material barges used to transport cap material, capable of holding 500 cy of material, were significantly larger than the 10-cy scows used for mechanical excavation and debris removal and therefore could not pass over the silt curtains. To most effectively maintain the integrity of the containment system and still allow passage for the barges, an air curtain was installed at the interior upstream curtain section in Work Zone 1 (Figure 2-7). The upstream perimeter curtain was also left open to allow barge passage during capping operations. This was allowed based on discussion with USEPA who required additional monitoring, constant observation, and no intrusive ongoing work in Work Zone 1 when the curtain was open.

ECN 024 approved installation of the air curtain system within the interior upstream curtain section of Work Zone 1 (photo RA35 in Appendix D). The system was comprised of 4-in HDPE pipe with 2-millimeter (mm) holes spaced every 6 in that lay along the river bottom and was anchored with 250-lb concrete bin blocks spaced every 15 ft along the bottom. The piping was connected to a 750 cubic ft per minute (cfm) air compressor. Turbidity monitoring was conducted to assess the performance of the air curtains during capping activities in Work Zones 1 and 2 in accordance with ECN 024. This monitoring was conducted daily mid-morning and afternoon from October 22-November 10, 2005 at locations ROPS-WCT5 (upstream, background water column monitoring transect) and US-1 (located just upstream of the air curtain) at 0.2, 0.5, and 0.8 times the total water column depth in accordance with the monitoring protocol described in Appendix A. Results of these monitoring activities indicated similar turbidity levels at both locations, indicating no adverse impacts were introduced by

the air curtain or allowing the perimeter upstream curtain to remain open during capping activities. Data obtained during these monitoring activities are included in Appendix B.

Silt Curtain

Prior to capping in both the southern near shore and the armored cap areas, silt curtain sections were deployed, enclosing the work areas on two sides by forming an "L." The curtains ran perpendicular from shore on the downstream side of each area and then approximately 100 ft upstream parallel to river flow (Figure 2-7), and extended approximately 5 ft into the water column. The curtains were deployed the day before work started in each area and removed immediately following completion of capping.

Daily Water Column Monitoring

Daily water column monitoring was conducted to assess the performance of all silt containment systems; details regarding this monitoring are described in Appendix A (with data provided in Appendix B). Results of this monitoring indicated no adverse impacts to the water column as a result of capping activities in the main channel or near shore areas. These results are further discussed in Sections 2.5.2 and 3.

2.3.6.2 Cap Material Source/Testing

There were four different types of cap material used during the ROPS. The main channel and northern and southern near shore areas were capped with a material consisting of a fine to medium sand and topsoil mixture (1:1 ratio). Results of the cap material testing indicated the particle size distributions were generally within the range of distributions for native Grasse River surface sediments in the near shore and main channel work areas, and the TOC content of the materials ranged from 0.45 to 2.00% (additional details are presented in Appendix A). The armored cap area was divided into an upstream and downstream half. The upstream half was capped with three different layers including a sand/topsoil base layer (same material used for the main channel and northern/southern near shore areas), a filter layer comprised of small gravel, and an armor layer of larger stones (D_{50} of 7 in). The downstream half was capped with three layers as well, including two different filter layers of small gravel and an armor layer (same material as the upstream half). The downstream section was constructed without the sand/topsoil base layer to provide information on the ability to install an armored cap without this layer in sections of the river where pre-capping surface sediment PCB concentrations were already low.

As described in ECN 002, the sand and topsoil mixture selected for the caps was to: 1) provide a replacement substrate reasonably similar to the grain size distribution in the native sediments; 2) achieve TOC of 1% to provide adsorptive capacity for future migration of PCBs; 3) be available from local sources; and 4) meet cost effective criteria. After evaluating material samples from three local suppliers and thoroughly researching the availability of other local sources, it was determined that meeting the 1% TOC target would be difficult. As described in ECN 002, a sand/topsoil mix was proposed that met other criteria, but whose TOC was approximately 0.33%. After evaluating alternatives, this cap mixture was approved by USEPA. The armored cap filter and armor stone material gradations were specified considering a number of potential forces of concern including: physical mixing of sediments by biological organisms; high river flow; prop wash from boat traffic; wakes from boat traffic; and ice jam-induced velocities and turbulence. Additional information on the armored cap design is presented in the *Armored Cap Basis of Design Memorandum* (Alcoa, September 2004).

The sand and topsoil was supplied from two different borrow pits owned and operated by Curran Logging, Inc. Sand was drawn from a stockpile located in Massena, while topsoil came from a borrow area in Lisbon, New York, approximately 30 miles from the site. All crushed stone materials (i.e., filter and armor materials) used in the armored cap area were supplied by Barrett Paving Materials, Inc. from a quarry in Norfolk, New York,

approximately 20 miles from the site. Physical and chemical testing of cap materials was performed prior to placement in the river (results are included in Appendix F.12).

2.3.6.3 Equipment Used/Positioning System

Capping was performed using two 100-ton cranes (one land-based and one river-based), two material barges, a tugboat, several small work boats, and a land-based loader. Material was delivered to the site in tandem-axle dump trucks and stockpiled in the river operations area. The loader was used to manage the stockpiles and blend the sand/topsoil materials. Each crane was fitted with a 2-cy clamshell bucket for loading cap material into the material barges. The tug boat was used to move the material barges between the loading and the capping areas, assisted by the small work boats as needed. When a material barge was empty, it was rotated out for a full material barge, thereby limiting downtime.

Once in position, the river-based material placement crane removed material from the materials barge with a 2-cy clamshell bucket, and moved the full bucket into place, guided by global positional system (GPS) equipment. The crane was equipped with a GPS tracking system and a Windows Offshore Positioning System (WINOPS) computer software package to track and record cap material placement. An on-board computer screen located in the cockpit of the crane allowed operators to identify the location of the barge in relation to the capping area. Fitted with a DGPS sensor, the bucket was shown on the screen as it moved into position for placement of cap material. Once over the intended location, the bucket was lowered beneath the water**,** opened and cap material was released. A 6-ft by 9-ft footprint (equating to the approximate release area of the bucket) was recorded on the computer screen. The crane operator placed the next bucket adjacent to the previous one, with any required overlap. This method was continued until the entire targeted cap area was covered. Output for the WINOPS for each cap area is provided in Appendix F.12.

2.3.6.4 Capping Operations

Capping was performed in four river areas using the equipment and positioning system described in Section 2.3.6.3. Operations commenced once the silt containment systems were established. Actual dates of capping operation are shown in Figure 2-3.

Allowable tolerances for individual cap material layers were evaluated and presented in the Operations Plan (Sevenson, May 2005) and a series of ECNs. Considering the target cap material thicknesses and allowable tolerances (described below), placement of cap materials in all areas was verified in the field through manual survey elevation measurements obtained at each grid node (as described in detail in Appendix A). Surveyors worked real-time to measure the top of cap elevation following placement of capping materials within the targeted areas to confirm the required amount of cap material had been achieved at each grid node. If measurements indicated the targeted thickness was not achieved within the allowable tolerance, then additional cap materials were placed or excess cap material was spread out until the required elevation was reached. This process continued until acceptable cap material thicknesses were achieved at all grid nodes in all capping areas. The resulting cap thicknesses achieved as a result of this process are summarized in Table 2-3 and shown for each grid node location on Figures 2-19 through 2-23.

Capping operations specific to each of the four ROPS areas capped are described in the following sections. A summary of daily cap placement activities is presented in Appendix F.12.

2.3.6.4.1 Northern Near Shore Area

The ROPS Work Plan (Alcoa, February 2005) proposed placement of a 1 ft sand/topsoil cap in the northern near shore area following the removal of 1 ft of sediment to restore the area to its original elevation. However, since there were areas where more than 1 ft of material was removed (as described in Section 2.3.2.2.3), additional cap thickness was required to re-establish the original bottom elevation across the area. As described in ECN 022, the entire area was capped with an adequate volume of material to bring the elevation back to original grade within a tolerance of +/- 3 in (+/- 0.25 ft). Since the survey rod used for real-time verification of cap elevation is sectioned to tenths of a foot, the 3-in tolerance was rounded to 0.3 ft for ease of verification in the field.

Capping of this area started on September 12, 2005 and continued through September 22, 2005 (seven days of capping), with placement of approximately 1,500 cy of cap material (photo RA25 in Appendix D). An additional 200 cy of cap material was placed at various time intervals between November 2-5, 2005 to achieve pre-removal elevations in all northern near shore grid locations. In total, approximately 1,700 cy of sand and topsoil materials were placed to re-establish original bottom elevation. The average daily production rate in this area was approximately 215 cy/day. Cap production rates in the northern near shore area were impacted by: 1) difficulty in maneuvering associated with the perimeter silt curtain gates; and 2) lack of survey control. These issues were managed with the following field adjustments: leaving the perimeter silt curtain gates open during capping operations and using an air curtain (Section 2.3.6.1); and conducting cap thickness measurements real-time in the field during November placement efforts. Final placed cap material thicknesses at each grid node location are shown on Figure 2-19.

2.3.6.4.2 Main Channel Work Zones 1 and 2

As detailed in the ROPS Work Plan (Alcoa, February 2005), post-dredge capping in the main channel was to be completed in the first 18 dredged subunits (regardless of PCB concentration or depth of material remaining), and in the remaining subunits based on residual PCB concentrations (i.e., areas with remaining PCB concentrations greater than the average pre-dredge surface concentration of 4.5 ppm [per ECN 012]). Subunits had been defined as approximate 100-ft by 100-ft areas within the main channel work area (Figure 2-10). Since measureable depths of sediment remained across much of Work Zone 1 (after multiple dredging passes), and dredging in Work Zone 2 was not completed (per ECN 028), all of Work Zone 1 and the disturbed area of Work Zone 2 were capped with 1 ft of sand and topsoil.

A slope stability analysis (using the limit equilibrium method) was conducted to determine the allowable cap thickness tolerance by evaluating the factor of safety against bearing capacity failure under various assumptions of soil friction angle. This analysis was predicated on an assumption of looser disturbed material in the top 3 to 6 in of the sediment column following dredging. This analysis is provided in ECN 033; the resulting tolerance for capping in Work Zones 1 and 2 was no less than 12 in (1 ft) with a maximum exceedance of +6 in (+0.5 ft).

Capping of the main channel dredging areas started on October 22, 2005 and was completed on November 10, 2005 (photo RA26 in Appendix D). A total of 11,600 cy of material was placed in the main channel area based on the pre- and post-capping bathymetric surveys performed by OSI (Appendix O). The average daily production rate was approximately 780 cy/day over 17 days of capping. Cap placement rates were impacted during the initial days of capping by difficulty of the material barges manuevering through the upstream perimeter silt curtain gate. This was remedied as discussed in Section 2.3.6.1 by allowing the gate to remain open during capping activities. Final placed cap material thicknesses at each grid node location are shown on Figures 2-20 and 2-21.

2.3.6.4.3 Armored Capping

As described in the ROPS Work Plan (Alcoa, February 2005), the area targeted for armored capping was approximately 1 acre in size (100-ft wide by 400-ft long), and located between T15 and T16 in the southern portion of the main channel. Based on 2003 sediment sampling results, the area targeted for armored cap placement contained surface sediment (i.e., 0 to 3 in) PCB concentrations that ranged from non-detect to 7.9 ppm and averaged 2.8 ppm (10 sample locations), and at-depth PCB concentrations (i.e., from 3 in to bottom of the sediment column) that average 40.0 ppm (one core location). As described in ECN 023, capping operations were sequenced to maximize use of the remaining construction season. As such, armored capping was performed concurrently with dredging activities in the main channel. The area was divided into two halves (upstream and downstream), with a sand/topsoil base layer placed in the upstream half only; no base layer was placed in the downstream half to evaluate the application of armored capping for sections of the river that have elevated PCB levels at depth, but lower concentrations in the upper portion of the sediment column. The upstream half of the armored cap area has a surface sediment PCB concentration of 3.4 ppm (six sample locations; no at depth data). The downstream half has a surface sediment concentration of 2.0 ppm (four sample locations including one core) and at-depth PCB concentrations that average 40.0 ppm (one core location). The upstream half of the armored cap area was capped with a 6-in base layer of sand/topsoil, a 6-in filter layer of gravel, and a 13-in armor layer consisting of 3-in to 10-in stone. The downstream half was capped with two 3-in filter layers of different gradation and a 13-in armored cap layer (same as the upstream cap armor layer).

To establish tolerances for each cap material layer, a geotechnical analysis was conducted to determine the factor of safety against bearing capacity failure under various assumptions of soil friction angle (similar to the cap tolerance analysis conducted for Work Zones 1 and 2). As described in ECN 027 Revision #1, the analysis evaluated the stability of the base sediment in supporting cap materials by determining the safety factors against bearing capacity when the in-situ base sediment was loaded under various capping material types and lift thickness. The results of this analysis recommended a +6 in (+0.5 ft) tolerance for all cap material types. Based on subsequent discussions with USEPA, the tolerance for the filter layers was modified to +3 in (+0.25 ft). Since the survey rod used to verify cap thickness in the field is sectioned to tenths of a foot, the 3-in tolerance was rounded to 0.3 ft. In addition, the final in-place total cap thickness was not to exceed the design thickness by more than 12 in (1 ft). The final modification to the tolerances for the armored cap area is documented in ECN 027 Revision #1.

Each half of the armored cap was constructed separately, and placement of each layer commenced after placement the underlying layer was complete and verified by survey. Based on a multibeam bathymetry survey conducted by OSI, approximately 2,600 cy of material was placed over 22 days between September 23 and October 21, 2005, resulting in an average daily production rate of about 180 cy/day. Cap placement rates were impacted by: 1) weather-related delays; 2) the inability of the clamshell bucket to penetrate the armor stone material stockpile; 3) the required thin layer design; 4) relatively tight cap thickness tolerances; 5) lack of survey control; 6) distance between the river operations area and the in-river placement area along with the presence of rock outcroppings that affected barge maneuverability; and 7) mechanical issues with the river-based crane. As possible, these issues were remedied in the field as follows: steel plates were welded to each side of the land-based crane's clamshell to increase the weight of the bucket, thereby improving individual bucket volumes; real-time survey measurements of cap thickness were implemented; river rock outcrops were marked as encountered to aid in navigability and to avoid damage to the barges; and replacement of the river-based crane. Final placed cap material thicknesses at each grid node location for each layer are shown on Figure 2-22. Underwater video obtained following placement of the armored cap is presented in Appendix L.

2.3.6.4.4 Southern Near Shore Area

The southern near shore capping area was located between T8.5 and T9.5 (approximately 500 ft in length), and extended on average approximately 40 ft from shore. This near shore area was selected based on a grab sample collected in 2003 that indicated surface sediment PCB concentrations of 18.4 ppm, and considering its close proximity to the main channel and northern near shore dredge areas. Additional sediment sampling was also conducted in August/September 2004. A total of 6 sediment cores were collected from the targeted southern near shore area, and approximately 8 to 16 in of sediment was recovered in each core. On average, the cores contained 75% fines, 24% sand, and 1% gravel. Cores generally contained low levels of PCBs. Four of the 6 cores contained surface PCBs less than 2 ppm, and the other two cores contained 36.5 ppm and 9.1 ppm at the surface. The average surface PCB concentration was 8.3 ppm, and deeper portions of the cores contained PCB levels below the detection limit. Additional details on results of the 2004 sampling event are presented in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b).

Capping in the southern shore area was performed in a single lift in accordance with the Operations Plan (Sevenson, May 2005) to obtain a thickness between 3 and 6 in of sand and topsoil. Capping was completed in three days, between November 15 and 17, 2005, and a total of approximately 300 cy was placed (average of 100 cy/day). No production issues were identified during cap placement in the southern near shore. Final placed cap material thicknesses at each grid node location are shown on Figure 2-23.

2.3.6.5 Monitoring

Monitoring was performed daily in association with capping operations to evaluate the various objectives of the capping components of the ROPS (Section 1.3). During-construction monitoring associated with each capping component included: water column monitoring; cap material surface elevation measurements; and cap material sampling. Environmental monitoring activities performed during capping operations and the associated results are described throughout Section 3 and in Appendix A. Specific data are contained in Appendix B.

2.3.7 Demobilization and Site Restoration

Demobilization and site restoration tasks were performed in accordance with the Operations Plan (Sevenson, May 2005). These activities were initiated on October 22, 2005 following completion of dredging in the main channel area, and focused on the removal and decontamination or disposal of equipment, materials, and waste associated with implementation of the ROPS, as well as restoration of disturbed areas to their original condition.

Since ROPS construction activities were not completed until late November 2005, restoration activities could not be completed in their entirety due to the onset of winter weather conditions (e.g., standing snow and sub-freezing temperatures). All ROPS site activity was discontinued on December 16, 2005. As a result, completion of final restoration activities is intended to occur in 2006.

Demobilization and site restoration activities are described below by ROPS area (PPA, SLF, MPP, and river operations area). The initial step in demobilization from each area was decontamination of equipment. Since this step applies to all ROPS areas, it is described separately below.

2.3.7.1 Equipment Decontamination

Decontamination and wipe sampling of equipment were required before leaving the site. In general, all equipment that either came in contact with waste or was located within an exclusion zone was decontaminated with pressure washers. After pressure washing, all cleaned equipment was staged at the designated "clean" area on the asphalt pad in the MPP. The IQAT then performed a visual inspection of the equipment. If the equipment appeared visually "clean," it was cleared for PCB wipe sampling. If equipment appeared visually "dirty," it was pressure washed again and inspection activities were repeated.

After satisfactory visual inspection of cleaned equipment, wipe samples were taken. Representative samples were taken for smaller items or items containing various or repetitive parts. For example, one section out of every 440 linear ft of piping was wipe sampled on the inside and outside of the pipe. This methodology was also applied to multiples of pumps, stands, cables, filter press plates, etc. Samples were sent to the ChemLab for total PCB (Aroclor) analysis. Wipe test results with a total PCB (Aroclor) concentration of less than 10.0 micrograms per 100 square centimeters ($\mu g/100\ cm^2$) were deemed "passing" and acceptable for release. In the event of a failure, the piece of equipment was pressure washed again, re-inspected, and re-sampled. If a representative (multiple part) piece of equipment failed, all items associated with the failing representative piece were pressure washed again and the piece was re-sampled along with an adjacent piece for quality control. The required shipping documents and certified wipe test laboratory results were supplied to the Alcoa Gate 4 security guard, and after review, the item(s) were permitted to leave the site.

A complete equipment list was generated to track progress of the wipe sampling associated with equipment decontamination. The completed list is contained in Appendix F.14.

2.3.7.2 Project Personnel Area

The PPA was the final area to be addressed during demobilization activities since this was the office complex for the ROPS project management staff, and included break trailers for the trade personnel in the field. Demobilization activities included termination of utility feeds, relocation of project files, and removal of office and support facilities. Restoration activities completed include grading of access areas and roads to prevent standing water and removal of fencing from the west side of parking area near Gate 4 and the field trailer area. Restoration activities associated with the PPA to be completed in 2006 include removal of the remaining vehicle/pedestrian separation fencing and posts, and final grading and seeding of access and lay down areas and roads.

2.3.7.3 Secure Landfill Cell 3

Placement of the interim landfill cap (described in Section 2.3.5.3) was the final ROPS activity associated with the SLF. Upon completion of cap installation, equipment and materials were decontaminated as described above. Before site work was discontinued, lay down areas and access roads were graded to prevent standing water, a pre-existing silt fence was reestablished, and concrete barricades were placed at the northern and southern berms to limit access.

Restoration activities associated with the SLF to be completed in 2006 include final grading and seeding around the perimeter of the cell. Additional details regarding these activities are included in the draft SLF Cell 3 Completion Report (CDM, February 2006).

2.3.7.4 Materials Processing Pad

Following completion of dredging activities, dredge slurry was no longer being sent to the solids processing and water treatment systems, so demobilization activities at the MPP focused on removal of residual solids in the system, equipment tear down, and decontamination. Once the components of the water treatment system were demobilized, water collected and generated at the MPP was pumped to a manhole that discharged to the Outfall 004/005 Impoundment. Restoration activities completed include grading of access areas and roads to prevent standing water. Restoration activities associated with the MPP to be completed in 2006 include final grading and seeding of perimeter laydown areas, access areas, and roads.

Alcoa requested approval from USEPA to allow the MPP to remain as a restricted access area that could be used in future site projects. Alcoa submitted an *Observation, Maintenance, and Monitoring Plan* (Alcoa, October 2005b) that identified measures for handling stormwater and seasonal snowmelt and provided for regular inspections of the area. USEPA approved this request allowing the MPP to remain, contingent on Alcoa making necessary changes to further secure the site. These changes include raising the berms at identified low locations and reconfiguring HDPE piping such that water from the area will be captured and treated prior to discharge.

2.3.7.5 River Operations Area

Demobilization activities associated with the river operations area began almost immediately following completion of dredging on October 21, 2005. Because temperatures during the last week of dredging had dipped to below freezing, it was a priority to drain water from all dredges and related equipment to prevent damage due to freezing water. As demobilization activities progressed, the booster pump area (including the dredge discharge pipeline), floating dock, river staging area, in-river work areas, and capping equipment were addressed.

Due to the timing of completion of in-river operations, demobilization of the silt containment system was not performed as planned. The original intent was that silt curtain-related materials would be disposed of at the SLF. Due to the limited volume of waste in Cell 3, the large volume of curtains, and the oncoming cold weather, ECN 034 was submitted to USEPA and approved on November 17, 2005, thereby allowing these wastes to be transported off-site and disposed at the CWM Model City facility. Off-site disposal of the silt curtains allowed for the installation of the temporary HDPE liner cap over the SLF without waiting for the silt curtains to be removed from river. Silt curtain anchors and chains were either loaded out as waste to the SLF or decontaminated and sampled prior to being used as weights on the interim SLF cap. Curtains were loaded into trucks for off-site transport starting on November 17, 2005 and continuing through December 3, 2005. In total, 17 trucks were used to transport 99 tons of material for off-site disposal.

As described in ECN 035, local water column monitoring was conducted November 10-12, 2005 prior to removal of the main channel containment system, to assess conditions within the work zone. The purpose of this monitoring was to show that PCB (Aroclor) and TSS levels within the work zones were at an acceptable level (i.e., less than or equal to levels exhibited at the upstream monitoring transect) prior to removal of the containment system. Water column sampling for PCB (Aroclor) and TSS analysis was also performed on November 13, 2005 during the actual containment system removal activities. Results were non-detect for PCB (Aroclor) and equal to or less than levels measured at ROPS-WCT5 for TSS and turbidity. Details regarding these monitoring activities are described in Appendix A with results presented in Appendix B.

On November 19, 2005 a post-capping bathymetric survey was performed in the main channel area by OSI. Based on their interpretation of the resulting data, OSI informed Alcoa of a number of objects they believed remained on the river bottom. OSI provided a list of location coordinates that were investigated by the IQAT

and Sevenson. At these locations, ROPS-related material, such as small sections of torn curtain, and miscellaneous anchors were identified, removed and eventually disposed.

Before site work was discontinued for the winter, lay down areas were graded to prevent standing water, the containment liner beneath the booster pump area was removed, the air monitoring station location along Route 37 was graded and seeded, two rows of silt fence and hay bales were placed at the entrance of the river ramp access (prior dock area); any prior existing silt fence (river bank area) was reestablished, fencing and parking lot stone were removed, and the observation deck area was removed. Restoration activities associated with the river operations area to be completed in 2006 include removal of remaining stone, and final grading and seeding.

2.4 Post-ROPS Monitoring Activities

Post-construction monitoring was performed in fall 2005 to gather data following completion of construction activities to assess potential short-term effects associated with dredging and/or capping operations. Modifications to the post-ROPS monitoring activities outlined in Operations Plan (Sevenson, May 2005) were required due to changes in the scope and schedule of the ROPS as presented in ECN 036. As a result, the post-construction monitoring program included sediment sampling, sediment surface elevation measurements, bathymetry surveys, water column monitoring, and underwater video of the armored cap area. Details on the post-construction monitoring activities are presented in Appendix A.

2.5 Compliance and Corrective Action

As introduced in Section 1.7, air, water column, effluent from the water treatment system, light and noise were monitored and assessed against pre-determined action levels for compliance. The following sections summarize results obtained through monitoring activities for each medium in comparison to action levels. Corrective actions undertaken as a result of any non-compliance results are described. This section also includes a discussion of spills identified and remediated during the ROPS.

2.5.1 Air

Air monitoring activities were conducted under two separate but related programs. The CHASP and SLF Cell 3 air monitoring programs were implemented to assess potential airborne releases that could potentially affect downwind communities. A summary of these activities is presented in Sections 2.5.1.1 and 2.5.1.2, respectively. The Operational HASP program air monitoring associated with on-site worker safety was performed in the vicinity of the ROPS operations.

2.5.1.1 CHASP and SLF Cell 3

Air monitoring was performed as defined in the CHASP (Alcoa, April 2005a) and SLF Cell 3 Air Monitoring Plan (Alcoa, June 2005; ECN 014) to protect the community from potential air quality issues associated with sediment removal, processing, and landfilling activities. The complete air monitoring program consisted of the collection of high volume samples for analysis of PCBs, polycyclic aromatic hydrocarbons (PAHs), particulate matter less than 10 microns (PM_{10}), and volatile organic compounds (VOCs), and monitoring via real-time meters for total PM_{10} and VOCs. Monitoring was conducted at a total of seven stations located upwind and

downwind of ROPS activities, including a background location. Air monitoring activities conducted in association with ROPS activities are detailed in Appendix A; results are contained in Appendix B.

Action levels were established for PCBs, PM_{10}, and VOCs; PAH results were considered in comparison to results obtained from the background station as summarized below. Contingency measures for exceedance of the PCB action level are described in DCF 007.

- PCBs – The daily standard PCB action level was established at 0.100 micrograms per cubic meter ($\mu g/m^3$). Results for all high volume PCB samples were at least an order of magnitude lower than the action level. As such, no corrective actions were required.

- PM_{10} – The action level for PM_{10} monitoring was 0.150 milligrams per cubic meter (mg/m^3) above background (average of readings obtained over a 15-minute time period). This action level was exceeded based on monitoring with real-time meters at least one location during 17 of the 99 days when continuous PM_{10} concentrations were measured. All high volume PM_{10} sample results were below the specified action levels. USEPA was notified after each exceedance, and no corrective actions were required, as several factors were noted in the field on these days that can affect the accuracy of the meters used during monitoring (e.g., fog, high humidity, medium/high pollen, heavy precipitation, etc.).

- VOCs – The action level for VOC monitoring was 5 ppm total VOCs above background. This action level was exceeded based on monitoring with real-time meters during two of the three monitoring events. However, the values obtained from the meters for maximum total VOCs were not confirmed by the summation of analytical results for individual VOCs from the corresponding collection of high volume samples. Certain weather conditions can affect the accuracy of the meters, such as high humidity, which was observed the days monitoring was conducted. As a result, no corrective actions were required.

- PAHs – The majority of the high volume samples collected for PAH results were below the method detection limit. PAHs that were detected were not elevated when compared with samples obtained at the background station and those obtained during the baseline monitoring event.

2.5.1.2 Operational HASP

Air monitoring activities associated with worker safety were conducted as outlined in the Operational HASP (Alcoa, March 2005b). Monitoring primarily consisted of the use of real-time monitors for dust or particulates and hydrogen sulfide gas. Meters were positioned on select operating equipment such as the dredge, filter presses, and shaker tanks, as well as upwind and downwind of the perimeter of the processing pad. The action levels for particulates and hydrogen sulfide gas were 0.150 mg/m^3 and 5 ppm, respectively. The real time particulate action level for determining worker exposure to PCBs was based on a risk assessment using the highest reported concentration of PCBs in the contaminated material. To exceed the OSHA PCB permissible exposure level (PEL) of 0.5 mg/m^3, a real time particulate level of 22.49 mg/m^3 or greater (significantly above the particulate action level) for the entire 12-hour shift would have to be measured. In addition, monitoring for PCBs was conducted via sampling per National Institute for Occupational Safety and Health (NIOSH) method 5503. PCB monitoring was conducted in association with workers that had the highest potential for exposure, including those at the dredge operations, dewatering and load-out operations, landfill operation, and at the downwind site perimeter. A total of 30 samples were collected and analyzed. Only one sample had detectable concentrations of PCBs, and this occurred at the shaker tanks on October 11, 2005. The reported concentration was 0.0027 mg/m^3, well below the PEL.

2.5.2 Water Column

Water column monitoring was performed as defined in Attachment VI of the Operations Plan (Sevenson, May 2005). For purposes of assessing compliance with corrective action triggers, three water column monitoring transects were monitored daily during all in-river construction activities (i.e., ROPS-WCT5 [upstream/background transect], ROPS-WCT14 [downstream of near shore areas and main channel dredging/capping, but upstream of armored capping activities], and ROPS-WC131 [downstream of all ROPS activities]). Monitoring included collecting samples for PCB (Aroclor) and TSS analysis, and measuring water quality parameters (i.e., water temperature, dissolved oxygen [DO], specific conductivity, pH, and turbidity). The results obtained at each of these transects were assessed against defined corrective action levels. The following presents an overview of which transects were monitored depending on the construction activity being performed.

- During dredging/capping in the northern near shore and main channel areas, and the thin-layer capping area:
  - Samples were collected at ROPS-WCT5, ROPS-WCT14, and ROPS-WC131
  - Corrective actions were based on the results obtained from ROPS-WCT5 (upstream) and ROPS-WCT14 and ROPS-WC131 (both downstream)

- During placement of an armored cap:
  - Samples were collected at ROPS-WCT14 and ROPS-WC131
  - Corrective action were based on the results obtained from ROPS-WCT14 (upstream) and ROPS-WC131 (downstream)

Attachment VI of the Operations Plan (Sevenson, May 2005) originally included only one downstream transect (ROPS-WC131) for use in determining if corrective action was necessary for dredging/capping in the near shore and main channel and thin-layer capping the near shore areas. However, based on discussions between USEPA and Alcoa, it was decided that both downstream transects (ROPS-WCT14 and ROPS-WC131) would be used as correction action trigger locations. This decision was based on the determination that the majority of PCBs detected at the downstream transects were soluble PCBs, and therefore significant differences were typically not observed between the transects coupled with the influence of travel time between the two monitoring locations. With respect to the latter issue, it was ascertained that under certain river flow conditions, the impact of daytime only activities, such as debris removal, on downstream water quality may not be reflected in the water column results from ROPS-WC131. A detailed description of the water column monitoring program is included in Appendix A; results are contained in Appendix B.

Action levels were established for PCBs, TSS, and turbidity in the ROPS Work Plan (Alcoa, February 2005). The action levels are based on concentrations obtained at the downstream water column transect or a comparison of the upstream and downstream water column transects as summarized below.

- PCBs – The corrective action trigger for PCBs was established at 2 µg/L at the downstream water column transects (i.e., ROPS-WCT14 or ROPS-WC131). The corrective action trigger for PCBs was exceeded on eight days during debris/sediment removal in the main channel. The table presented below summarizes these water column exceedances and includes information regarding the construction activities conducted, PCB level detected, and corrective action implemented.

Date	Construction Activity	PCB Level (µg/L)	Corrective Action
July 8, 2005	Dredging and debris removal in Work Zone 1	ROPS-WCT14 = 2.151 ROPS-WC131 = 2.454	Divers inspected and implemented repairs of curtains
July 19, 2005	Dredging and debris removal in Work Zone 1	ROPS-WC131 = 2.648	Divers inspected and implemented repairs of curtains
July 20, 2005	Dredging and debris removal in Work Zone 1	ROPS-WC131 = 4.402	Divers continued with curtain repairs and reviewed field activities to identify contributing operations
July 21, 2005	Dredging and debris removal in Work Zone 1 and dredging in Work Zone 2	ROPS-WCT14 = 3.151 ROPS-WC131 = 2.445	Hours of debris removal reduced to no more than 6 hours per day; dredge operational changes and restricting slurry line backflush
July 22, 2005	Dredging in Work Zone 2 and debris removal in Work Zone 1	ROPS-WC131 = 2.559	Hours of debris removal reduced to no more than 6 hours per day
July 26, 2005	Dredging and debris removal in Work Zone 1	ROPS-WCT14 = 2.359	Curtain repairs
August 25, 2005	Dredging in Work Zone 1 and dredging and debris removal in Work Zone 2	ROPS-WCT14 = 2.126	All materials (debris and sediment) brought to surface during debris removal activities (via rake) placed in scows rather than back in water
September 10, 2005	Debris removal in Work Zone 1	ROPS-WC131 = 2.226	Curtain repairs

- TSS – The corrective action trigger for TSS was a detection of TSS levels at the downstream water column transect (i.e., ROPS-WCT14 for near shore or main channel dredging/capping or ROPS-WC131 for main channel armored capping) greater than 25 mg/L over the background (i.e., TSS levels at the upstream water column transect [ROPS-WCT5; since armored capping and main channel capping occurred simultaneously]). The TSS corrective action trigger was not exceeded during the ROPS. All TSS data are included in Appendix B.

- Turbidity – The corrective action trigger for turbidity was a detection of turbidity levels at the downstream (i.e., ROPS-WCT14 for near shore or main channel dredging/capping or ROPS-WC131 for main channel armored capping) water column transect greater than 25 nephelometric turbidity units (NTUs) over the background (i.e., turbidity levels at the upstream water column transect [ROPS-WCT5; since armored capping and main channel capping occurred simultaneously]). The turbidity corrective action trigger was not exceeded during the ROPS. All turbidity data are included in Appendix B.

2.5.3 Water Treatment System Effluent

During the operation of the on-site wastewater treatment plant, compliance issues occurred on August 16 and 17, 2005. On each of these days, the required EBCT (per the ELMR as described in Section 2.3.4.1) was not

maintained. NYSDEC was notified and an Environmental Excursion or Event (EEE; example included in Appendix F.10) report was filed. The exceedances were a result of a failure in the emergency pager system set to notify personnel when discharge rates reached 1,950 gpm. Corrective action was taken and flows monitored more closely. Also a warning light was installed on the pad to alert the water treatment operator when flows reached 1,850 gpm.

2.5.4 CHASP Light and Noise

Noise and light monitoring were performed to identify any potential impacts to the surrounding community described in the CHASP (Alcoa, April 2005a) that may result from ROPS construction activities. These monitoring activities are described in the following sub-sections.

2.5.4.1 Noise Monitoring

Monitoring was conducted to identify nuisance noise associated with the operation of mechanical equipment such as dredges, trucks, sediment processing equipment, etc. Noise monitoring was conducted using a Sper Scientific Sound Meter (SN #820029) sound-level meter. Noise monitoring was performed routinely from June 16 to October 14, 2005 at various neutral locations (i.e., locations between the active construction areas and nearest noise receptors), including the Alcoa Road Bridge, Route 37, observation deck area on County Route 42, and at the office trailers in the PPA. The neutral zone noise monitoring data are presented in Appendix F.13; these data represent the highest level recorded for each day of monitoring. Sound levels at these neutral locations were evaluated against the action levels presented in the CHASP (Alcoa, April 2005a) that included the following:

- Residential control level (threshold at which mitigation is recommended): Daytime = 75 decibels (dBA; maximum hourly average);
- Residential standard level (threshold at which mitigation is required): Daytime = 80 dBA (maximum hourly average) and evening (10:00 pm to 7:00 am) = 65 dBA (maximum hourly average); and
- Commercial/industrial standard level: Daytime and evening = 80 dBA.

The highest recorded reading for each day was compared against these action levels to assess the need for corrective action. Of the 64 days of noise monitoring, 15 maximum readings exceeded the residential control level (75 dBA). Considering the standard level of 80 dBA (level at which mitigation is required), the highest recorded noise level exceeded this value on 2 days (July 1 and August 4, 2005) with measurements of 83.9 and 85.0 dBA at the Alcoa Road Bridge and Route 37, respectively. The two locations with elevated readings are in high traffic areas. The elevated noise levels recorded could be attributed to high traffic volumes on those days. No mitigation measures were implemented.

Additional noise monitoring was conducted routinely at the dredging and processing areas to evaluate worker noise exposure from June 16 to October 14, 2005. Results from these monitoring activities are also presented in Appendix F.13. Levels were such that hearing protection was mandated at the river dredging/capping and MPP operations for all workers as a precautionary measure only. Workers at other lower noise level locations used a voluntary protocol only for hearing protection.

No complaints regarding noise levels were received from the public or from the ROPS workforce during the ROPS.

2.5.4.2 Light Monitoring

Since ROPS construction activities were conducted during evening hours, artificial lighting was used for worker safety during dredging, dredging-related activities, and sediment processing operations. As such, light monitoring was continuously evaluated qualitatively for maximum illumination considering worker safety and verifying that any lighting configuration did not negatively affect the surrounding community. When any lighting configuration was changed, a qualitative visual evaluation was completed for worker safety and any community impact.

No lighting issues were identified by the public for any evening hours work. The visual monitoring activities demonstrated that no changes of light quality or shield (glare limiting) were required for the lights and light plants stationed at the river and MPP. Additionally, lighting was sufficient for site workers to safely perform all job tasks. Minor adjustments were continually made (and then evaluated) to the lighting configuration periodically to complete evening tasks.

2.5.5 Spill Reporting and Documentation

During implementation of the ROPS, five petroleum spills were identified. Upon identification, all spills were immediately addressed. Alcoa and appropriate Agencies (i.e., NYSDEC) were notified, the spill and surrounding area were cleaned, materials or soils saturated with the spill were properly disposed, and all reporting/documentation, including the Spill Response Notification Form (example form presented in Appendix C), were completed.

For each spill, an Alcoa Spill Management Team representative and a NYSDEC spill supervisor inspected the site following cleanup activities. An analytical sample(s) was obtained from the cleaned area and analyzed for any remaining petroleum constituent(s). Results were reviewed to confirm clean residuals; if results were contrary, further “cleanup” was completed, followed by a second sampling event, etc.

The following presents a summary of each spill and the cleanup response completed to remedy the spills.

- On June 8, 2005, approximately ¼ ounce of hydraulic oil (vegetable oil based) was released to the river via a pinhole leak in the dredge hydraulic line. This release occurred while the dredge was within the containment of Work Zone 1, as well as within the confines of oil absorbent booms which encircled the dredge, and therefore was contained. Since the volume of oil released was small, the oil absorbent booms showed no signs of staining and therefore remained in the river for later disposal.
- A release of less than one gallon of oil was reported on August 4, 2005 when a welding machine was dropped into the river during transport of the equipment from a boat to the barge. The welding machine was recovered immediately and the oil was contained via the use of an oil absorbent boom.
- On August 9, 2005, approximately two gallons of gear oil was discovered along the road leading to the river staging area. The release originated from a truck transporting the gear housing of a crane along the road that tipped while being transported. The spill covered an area approximately 1 in wide by 100 ft in length. Soil with gear oil was excavated and disposed. A sample collected following excavation of the targeted soil for petroleum product analyses confirmed that the spill had been appropriately remedied.
- Approximately 1.5 quarts of motor oil were spilled at CHASP air monitoring Location #2 on August 11, 2005. Following an oil filter change, the generator was turned on and oil leaked from the O-ring. The spill under the generator covered an approximately 10 in diameter area. Soil with motor oil was removed using hand shovels and disposed. A sample was collected following excavation of the targeted soil for petroleum product analyses to confirm that the spill had been appropriately remedied. The

initial sample indicated petroleum products still remained, and additional soil was removed and another sample was collected. This second sample confirmed that the spill had been appropriately remedied.

- A release occurred on August 17, 2005 of approximately 2 gallons of hydraulic oil. The release occurred from a faulty O-ring on an auger motor on the dredge. The dredge was within the work zone containment system. Once the release was identified, the auger motor was immediately shut down and repaired, and oil absorbent booms and diapers were utilized to absorb the oil. The booms and diapers were disposed of appropriately.

2.6 Overall ROPS Schedule

The planned and actual schedules for the major ROPS components are presented on Figure 2-3. The planned schedule reflects the anticipated timing/duration of construction activities presented in the Operations Plan (Sevenson, May 2005) with the addition of planned monitoring activities based on the original timing of construction activities and the monitoring program defined in Attachment VI of the Operations Plan (Sevenson, May 2005).

The actual schedule reflects process- and weather-related delays and major changes to scope that were implemented during the ROPS. In summary, some of the major delays and scope changes (presented in detail in previous sections) impacting schedule included:

- Dredge equipment downtime due to flow limitations in the solids processing area, equipment damage due to site bottom conditions, impacts of debris, and equipment malfunction;
- Difficulties encountered in establishing the depth of elevated PCBs levels in the sediment column due to measurement techniques and variations in bottom conditions;
- Modifications in debris removal and dredging equipment;
- Omission of dredging Work Zone 3;
- Expansion of Work Zone 1, with limited dredging in Work Zone 2;
- Capping over all of Work Zone 1 and 2 without use of the decision matrix presented in the ROPS Work Plan (Alcoa, February 2005); and
- Five significant storm events resulting in high river flows and conditions unsuitable for construction activities (i.e., July 13, September 2-7, September 19-23, September 30-October 1, 2005, and October 15-17, 2005).

The actual schedule shown on Figure 2-3 incorporates both the construction and monitoring activities and reflects actual dates and durations for implementation of the project components.

3. Evaluation of Environmental Monitoring Data

3.1 General Overview of Environmental Monitoring Program

An intensive environmental monitoring program was developed for the ROPS to document baseline river conditions, as well as conditions during and after the ROPS construction activities. Baseline monitoring was conducted in 2004 and spring 2005, during-construction monitoring was performed from April to November 2005, and post-construction monitoring was conducted in November and December 2005. Longer-term monitoring will be conducted in 2006, and this program is currently under development in coordination with the Agencies. The monitoring program was designed to assess the overall and component-specific objectives outlined in Section 1.3, and generate data necessary to evaluate the Data Quality Objectives (Environmental DQOs) presented in Section 3.1.1. It included sediment surface elevation and probing measurements, sediment chemistry and grain size information, water column monitoring, air monitoring, ecological monitoring, bathymetric measurements/remote sensing surveys, ex-situ dredge material sampling, water treatment effluent sampling, Geotube sampling, and cap material sampling. Monitoring activities were performed in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005), various ECNs, and the protocols established therein.

A summary of the activities performed and information generated during each of the monitoring events is presented in Sections 3.1.2 through 3.1.5. Details regarding the specific activities conducted during each monitoring component are presented in Appendix A; Appendix K describes the Geotube monitoring activities. Additional construction-related monitoring activities conducted during the ROPS, such as noise and light monitoring and wipe sampling, are described in Section 2.5. Table 3-1 identifies where all environmental monitoring data are provided within this report. Appendix M presents a discussion of the quality assurance (QA)/quality control (QC) sample results and evaluation.

3.1.1 Environmental DQOs

Environmental DQOs were developed for the ROPS to clarify the overall and component-specific objectives of the project and ensure that the data collected as part of the monitoring program would be appropriate for their intended use. The ROPS monitoring program was originally designed to provide the data needed to evaluate the following DQOs.

<u>All Components</u>

- Develop a refined understanding of the pre-construction physical and chemical conditions within the ROPs river areas targeted for dredging and/or capping (i.e., main channel, side slopes, and near shore areas).
- Determine system-wide impacts of construction activities, if any, on PCB levels in the water column and fish.

<u>Dredging Component</u>

- Quantify the downstream transport of PCBs that occurs as a result of dredging activities.
- Determine PCB levels and sediment volumes that remain after production dredging.
- Assess the relationship between local conditions and post-dredging PCB residual concentrations to the extent possible.
- Determine the effectiveness of post-dredging capping as a means to isolate PCB-containing residual sediment.

- Determine impacts of dredging activities, if any, on PCB concentrations in the air.

Armored Cap Component
- Determine the ability of the native sediments to support an armored cap designed to withstand the forces imposed by increased velocities and turbulence under an ice jam (as observed during the 2003 event).
- Assess impacts of capping activities, if any, on the downstream transport of PCBs in the water column.

Near Shore Area Component
- Quantify the downstream transport of PCBs that occurs as a result of dredging activities and assess the impacts of capping activities, if any, on the water column.
- Determine the ability of thin-layer capping to isolate PCB-containing sediments in near shore areas.
- Document the changes in habitat caused by dredging or thin-layer capping in near shore areas.
- Evaluate sedimentation rates in near shore areas of the river.

Ice Control Structure Component
- Document the changes in habitat caused by construction of an ICS.
- Quantify loadings of clean sediments from upstream into the lower river and quantify the impact of an ICS on sediment transport to the lower Grasse River.
- Document the efficacy of an ICS as a means to mitigate ice runs into the lower Grasse River.
- Assess the stability of sediments downstream of region exhibiting effects from ice-related scour.

Table 3-2 presents the DQOs and the related monitoring element conducted to meet the specified objectives. As discussed in Section 1.2, the ROPS Work Plan (Alcoa, February 2005) also included provisions for installation of an ICS. Based on community concerns, the ICS component was not implemented as part of the ROPS activities, and therefore DQOs related to the ICS were not evaluated as part of the ROPS.

3.1.2 2004 Baseline Monitoring Activities

Baseline monitoring was conducted in summer/fall 2004 and spring 2005 to obtain additional information necessary to refine the scope of the ROPS activities and fill data gaps regarding baseline conditions as a point of comparison with future monitoring results in order to assess achievement of objectives, and consider seasonal variation in biological communities in the targeted areas. Baseline monitoring activities conducted in summer/fall 2004 included:

- Sediment sampling in the main channel and near shore areas in August/September 2004;
- Sediment elevation and/or probing measurements in all areas targeted as part of the ROPS from July to September 2004;
- Geotechnical investigation in the main channel armored cap area in September 2004;
- Ecological monitoring, including benthic community sampling and habitat characterization, in the northern and southern near shore areas in September 2004; and
- Ecological monitoring, including benthic community sampling, habitat characterization, fish community survey, and vegetative survey in the proposed ICS area in September 2004.

The number of samples collected as part of the 2004 baseline monitoring events is presented on Table 3-3. Details of these monitoring activities are provided in the *2004 ROPS Baseline Monitoring Summary Report* (Alcoa, April 2005b). Data from these monitoring activities are included in Appendix B.

3.1.3 2005 Baseline Monitoring Activities

The 2005 baseline monitoring events, which were conducted in April and May 2005 prior to initiation of ROPS construction activities, were performed to supplement the data obtained during the 2004 baseline monitoring surveys. These monitoring activities included:

- Sediment surface elevation and probing measurements;
- Water column monitoring;
- Air monitoring; and
- Ecological monitoring, including invertebrate community sampling and habitat characterization.

The number of samples collected as part of the 2005 baseline monitoring events is presented on Table 3-3; details are presented in Appendix A. Data from these monitoring activities are included in Appendix B.

3.1.4 Construction Monitoring Activities

During-construction monitoring was conducted to obtain timely information on the environmental effects and operational performance of the dredging and capping activities. The types of monitoring conducted during the ROPS are listed below.

<u>Debris and Sediment Removal</u>

- Water column monitoring
- Sediment surface elevation and probing measurements
- Remote sensing surveys (i.e., velocity measurements/study, multibeam survey, and sub-bottom investigation)
- Sediment sampling
- Air monitoring
- Ex-situ dredge material sampling
- Water treatment effluent discharge sampling
- Geotube sampling
- Dredge positioning during dredging
- Quality control surveys

<u>Post-Dredge, Thin-Layer and Armored Capping</u>

- Water column monitoring
- Sediment surface elevation measurements
- Cap material sampling

Table 3-3 presents a summary of each sampling event, including locations sampled, and total number of sample/measurements obtained; details are presented in Appendix A. Data from these monitoring activities are included in Appendix B.

3.1.5 Post-Construction Monitoring

Post-construction monitoring (fall 2005) was performed to characterize the physical and chemical properties of the dredged and capped areas at the point of completion of the ROPS, and the short-term response of river water quality to the cessation of construction activities. Longer-term monitoring will be conducted in 2006 and is

currently under development in coordination with the Agencies considering the results of the baseline, during-, and post-construction monitoring programs. The 2005 post-construction monitoring program included:

- Sediment sampling;
- Sediment surface elevation measurements;
- Multibeam bathymetry;
- Water column monitoring; and
- Underwater video (armored cap area).

Table 3-3 presents a summary of each sampling event, including locations sampled, and total number of sample/measurements obtained; details are presented in Appendix A. Data from these monitoring activities are included in Appendix B.

In addition to the above activities, fall resident fish sampling was performed between August 29 and September 21, 2005 as part of the routine annual Grasse River Supplemental Remedial Studies (SRS) trend monitoring program. These data are collected on a yearly basis and are discussed in this report because they provide additional information pertaining to potential impacts the construction activities have on biota in the river.

3.2 Debris and Sediment Removal

Dredging in the ROPS northern near shore and main channel areas allowed for a site-specific assessment of the implementability and effectiveness of this potential remedial option. Field constructability observations and challenges encountered, along with the operational and environmental monitoring data collected during the ROPS, allowed for a detailed assessment of dredging effectiveness in the lower Grasse River. Details regarding the implementability and effectiveness of ROPS debris and sediment removal activities are presented in the following subsections.

3.2.1 Depth and Volume of PCB-Containing Sediment Targeted for Removal

PCB data obtained from manual coring conducted in 2003 and 2004 indicated that the main channel portion of the ROPS area generally contained 3 to 5 ft of contaminated sediments that were primarily composed of sand overlying silty sand and sandy silt. PCB concentrations in these sediments exhibited a typical profile with depth; relatively low in the top 18 to 24 in and generally increasing at greater depths to a peak often occurring within 6 to 18 inches of the bottom of the core. Manual sediment probing was conducted concurrently with sediment core collections and probing depths correlated well with the depths of recovered sediments, suggesting: 1) the sediment cores captured the entire column of contaminated sediments (i.e., fully penetrated through the soft, PCB-containing sediments); and 2) the sediment probing measurements provided reasonable estimates of the depth of contaminated sediment in the river. This view was further supported by stratigraphic analyses of sediment cores collected in 2003 which indicated that the PCB-containing sediments were underlain by a poorly-sorted sand-rich glacial till (Alcoa, April 2004). This interface was presumed to coincide with the depth of refusal for both the core tube and probing rod. Attempts to quantitatively characterize the sub-bottom conditions in this area by way of remote sensing were not successful (Alcoa, April 2004). On the basis of the understanding of the site conditions and techniques employed during previous site investigative and remedial efforts, probing was chosen as the means to map the bottom extent of the dredge cut. Probing depth measurements were collected along a pre-defined sampling grid in 2004 and 2005 to define the target depths of removal and anticipated removal volumes for the ROPS. Using the probing depth information obtained during these two baseline surveys, it was estimated that about 28,000 cy and 21,500 cy of sediment would be targeted for removal in Work Zones 1 and 2, respectively.

Sediment probing and manual cores were collected during the main channel ROPS dredging activities after several feet of sediment had been removed by dredging. These data indicated that, in some areas of Work Zone 1, the depths to which the probe could be advanced after some dredging had occurred were at variance with the originally estimated depths of sediments as determined by the baseline probing measurements. Possible causes considered included variability in bottom conditions over short distances, less resistance to the probe with the removal of several feet of overlying sediments, and loosening of sediments by the dredge that could not be probed previously. As probing measurements were incorporated into the study design as a critical measure of the progress of the work, several actions were taken in response to this observation. These actions included: 1) collecting vibracores (instead of manual push cores) to measure the thickness of remaining PCB-contaminated sediments; 2) completing multibeam bathymetry surveys to characterize the nature of the river bottom; and 3) undertaking diver surveys in the main channel dredge area to observe and document river bottom conditions, particularly in areas where vibracoring and continued dredging attempts were yielding inconsistent information regarding the extent of remaining sediments.

Many of the vibracores collected from the main channel area penetrated through a distinct stratigraphic interface into what appeared to be glacial till (Figure 3-1). The dark sediments characteristic of the deeper sediments containing the higher PCB concentrations in the baseline cores were present in the vibracores and were underlain by lighter, denser (stiffer) sediments. Analytical testing of sediments above and below this stratigraphic interface confirmed the physical and chemical differences between these sediments; the dark, less dense sediments found above the stratigraphic interface contained PCBs, whereas those below the interface generally contained PCB concentrations below 1 ppm and often below the method detection limit. Most of the vibracores subsequently collected in areas where dredging had removed several feet of sediment exhibited penetration into native geologic strata. Photo logs of all cores collected during the ROPS are contained in Appendix N.

For each vibracore that penetrated into the underlying native strata, an estimate of the pre-removal depth of PCB-containing sediment (the depth of contamination, or DoC) was “reconstructed” by subtracting the elevation of the stratigraphic interface (determined from the surface sediment elevation at the time of collection and the sediment thickness above the observed interface) from the pre-removal surface sediment elevation measured at that location during the multibeam bathymetry survey. These re-constructed DoCs were then compared to the baseline probing depths, which had been used as the measure of the thickness of PCB-containing sediments, and the probing depth measurements collected at the time of vibracore collection. These comparisons indicate that 65 to 73% of the baseline probing depths deviated from the DoC by more than 6 in, with 38 to 46% deviating by more than 12 in (Figure 3-2, top and middle panels). No consistent bias was observed (i.e., the sediment probing data did not consistently over-predict or under-predict the reconstructed DoCs). In general, differences between sediment probing depths and reconstructed DoCs increased with increasing DoC (Figure 3-3). In other words, probing provided a more accurate estimate of DoC in thin sediment deposits than in thick sediment deposits.

The multibeam and diver surveys found that the much of the main channel river bottom contains rocks, boulders, and bedrock outcrops. These features can limit the penetration of a probing rod or a core tube, particularly under baseline conditions when the rod or tube cannot move laterally off an obstruction after having penetrated several feet of sediment. Vibracoring after sediment removal has the advantage of lateral movement to sediments between rock features and can sample sediments that would be less likely to be found under baseline conditions. This fact may contribute to the differences between the baseline estimates of DoC and those obtained from the post-dredging vibracores.

3.2.2 Sediment Volume Dredged During the ROPS

Sevenson made daily estimates of the volume of solids produced at the MPP (sand, filter cake, oversized debris) and the volume of mechanically excavated debris removed from the river and trucked from the river operations area to the MPP. These estimates should provide a reasonable basis to estimate the volume of in-situ material removed, because all in-situ solids removed from the river were either sent to the MPP (hydraulic dredging) or the river operations area loading dock (mechanical excavation). However, during the course of the ROPS, it became evident that these estimates were inconsistent with the amount of processed material being sent to the SLF. In response, an independent mass balance was conducted and validated by comparison of pre- and post-dredging multibeam bathymetry survey results. The in-situ removal volumes estimated from these two methods are as follows:

- Mass Balance: 30,100 cy
- Multibeam Bathymetry: 26,000 cy

These methods are described in greater detail in the following subsections.

3.2.2.1 Mass Balance Estimate

The mass balance estimate is based on the principal of dry mass conservation. Specifically, the dry mass of the solids in the in-situ material removed during hydraulic dredging equals the dry mass of the solids collected on the MPP. The dry mass of solids was calculated based on volume measurements of the collected solids and its wet bulk density and percent solids. For example, a volume estimate of the sand produced on the MPP for a given day was field measured. The sand volume was then converted to a wet mass by multiplying the volume by the wet bulk density of the sand. The wet mass of the sand was then converted to a dry mass by multiplying the wet mass by the percent solids in the sand. Similarly, the dry mass of solids in the filter cake and oversized debris were calculated daily based on field measurements of the volume of filter cake and oversized debris produced. The dry mass of all three materials (sand, filter cake, oversized debris) were then added together to represent the total dry mass of solids on the MPP. Since these solids were collected directly from the hydraulic dredge slurry pipeline, they also represent the dry mass of solids from the in-situ material in the river. The dry mass of in-situ solids was then converted to an in-situ volume removed, based on the density and percent solids for the in-situ material.

Assumptions

The conversion between volume and dry mass was based on densities for the in-situ material, sand, filter cake, and oversized debris, and percent solids for the in-situ material, sand, and oversized debris that were reported in the Operations Plan (Sevenson, May 2005). The values used for percent solids in the filter cake were those measured daily in the lab. To substantiate the constant values reported in the Operations Plan, density and percent solids measurements of field-collected sand and filter cake samples were taken. These field samples showed density and percent solids values within 10% of the values in the Operations Plan. The assumed constant density and percent solids of the oversized debris could not be verified with field data. Since the volume of oversized debris was small (roughly 15%) in comparison to the volume of sand and filter cake produced, a variation in the constant values for oversized debris would not be expected to impact the total dry mass estimate significantly. Finally, the density and percent solids values used for the in-situ material were based on a treatability study performed by Sevenson prior to dredging.

Correction Factors and Field Implementation

Prior to September 8, 2005, volume measurements of the sand, filter cake, and oversized debris stockpiles produced each day were taken by Sevenson. Since these estimates were shown to be significant overestimates of actual volumes produced, Sevenson's recorded volumes of sand, filter cake, and oversized debris produced prior to September 8, 2005 were corrected. Since the stockpile volumes for individual days prior to September 8, 2005 could not be directly measured and compared to Sevenson's estimates, correction factors were developed to modify the original estimates. These correction factors were based on the methods of estimating stockpile volumes.

Beginning on September 8, 2005, measurements of the dimensions (e.g., height, length and width) of the sand and oversized debris stockpiles produced each day were taken by the IQAT and Sevenson. Sevenson then estimated stockpile volumes by multiplying the three dimension measurements. The IQAT also estimated stockpile volumes from these data, but assumed the stockpile was of trapezoidal or conical shape for the volume calculation. Comparison of the Sevenson and IQAT volume estimates through September 16, 2005, indicated that the Sevenson estimates were roughly 2.75 times greater than the IQAT estimates for sand and 3.5 times greater for the oversized debris stockpile volume estimates. Consequently, Sevenson's reported volumes for sand and oversized debris produced for the days prior to September 8, 2005 were reduced by a factor of 2.75 (sand) and 3.5 (oversized debris).

Using the methods and assumptions described above, daily volumes of sand, filter cake, and oversized debris were used to calculate the volume of in-situ material removed by hydraulic dredging each day.

Geotube Contribution

Beginning September 12, 2005, a portion of the solids from hydraulic dredging were also collected in Geotubes located on the MPP. Similar to the methods described above, the dry mass of solids in the Geotubes was calculated and converted to a volume of in-situ material removed via hydraulic dredging. The dry mass of solids in the Geotubes was calculated based on the volume of water sent to the Geotubes each day, and an assumed constant percent solids of 1.5% in the slurry line to the Geotubes.

Mechanical Excavation and Debris Removal Contribution

The in-situ material removed during debris removal accounted for approximately 5% of the total volume removed during the ROPS. Since in-situ material collected during debris removal was not processed, the volume of material collected in the scows (as measured at the loading dock) was assumed to be equal to the volume of in-situ material removed during debris removal. As a result, daily estimates of the volume of in-situ material removed during debris removal were produced through estimates of material collected in the scows. The total volume of material was taken as the estimated volume from the manual sediment elevation measurements. This northern near shore removal volume estimate was then added to the estimates for the in-situ volume removed during debris removal and by hydraulic dredging.

Summary of Mass Balance Volume Estimates

Results from the mass balance method of estimating the volume of in-situ material removed showed that approximately 27,000 cy of material was removed by dredging (auger, cutterhead and clamshell) and 1,500 cy was removed during debris removal. Adding the estimate of 1,600 cy removed from the northern near shore results in a total of 30,100 cy of total in-situ material being removed during the ROPS.

3.2.2.2 Multibeam Surveys

Four multibeam surveys were conducted during the ROPS to obtain precise sediment elevations throughout the main channel area; September 12-13; September 30; October 22; and November 18, 2005 (data generated during each of these surveys are provided in Appendix O, while results of these surveys are discussed in Appendix A). The multibeam surveys generated sediment elevation measurements at a density of one measurement for every square foot of river bottom and, thus, provided robust data sets upon which accurate changes in sediment elevation and volumes of materials removed between surveys were determined with confidence. To this end, a comparison of pre- and post-dredging sediment elevations was performed to estimate the volume of sediment and debris removed during the ROPS. An assessment of the uncertainty/error associated with comparing multibeam bathymetry surveys was also performed; a discussion of this evaluation is provided below.

Assessment of Multibeam Survey Comparisons

Measurement uncertainty associated with elevation differences between multibeam surveys was assessed through the comparison of sediment elevation measurements for areas within the river that were surveyed but not directly impacted by the ROPS construction activities. This assessment was possible for two areas in the river: 1) an approximate 35-ft by 150-ft area at the downstream extent of Work Zone 2; and 2) an approximate 25- to 50-ft buffer zone along the channel-side perimeter of the armored cap area (Figure 3-4). The Work Zone 2 area was selected because ROPS-related construction activities were not performed in this region between the September 30, 2005 and November 18, 2005 multibeam surveys. Similarly, for the armored cap area, the multibeam surveys conducted on September 13, 2005 and October 22, 2005 included a portion of the river that was not targeted for construction. These areas allowed for the comparison of approximately 5,600 and 25,800 paired elevation measurements for the Work Zone 2 and armored cap areas, respectively.

Cumulative frequency distributions of the elevation differences for paired measurements in the Work Zone 2 and armored cap areas are presented in Figures 3-5 and 3-6, respectively. Sediment elevation differences in the unaffected portion of Work Zone 2 range from –0.25 to +0.25 ft, with an absolute mean elevation difference of 0.07 ft and a 95th percentile value of 0.18 ft (Figure 3-5). Greater variability is observed for the elevation differences for the armored cap area. In this region, the elevation differences range from –0.76 to +0.92 ft, with an absolute mean elevation difference of 0.10 ft and a 95th percentile value of 0.31 ft (Figure 3-6). The greater variability in the armored cap area is not unexpected, given that the ice jam-related scour and deposition that occurred in spring 2003 created an irregular topographic surface in this region (Alcoa, April 2004).

Overall, this assessment indicates that the comparison of multibeam surveys is an accurate way of estimating the depths and volumes of materials removed during the ROPS. The 95th percentile elevation differences provide an indication of the minimum difference that may be concluded to represent a real change beyond that which may result from measurement error. Thus, using the 95th percentile elevation difference from the armored cap as a conservative estimate of measurement error, elevation changes in excess of 0.31 ft are considered measurable changes.

Estimation of Sediment and Debris Removed from Main Channel Area

Estimation of the volume of sediment and debris removed from Work Zones 1 and 2 was accomplished through a comparison of sediment elevation changes between the June/July 2003 and September 30 and October 22, 2005 multibeam surveys (Figure 3-7). This comparison indicates that approximately 24,400 cy (21,000 to 27,800 cy considering measurement uncertainty of 0.31 ft, as described above) of sediment and debris were removed from the ROPS main channel; approximately 20,600 cy from Work Zone 1 and 3,800 cy from Work Zone 2. Addition of the 1,600 cy removed from the northern near shore area yields a total removal volume of 26,000 cy (22,600 to 29,400 cy) for the ROPS.

3.2.3 Sediment Volume Disposed During the ROPS

As noted in Section 2.3.5.2**,** two sets of measurements were taken after the sediment was processed and treated on the MPP:

- Truckloads hauled from the MPP to SLF Cell 3; and
- Waste volume surveyed after compaction in SLF Cell 3.

The discussion that follows is focused on the waste from the lower Grasse River which consists of:

- Mixed filter cake and sand;
- Filter cake;
- Cyclone-separated sand;
- Geotube sediment; and
- Grasse River debris.

All other materials did not originate with materials dredged or removed from the Grasse River.

Volume from Truckload Records

Materials were hauled from the MPP to Cell 3 using 15 cy capacity dump trucks. The contents and volume of each truckload were documented on a load ticket. The total volume of waste materials from the lower Grasse River, obtained by summing the volumes recorded on each load ticket, is about 25,000 cy. This quantity is estimated to be the volume placed in Cell 3 before compaction.

Volume from Field Survey

The volume of waste material compacted in SLF Cell 3 was obtained by calculating the volume between the surveyed top of drainage sand surface (under the waste) and the surveyed top of waste surface. The total waste volume obtained in this manner was compared to the total waste volume determined by summing the truckload records. The reduction in volume of all waste placed in Cell 3 due to compaction was 20.3%. Therefore the volume hauled to the landfill, as determined by truckload records, was adjusted downward by 20.3% to yield the compacted volume of each waste constituent. This calculation determined that the compacted volume of waste materials from the lower Grasse River in SLF Cell 3 is 19,900 cy.

Summary of Landfill-Based Volume Estimates

In summary, the land-based volume estimates of materials removed from the Grasse River and disposed in SLF Cell 3 are:

- Uncompacted volume based on truckload records - 25,000 cy; and
- Compacted volume based on survey in SLF Cell 3 - 19,900 cy.

3.2.4 Productivity

3.2.4.1 Debris Removal

Debris removal activities were required throughout much of the ROPS to facilitate the removal of sediment from the targeted dredge areas. Debris included timber pile, other woody debris, rocks, cobbles, boulders and miscellaneous trash such as tires (Figure 3-8). In June and July, approximately 445 cy of debris was removed from the main channel area (primarily Work Zone 1 and to a lesser extent Work Zone 2), at an average of about 26 cy of debris per day. In August, when the dredge operations started encountering difficulties along the river bottom, debris removal operations increased to an average of about 38 cy/day; a total of about 730 cy of debris were removed during this period. Debris removal activities shifted to the expanded Work Zone 1 area following the decision in late August to include this area in the scope of work that was targeted for completion prior to demobilization. About 200 cy of debris was removed from this area during the three days operations (September 9, 12 and 13) were conducted (at an average rate of 67 cy/day). Debris removal was then only conducted on three other days (October 10, 11 and 14). On these days, a total of about 120 cy of debris were removed. Overall, approximately 1,500 cy of debris were removed from the river, representing approximately 5.5% of the total volume of material (i.e., debris and sediment) removed during the ROPS. The average rate of debris removal for the ROPS was 38 cy/day.

3.2.4.2 Sediment Removal

Dredge productivity is defined as the volume of sediment removed from the river over a specific time period (i.e., per hour of dredge operations or per day) and is reported in cy/hr or cy/day. The solids mass balance described in Section 3.2.2.1 was used to provide daily estimates of the volume of sediment removed from the river. Effective dredge times (i.e., hours of dredge operations) were determined from daily dredge operator records. A discussion of the dredge productivity of the dredging activities over the course of the ROPS is discussed below.

3.2.4.2.1 Productivity of the Horizontal Auger

Over the first six to eight weeks of in-river activities, when the dredge was operating in the upper portions of the sediment column, sediment removal operations were conducted anywhere from 6 to 17 hours per day (Figure 3-9, top panel). The day-to-day fluctuations in dredge operations (i.e., dredge effective time) were the result of a combination of factors, including the time needed to move the dredge from one location to another, equipment downtime due to debris, dredge repair and maintenance, line plugging, full processing tanks, and inclement weather. Damage to the silt curtains due to pressure waves and high river flows also caused delays in the dredging operations. Factors affecting effective dredge times are discussed further in Section 3.2.4.2.2. On average, dredge operations (i.e., dredge effective time) occurred about 11 hours per day with an average effective dredge production rate of about 38 cy/hr (Figure 3-9, bottom panel) or 410 cy/day through July.

By mid-August, dredging had removed sediments down to what was believed to be hard bottom. However, follow-up sediment probing indicated that 6 to 12 inches of sediment remained in many areas of Work Zone 1. Sediment cores collected from Work Zone 1 in late August to study these sediments indicated that significant depths of PCB-containing sediment remained in some portions of the main channel area. In response to this finding, dredging efforts focused on removing these sediments and numerous dredge passes were made, both in upstream/downstream and across channel directions. This exhaustive effort, in combination with the dredging conducted prior to the encountering of hard bottom, entailed a total of 1,156 upstream/downstream and 244 across channel dredge passes in Work Zone 1 (Figures 3-10 and 3-11, respectively), corresponding, on average,

to over 100 dredge passes in each 25-ft by 25-ft sub-unit within the work zone. The horizontal auger had an 8 ft width and therefore complete coverage of the width of each sub-unit required roughly 4 dredge passes across when accounting for overlap between passes. These attempts to remove the remaining sediments from Work Zone 1 were inefficient as evidenced by declines in dredge effective time (from an average of 11 hours per day to about 5 hours per day; Figure 3-9, top panel) and effective production rates (from an average of 38 cy/hr to about 20 cy/hr; Figure 3-9, bottom panel). Average removal rates dropped from about 410 cy/day to about 135 cy/day through early September.

The intense focus on removing the remaining sediments in Work Zone 1 prompted a change to the ROPS approach in order to accomplish as many of the project objectives as possible given the time that remained in the construction season. Work Zone 1 was expanded downstream by about 75 ft; limited work was conducted in Work Zone 2, and Work Zone 3 was eliminated. The expansion of Work Zone 1 allowed for continued efforts to remove as much sediment as possible from select areas of Work Zone 1, along with providing a work area with a significant depth of sediments that had not been dredged to the same extent. In addition, two alternative dredging technologies (swinging ladder cutterhead dredge, mechanical clamshell) were used towards the end of the construction season to assess the ability of these methods at removing the remaining sediments (Section 3.2.4.2.3). A Geotube study was initiated to evaluate an alternative means for handling and processing the additional water drawn from the river during times when productivity was low (Section 2.3.3.4).

The average dredge productivity for the horizontal auger during the ROPS program was estimated at 30 cy/hr when the dredge was operating, with an overall average daily dredging rate of about 330 cy/day. The average effective dredge time for the period July 1 through October 21, 2005 averaged about 9 hours per work day (or 37.5% when expressed as a daily percentage). Note that dredge down times recorded on the operator logs prior to July 1, 2005 were not broken down by specific cause prior to July 1, 2005 and, thus, were not used in the estimation of the overall average effective dredge time.

3.2.4.2.2 Factors Affecting Horizontal Auger Productivity and Dredging Effectiveness

Several difficulties experienced during the repeated dredging attempts contributed to the decline in productivity and the inability to remove all of the targeted sediments from Work Zone 1. Some of these difficulties included: 1) down time due to operational difficulties; 2) impacts associated with irregular hard bottom conditions and repeated attempts to remove remaining sediments; and 3) maintenance and repair of damage to the silt curtains caused by pressure waves and high river flows. Several adjustments were made over the course of the ROPS to address and overcome these obstacles, with the ultimate goal of removing as much sediment from the river as possible. This included ceasing further work in Work Zone 2 despite the fact that a larger volume of sediments could be removed from this area in the time remaining on the project (due to the thicker sediment deposits in this area relative to Work Zone 1) and acknowledging that Work Zone 2 would need to be capped at the conclusion of the work despite the fact that a significant volume of PCB-containing material remained in this area.

Down Time Due to Operational Issues

Operational factors such as the time needed to move the dredge from one location to another, clogged dredge lines, full processing tanks, and shift changes affected productivity rates during the ROPS. About 29% of the dredge down time was attributed to these operational issues. Several adjustments were made throughout the ROPS to address each of these individual factors. Examples include:

- use of diatomaceous earth as a filler to help prevent blinding of the filter presses;
- extensive work on optimization of the polymer addition system for the filter presses;

- engagement of a filter press expert;
- repositioning of the dredge cut alignment (from north/south to east/west) in an attempt to access hard to reach sediments and, thus, increase solids feed to the treatment system;
- modification of the dredge forward speed and auger rotation rate in an attempt to capture more solids at the auger head;
- mobilization of alternative dredging technologies (i.e., swinging ladder cutterhead dredge and mechanical clamshell) in an attempt to remove remaining sediments; and
- initiation of the Geotube pilot study to handle additional water drawn during times of low productivity.

These adjustments had little impact on productivity rates, although some improvement was noted.

Impacts of Bottom Conditions on Dredging Effectiveness

About 14% of the dredge down time was attributed to the presence of debris and damage to dredge equipment. Even after considerable efforts to remove debris from the river by first a perforate clamshell and then a mechanical rake in advance of the dredge, the auger dredge head was frequently damaged by unidentified debris and what the dredge operators described as hard bottom and/or rock (Figure 3-12). Several actions were undertaken to understand the river bottom conditions in the ROPS main channel area, including:

- conduct of a multibeam survey to document the river bottom topography;
- conduct of a remote sensing survey to understand the sub-bottom stratigraphy;
- initiation of diver surveys to observe river bottom conditions;
- installation of a video camera on the dredge head to document river bottom conditions; and
- mobilization of mechanical clamshell and swinging ladder cutterhead dredge to the site for use in focused removal efforts.

A multibeam bathymetry survey was conducted within the work zone on September 12-13, 2005 to document the topography of the river bottom and, if possible, understand the cause of both the difficulties in removing the targeted sediments and the associated equipment damage. The results of this initial survey showed ridge-like features throughout the main channel ROPS area (Figures 3-13 and 3-14), which contributed to the inability to remove sediments from some areas of the work zone. Underwater diver video of these features confirmed they were comprised of large rocks and boulders (Appendix J).

In addition to the major rock projections observed on the multibeam survey, a significant number of lesser topographic features are evident. These features could represent an uneven bedrock surface, an uneven hard glacial till surface, rocks/boulders that are embedded in the native stratigraphy, or some combination of all of these features. In an attempt to develop additional information related to these sub-bottom characteristics, sub-bottom profiling work was conducted in Work Zone 1 in conjunction with the October 22, 2005 multibeam bathymetry survey.

Efforts to map the sub-surface stratigraphy of river sediments were previously attempted in 2003 as part of the ice jam investigation, however, electromagnetic (i.e., ground penetrating radar [GPR]) and acoustic technologies were deemed ineffective due to variable sub-surface conditions, the presence of gas in the near-surface sediments, and the presence of coarse compact glacial till sediments (Alcoa, April 2004). Some of the factors that contributed to the difficulty in characterizing the sub-bottom conditions in 2003 were potentially minimized and/or eliminated during the sediment removal activities (i.e., considerable amounts of coarser sediments and any associated gas in those sediments had been removed from the river). For this reason, an attempt to characterize sub-bottom conditions was made using a dual frequency (acoustic) depth sounder. GPR was deemed unsuitable due to the deeper water depths within the work zone and, thus, was not employed during the study. The dual frequency depth sounding equipment received reflections from the high frequency (200

kiloHertz [kHz]) signal that provided information pertaining to the depths/elevations of the sediment surface at each of the surveyed transects. However, the low frequency (24 kHz) signal was unable to penetrate into the sediments and, thus, this technology was not able to provide any useful information pertaining to the sub-bottom conditions within the work zones.

Maintenance of the Silt Curtains

The silt curtain containment system required continual attention throughout conduct of the in-river activities due to damage resulting from the effects of pressure waves[1] in the lower Grasse River, severe weather, high river flows, and direct impacts by work boats and dredges. Typical curtain damage included ripped seams, broken anchor lines, damaged floats, tears in the skirt, and general misalignment. More severe damage such as metal joint failure, broken cables, extensive curtain failure, spud barge movement, and lost anchors was noted during high flow events or intense local storms. Daily inspections and repairs of any noted damage to the silt curtains was performed throughout the ROPS. About 20% of the down time recorded between July 1 and October 15, 2005 was attributed to these maintenance activities.

In addition to the daily inspections and repairs, several other adjustments were made to the containment systems in an attempt to increase the durability/reliability of the silt curtains and reduce the down time associated with weather-related impacts to the system. Such activities included: 1) conduct of a velocity study in and around the containment system to understand flow distribution in the vicinity of the work zone; 2) replacement of damaged curtains; 3) conduct of strength testing on the silt curtains; 4) design and installation of higher strength curtains in areas of repeated damage; 5) placement of additional anchoring at the downstream perimeter of the containment system; and 6) re-positioning of spud barges. These adjustments helped to reduce, but not eliminate, dredge down time.

3.2.4.2.3 Productivity of Alternative Dredging Technologies

The last two weeks of dredging activities focused on assessing the ability of alternative dredging technologies to remove the remaining sediments from Work Zone 1. This evaluation consisted of the application of a swinging ladder cutterhead dredge and mechanical clamshell to various areas within Work Zone 1. The swinging ladder cutterhead dredge was applied to three areas within the central and northern portions of Expanded Work Zone 1 that contained sediment that had been dredged multiple times by the horizontal auger and one area at the downstream extent of Expanded Work Zone 1 that contained thicker deposits of PCB-containing sediments (Figure 2-14). During removal of the sediments that had been dredged by the horizontal auger (on October 14, 15, 18 and 21, 2005), the cutterhead dredge operated at an effective productivity rate of about 11 cy/hr. The effective productivity was higher (about 17 cy/hr) when the thicker sediments at the downstream extent of Expanded Work Zone 1 were being removed. Overall, the effective productivity rate of the cutterhead dredge averaged 14 cy/hr.

[1] Pressure waves in the Grasse River are the result of water releases from the Snell Lock, located in the St. Lawrence River immediately upstream of its confluence with the Grasse River. The release of water from the Snell Lock causes a temporary increase in water elevation in the St. Lawrence system, inducing a wave that propagates up the Grasse River. The wave causes a temporary increase in the water levels and flow reversal (i.e., upstream currents). The wave is generally observed in the upper portion of the lower Grasse River (i.e., in the vicinity of the Alcoa facility) about 20 to 30 minutes after water is discharged from the lock, and persists upstream for about 5 minutes before reflecting off of upstream obstructions and returning as a lesser wave back downstream. This process is repeated 8 to 10 times daily, depending on the water release schedule for the lock. This phenomenon was first documented during the 2001 CPS, when silt curtains were dislodged and damaged during the occurrence of these pressure waves (Alcoa, April 2002).

The overall effective productivity rate of the swinging ladder cutterhead dredge of 14 cy/hr is slightly lower than the 16 cy/hr achieved by the horizontal auger during the two weeks prior to bringing the cutterhead dredge on site. The cutterhead dredge used spuds to control position of dredging, and was able to dredge an approximate 20 ft width within 2.5 ft of the identified dredge cut line. This was more precise than the auger head dredge on cables. Average dredge positioning at the end of the ROPS for the auger head dredge was plus or minus 10 ft. The cut width was 8 ft, equal to the auger head width. This variation in the horizontal dredge positioning between the two types of hydraulic dredges was likely due to the impact of site bottom conditions on the positioning system for the horizontal auger. The auger head is a rotating auger that pulls the sediment toward the middle of the 8 ft cutterhead. The dredge moves in a straight path along the bed, using cables anchored on the cut line. In soft sediment the auger head dredge operates as designed, and the operator can control the auger head dredge position with acceptable accuracy by using electronic positioning. When the auger head moved into the denser sediment and encountered obstructions on the river bed, the dredge was moved off of the original cut line. Efforts were made to compensate for this by conducting repeated passes through the dredge area, repositioning the dredge to run perpendicular to river flow, and altering the forward speed and auger rotation rate.

This same problem exists with the basket cutter on the swinging ladder dredge. The basket cutter, however, swings the ladder and cutterhead across the dredge cut. The cutterhead also rotates within the approximate 3 ft diameter of the cutter as compared to the 8 ft wide auger head. The anchoring of the swinging ladder is with two spuds anchored on the bed as compared to the cable on the auger dredge. This combination of cutterhead operation and spud anchoring allowed an improved range of horizontal positioning for the cutterhead, but the accuracy and control of positioning by both dredge types was impacted by the hard bottom conditions that exist on the river. The similar productivity rates, however, suggest that both dredge technologies were comparable on a dredge production basis at removing the remaining in-situ sediments.

The mechanical clamshell was employed at four discrete locations within Work Zone 1 (grid nodes 179, 183, 381 and 418) where significant thicknesses of PCB-containing sediments remained after numerous dredge passes through these areas. Approximately 15 to 30 cy of material was removed from each of these locations during these efforts. In most instances, the clamshell was only partially-full upon retrieval from the river bottom and several dredging attempts were required at each location before the 15 to 30 cy removal volume was attained.

3.2.5 Release of Solids and PCBs During Removal Activities

Water column monitoring associated with debris removal and dredging activities began on June 8, 2005 and continued daily (when these activities were occurring) through October 21, 2005 to assess short-term effects of debris removal/dredging on the water column. Monitoring included the collection of water column samples and measurement of water quality parameters at several local (near-field; D1, D2, D3 and D4) locations situated immediately adjacent to the containment system and at far-field transects located upstream (ROPS-WCT5) and downstream (ROPS-WCT14 and ROPS-WC131) of the work zone (Figure 3-15). In total, over 800 water column samples were collected and analyzed for PCBs and TSS. These data were then used to evaluate releases to the water column during debris and sediment removal activities.

Far-field transect ROPS-WCT14 was located about 2,000 ft downstream of the ROPS main channel dredging area and about 3,200 ft downstream of Work Zone 1. ROPS-WC131 was located about 4,200 ft downstream of ROPS-WCT14. The time of travel from the downstream boundary of Work Zone 1 to ROPS-WCT14 and ROPS-WC131 are about 0.5 days and 1 day, respectively, at a river flow of about 500 cfs (and are inversely proportional to flow). Thus, solids and PCB levels measured at these stations typically reflect releases that were about 0.5 days apart. The correspondence of the solids and PCB data at these stations likely reflects the

extensive longitudinal dispersion expected as releases migrated over the 0.5 day to 1 day travel time. However, the varying travel times (due to varying flow conditions) from Work Zone 1 to these far-field stations complicate the interpretation of releases to the water column that are attributable to specific construction activities within the work zone.

3.2.5.1 Releases of Solids and PCBs to the Water Column

Elevated PCB concentrations were measured adjacent to and downstream of the silt containment system throughout sediment and debris removal operations. PCB levels measured at the local monitoring stations in the bypass channel adjacent to the work zone (D1, D2 and D3) were, on average, 2 to 23 times higher than those measured upstream, indicating PCBs were released into the bypass channel during debris and sediment removal activities (Figure 3-16, top panel). The highest PCB levels were consistently observed immediately downstream of the containment system (at D4), where levels were, on average, about 50 times higher than those measured upstream of the work zone (at ROPS-WCT5). The maximum PCB concentration measured at D4 was 9.229 µg/L (July 21, 2005). PCB levels measured at locations further downstream (ROPS-WCT14 and ROPS-WC131) were lower than those at D4, but still substantially elevated relative to those observed in the river during prior years (Alcoa, April 2004; Alcoa, April 2005b). Water column data collected to identify the nature of the PCBs escaping the containment system (i.e., dissolved vs. particulate) indicated that a large fraction (i.e., 66 to 89%) of the PCBs measured outside of the containment system were in the dissolved form (Section 3.2.5.1.2).

PCB levels exceeded the 2 µg/L action level at both ROPS-WCT14 and ROPS-WC131 for the first time on July 8, 2005 (Figure 3-17, middle and bottom panels). The action level was again exceeded on July 19, 2005, and levels remained above the action level for four consecutive days (through July 22, 2005). In an effort to reduce PCB levels at the downstream stations, a number of modifications were made to the debris removal process, which, based on visual observations of sediment release, appeared to be at least partially responsible for the exceedances. The debris removal equipment and debris removal operations were modified (Section 2.3.2.3.2), and debris removal activities were restricted to 6 hours of operation per day beginning on July 21, 2005. In addition, velocity and water column PCB data were collected from the ROPS area to understand water and PCB exchange between the work zone and adjacent areas. Results of the velocity study (see Appendix P) indicated that about 20 to 40% of the flow entering the river from upstream traveled through the containment system; the remaining portion of the flow traveled through the bypass channel. Of the flow moving through the work zone, most exited through the containment system in Work Zone 3. Some exchange between Work Zones 1 and 2 and the bypass channel was observed, although this exchange was small relative to that exiting the work area through Work Zone 3. The velocity study also indicated that complex circulation patterns, including the formation of back eddies near D4, were generated by the configuration of the containment system and the effects of pressure waves moving through the study area.

From July 22, 2005 through the completion of the construction activities, PCB concentrations at the downstream stations (i.e., ROPS-WCT14 and ROPS-WC131) remained elevated but below the 2 µg/L action level except for three days; July 26, August 25, and September 10, 2005. In total, PCB concentrations measured during the ROPS exceeded the 2 µg/L action level (applicable to downstream stations ROPS-WCT14 and ROPS-WC131) on 8 of the 88 days of debris and sediment removal activities. The PCB concentrations resulting from the ROPS activities depended in part on the extent of dilution provided by the river flow. During most of July, flows were much higher than the 400 to 500 cfs typical for this month, thus providing greater dilution and perhaps a lower frequency of action level exceedances that might have occurred in a more typical flow year (Figure 3-18). Elevated flows were also experienced in mid-June and most of September, October and November.

TSS and turbidity levels exhibited trends similar to those observed in the PCB measurements, although the increased levels observed at the downstream locations were less pronounced than those of PCBs (Figure 3-16, middle and bottom panels). The TSS and turbidity action levels (25 mg/L and 25 NTU over background) were not exceeded at the downstream stations during debris and sediment removal activities.

3.2.5.1.1 Fractional PCB Loss Downstream

Time series of PCB fluxes at the two downstream monitoring locations, ROPS-WCT14 and ROPS-WC131, are presented in Figure 3-19. The PCB fluxes at these locations are variable, but exhibit the same temporal patterns and are relatively similar in magnitude, suggesting the fluxes at these locations are reliable indicators of the PCB mass released during the dredging and debris removal efforts. PCB fluxes could not be calculated for the location immediately downstream of the containment system, given the lack of flow data and the existence of back eddies in the vicinity of this location. The PCB mass lost downstream during removal activities was computed from the daily PCB measurements at ROPS-WCT14 and flow records from the United States Geological Survey (USGS) flow gage at Chase Mills; ROPS-WCT14 was selected for this calculation because it is more representative of the PCBs released during removal activities given its proximity to the work zones relative to ROPS-WC131. The PCB flux estimates computed from these data indicate that about 102 kilograms (kg) of PCBs were released and transported downstream during the ROPS debris and sediment removal activities. The data at ROPS-WC131 yield a similar result (i.e., 92 kg), supporting the reasonableness of the mass estimate.

A mass balance was performed using data collected during the ROPS to understand the magnitude of the PCBs released downstream relative to the mass of PCB removed from the river. The mass balance consists of four components: 1) initial PCB mass in the ROPS area; 2) PCB mass that escaped the containment system and was transported downstream; 3) PCB mass lost to the atmosphere via volatilization; and 4) PCB mass remaining in the river after dredging. The difference between the initial PCB mass (i.e., ROPS target PCB mass) and the other three components represent the PCB mass removed during the program. This analysis does not track PCB mass through the water/sediment treatment process, but based on data collected during the ROPS, the PCB mass in the wastewater treatment effluent that was discharged back to the river is negligible.

Initial PCB Mass in the ROPS Work Area

The PCB mass in sediments from Work Zones 1 and 2 prior to the initiation of the ROPS construction activities was computed using the 29 sediment cores collected from the ROPS main channel area during the 2003 Phase II, January 2004, and 2004 ROPS baseline sediment surveys (Alcoa, April 2004; Alcoa, April 2005b). PCB mass was estimated as follows: 1) the PCB mass-per-unit-area was computed for each sediment core; 2) Thiessen polygons were drawn around each sediment core to establish the areal extent that each core was assumed to represent; 3) the Thiessen polygons were trimmed to the extent of Work Zones 1 and 2; 4) the mass-per-unit-area for each core was multiplied by the surface area of its respective polygon to estimate the PCB mass residing within that polygon/area; and 5) the 29 PCB mass estimates were summed to obtain a total PCB mass in the ROPS area. This calculation yielded a total PCB mass estimate of about 5,000 kg (3,300 kg in Work Zone 1 and 1,700 kg in Work Zone 2). It should be noted that this estimate may be low because most of the baseline cores did not capture the full depth of PCB-containing sediment in all areas (as described in Section 3.2.1). The degree of underestimation due to this factor is not expected to be substantial because most of the cores included a sufficient depth of sediment to encompass the peak PCB concentration, which is known to exist near the bottom of the column of PCB-containing sediments.

A similar approach was used to estimate the target PCB mass in the northern near shore area. For each of the eight sediment cores collected during the 2004 baseline survey, the PCB mass-per-unit-area (based on the

targeted top 12 inches of sediment and PCBs) was computed and multiplied by the surface area of the Thiessen polygon drawn around each core. Summing the eight individual PCB mass estimates yielded a total PCB mass of about 15 kg.

PCB Mass Lost to the Atmosphere

The calculation of the PCB mass lost to the atmosphere is described in Section 3.2.5.2. Results of this calculation indicate that 1.0 to 1.2 kg of PCBs were lost to the atmosphere during the removal activities. These results are qualitatively consistent with the PCB measurements in air samples collected during the ROPS, which were consistently well below the action level for PCBs in air.

PCB Mass Remaining After Dredging

The PCB mass in sediments remaining in Work Zones 1 and 2 after dredging was computed using 46 sediment cores collected during the September 30, October 10-12, and October 21-24, 2005 sampling events. The September 30, 2005 sampling event consisted of the collection of 13 sediment cores from Work Zone 2. Since dredging activities were not conducted in Work Zone 2 after this sampling event, these data were used to define post-dredging conditions for this area. Five cores from the October 10-12 survey were used in conjunction with the 28 cores collected on October 21-24 to define post-dredging PCB conditions in Work Zone 1. The five cores from the October 10-12, 2005 survey were used because dredging activities were not conducted in the areas from which these cores were collected after the sampling event occurred. For each of the 46 sediment cores, the PCB inventory (based on DoC) was determined from the PCB concentration data and the surface area of the Thiessen polygon drawn around each core. Summing the individual PCB mass estimates yielded a total remaining PCB mass of about 1,700 kg (500 kg for Work Zone 1 and 1,200 kg for Work Zone 2).

Fractional Loss Downstream

Based on the PCB mass balance conducted for the in-river activities, approximately 3,300 kg of PCBs were removed during the ROPS (initial mass – mass lost to atmosphere – mass remaining). Of the 3,300 kg of PCBs removed from the river during debris and sediment removal activities, 102 kg (3%) were released downstream.

3.2.5.1.2 Nature of the PCB Releases

As described in Section 3.2.5.1, water column data were collected on June 17, June 20 and June 22, 2005 to examine the extent to which dissolved and/or particulate-associated PCBs were escaping the containment system and causing the elevated PCB measurements at D4 and the downstream transects. During these three surveys, filtered and unfiltered water samples were collected at the local stations adjacent to the containment system (D1 and D2) and at the downstream local locations/transects (D4, ROPS-WCT14 and ROPS-WC131). In addition, on June 22, 2005, filtered and unfiltered water samples were collected from within the containment system. The results of the June 17 and June 22, 2005 surveys are discussed below; PCB levels measured on June 20, 2005 were below the detection limit at all locations due to relatively high flows (1,050 cfs) and the fact that work was not conducted over the weekend (June 20, 2005 was a Monday) and, thus, could not be used to assess the nature of the PCB releases from the containment system.

Filtered water column samples collected inside[2] (D5 and D7) and immediately outside (D4) of the containment system on June 22, 2005 contained similar dissolved PCB concentrations, suggesting that the silt curtains did

[2] The sample collected at D6 on June 22, 2005 was not included in this comparisons since the measured dissolved PCB, particulate PCB and TSS levels, as well as the relationships between parameters, were much different than those for other samples collected on this day. The reason why this sample differed from the others collected on this day is not known.

not inhibit downstream transport of dissolved PCBs. Dissolved PCBs accounted for 49 to 59% (D5 and D7) and 66% (D4) of the total PCBs during this sampling. The dissolved PCB fraction of 72% measured at D4 on June 17, 2005 is consistent with that from June 22, 2005 (66%). At the downstream transects (ROPS-WCT14 and ROPS-WC131), dissolved PCBs comprised about 69 to 89% of the total PCBs. The dissolved phase PCBs were primarily quantified as Aroclor 1221.

TSS and the volumetric concentration of particulate phase PCBs (i.e., µg/L) measured immediately downstream of the containment system (at D4) on June 22, 2005 were about two-fold lower than those measured inside of the containment system (D5 and D7). The consistent decline in both TSS and particulate phase PCBs suggest that on this date the silt curtains retained about 50% of the solids generated within the system. A 50% solids retention should be viewed as an upper-bound estimate for the trapping efficiency of the silt curtains on this date, since: 1) the fine sand fraction of the solids that escaped the containment system likely was not represented in the water column measurements; and 2) the back eddies in the vicinity of D4 likely diluted solids to some extent in the vicinity of this location with water exiting the bypass channel. The visual difference in water quality inside and outside of the containment system suggests that, when functioning as designed, the system was capable of retaining a significant fraction of the sediments resuspended by the dredging and debris removal operations. When the silt curtains were in place and in good working order, the water on the outside perimeter of the silt curtain appeared to the IQAT to be of similar clarity as water upstream of the ROPS area and in the bypass channel, whereas the water inside the silt curtains was more turbid, particularly during debris removal operations.

The paired filtered (i.e., dissolved PCBs) and unfiltered (i.e., sum of dissolved and particulate phase PCBs) PCB measurements were used to compute PCB partition coefficients. Partition coefficients are a measure of sorptive behavior and are computed as the ratio of particulate phase PCBs (milligrams per kilogram [mg/kg]) to dissolved phase PCBs (mg/L). Except for one anomalous value (D6, June 22, 2005), the partition coefficients are similar across all locations; an average partition coefficient of 90,300 liters per kilogram (L/kg) was estimated from these data (excluding the outlier from June 22, 2005). This partition coefficient was used, along with unfiltered PCB and TSS results, to estimate particulate phase PCB concentrations at D4 for days when only unfiltered PCB samples were collected. These particulate phase PCB estimates at D4 are compared to measured PCB concentrations of the filter cake, which are representative of the PCB concentration on the dredged sediments, in Figure 3-20. The correlation between particulate phase PCBs immediately downstream of the containment system and particulate PCB concentrations on the dredged material suggests that sediments resuspended by the dredge are a contributing source of the water column PCBs observed outside of the containment system.

3.2.5.1.3 Relationship to Equipment Used

Sediment Removal vs. Debris Removal

An evaluation was performed to understand the extent to which sediment removal and debris removal activities were responsible for the elevated PCB concentrations that were observed at the downstream monitoring locations during the ROPS. This evaluation consisted of comparisons of: 1) time series of PCB fluxes at ROPS-WCT14, which represent the PCBs lost during the ROPS, and filter cake PCB concentrations, which provide an indication of the PCB concentration of the sediments removed during dredging; and 2) the average PCB flux at ROPS-WCT14 during times of sediment and debris removal activities with those during times when debris removal activities were not being performed.

Time series of PCB flux at ROPS-WCT14 and filter cake PCB concentrations are compared in Figure 3-21. A general correlation is observed in the PCB flux and filter cake PCB data; higher PCB fluxes at ROPS-WCT14

generally coincide with higher filter cake PCB concentration, while lower PCB fluxes generally coincide with lower filter cake PCB concentrations. For example, PCB fluxes at ROPS-WCT14 and filter cake PCB concentrations from August 1-26, 2005 are consistently lower than those measured before and after this timeframe (Figure 3-21, shaded area). This correlation is more clearly evident in Figure 3-22, where average PCB fluxes and filter cake PCBs for each time period (i.e., prior to August 1, August 1-26, and after August 26) are compared. The average PCB flux at ROPS-WCT14 during times when debris and sediment removal were being performed compared to time periods when only sediment removal was being conducted indicates that, on average, downstream PCB fluxes were about 20% greater during combined debris removal and sediment removal operations (Figure 3-23).

The comparison between PCB flux downstream of the ROPS area and filter cake PCB concentrations , in conjunction with the comparison between particulate PCB concentrations at D4 and filter cake PCBs concentrations (Figure 3-20), indicates a correlation between dredging operations and downstream PCB releases. The evaluation of PCB fluxes during periods of concurrent sediment and debris removal activities versus sediment removal activities alone suggests that debris removal was a contributing factor, but that a significant portion of the PCB flux was associated with the operation of the hydraulic auger dredge. This analysis is complicated by the lack of information on the depth of sediment encountered during debris removal activities, and the PCB concentration of the sediments affected by the debris removal activities.

Horizontal Auger vs. Cutterhead Dredge

A horizontal auger was used for sediment removal during most of the ROPS; a mechanical clamshell and a swinging ladder cutterhead dredge were tested during the last two weeks of the active dredging. Coincidentally during the last two weeks of testing, when the cutterhead dredge was in operation, water column PCB levels at the downstream locations (ROPS-WCT14 and ROPS-WC131) were substantially lower than those over the prior few weeks. This, coupled with the fact that the average dredging rates for the horizontal auger/mechanical clamshell (October 4-11, 2005) and the cutterhead dredge (October 12-21, 2005) were similar (15 cy/hr and 14 cy/hr, respectively) suggested that fewer PCBs were released during sediment removal with the cutterhead dredge than with the horizontal auger. The calculated PCB fluxes support this conclusion; the PCB flux during the cutterhead operation was about four to fives times lower than that produced during the last two weeks of horizontal auger operation. However, review of additional site data indicates the decline in water column PCBs was the result of a combination of several factors, including: flow dilution; lower PCB concentrations in the sediments being dredged by the cutterhead; and seasonal changes in water column PCBs throughout the river. Each of these factors is discussed below.

A review of flow records for the Grasse River gage at Chase Mills indicated that flows during the period when the cutterhead dredge was being used (i.e., October 12-21, 2005) averaged about 4,000 cfs. This average flow is about 2.3 times higher than the average flow (1,750 cfs) for the first 11 days of October (i.e., October 1-11, 2005) when the horizontal auger/mechanical clamshell was in use. Assuming a constant PCB source, an increase in flow during this period would reduce (through dilution) PCB concentrations in the water column by more than a factor of two. For this reason, some, but not all, of the observed decline in water column PCBs during the last three weeks of ROPS dredging activities can be attributed to flow dilution.

Sediment vibracore data collected from expanded Work Zone 1 from October 10-12, 2005 were used to define PCB levels in the sediments targeted by the cutterhead dredge. Based on the 10 cores collected from areas where the cutterhead dredge was ultimately applied, the average PCB concentration in the sediments removed by the cutterhead dredge was estimated at 55 ppm. This is about 3.3 times lower than the average PCB concentration of sediments removed by the horizontal auger/mechanical clamshell during early October (about 185 ppm, based on PCB levels in eight cores collected in August and September). The average dredging rates for the horizontal auger/mechanical clamshell (October 4-11, 2005) and the cutterhead dredge (October 12-21,

2005) were similar (15 cy/hr and 14 cy/hr, respectively), suggesting that the 3.3-fold difference in PCB concentration in the sediments removed via the cutterhead dredge also contributed, in part, to the decline in water column PCBs. Filter cake PCB concentrations measured during this timeframe are qualitatively consistent with the estimates from the vibracores; PCB levels in the filter cake samples during use of the horizontal auger in early October averaged about 104 ppm while those from the last 12 days of dredging with the cutterhead dredge averaged about 57 ppm.

Baseline water column PCBs decline in late September/early October (Alcoa, April 2004; Alcoa, April 2005b). Review of data measured at water column transect WC-007 (river mile 5.3, in the vicinity of the ROPS armored capping area) over the past several years indicates that PCB levels decline by 8 to 69 nanograms per liter (ng/L) during October (Alcoa, April 2004; Alcoa, April 2005b). Therefore, the seasonal change in water column PCBs that typically occurs in the river likely contributed to the decline in PCBs observed in early to mid-October. However, given the order of magnitude of the historic PCB levels (relative to those experienced during the ROPS), this contribution was likely small.

Comparisons of the average PCB and TSS fluxes at the downstream monitoring location (ROPS-WCT14) made for periods when the horizontal auger and cutterhead dredges were operated at similar rates (i.e., less than 14 cy/hr) indicates that the horizontal auger released more PCBs but less TSS than the cutterhead dredge (Figure 3-24). Examination of the filter cake PCB concentrations measured during these periods indicates that the higher PCB fluxes at ROPS-WCT14 were attributable to the higher PCB concentrations of the sediments being dredged by the auger (relative to the cutterhead dredge; Figure 3-24). The higher TSS fluxes associated with the cutterhead operation indicates greater resuspension, implying that, all other things being equal, the cutterhead dredge would cause greater downstream PCB transport than the horizontal auger.

3.2.5.1.4 Impacts of PCB Releases on Fish Tissue PCB Levels

PCB levels measured in three resident fish species between August 29 and September 24, 2005 exhibit a similar spatial trend; average lipid-normalized PCBs are highest immediately downstream of the ROPS (i.e., Upper Stretch) area and decline with distance downstream (Figure 3-25). This spatial trend is consistent with increased exposure to PCBs that were released during the ROPS sediment and debris removal activities. The increases in fish tissue PCBs that occurred as a result of the ROPS in 2005 are more evident when compared to historic levels (Figures 3-26 through 3-28). Average lipid-normalized PCB levels in smallmouth bass and brown bullhead in 2005 are 2 to 4 times higher than those measured in 2004, and consistently higher than those measured over the past several years (Figures 3-26 and 3-27). Slightly higher increases in average lipid-normalized PCBs are observed in young-of-year (YOY) spottail shiner near Outfall 001 and the Unnamed Tributary, where 2005 levels are 5 to 6 times higher than those measured in 2003 and 2004 (Figure 3-28). The most dramatic increase in PCB concentration is for YOY spottail shiner at the River Mouth. At this location, the average lipid-normalized PCB concentration in 2005 is 25 times higher than that from 2004. The 2005 PCB levels measured in YOY spottail shiner are the highest on record[3]. The greater increase in the YOY spottial shiner (relative to adult smallmouth bass and brown bullhead) is not unexpected; small fish respond much more quickly to changes in exposure than large fish.

The fish PCB data for 2005 are unique in that increases relative to recent years occur for all species and all locations. Natural variability is substantial and the historical record includes other examples of year-to-year

[3] Prior to 2001, YOY spottail shiners were not specifically targeted for collection; collections consisted of both adult and YOY spottail shiners. Figure 3-28 includes composite samples of fish with a maximum length of 65 mm, the current monitoring program's criterion for distinguishing between YOY and adult spottail shiners. Also, in 2001, two groups of spottail shiners were encountered in the field; one group consisted of spottail shiners spawned in the spring and the other contained spottail shiners spawned in the late summer/fall. For proper comparison, only the results for the YOY spottail shiners spawned in the fall were considered.

increases, but no other examples in which increases occurred in all cases. The presumed ROPS-related increases can be given context by comparison to the changes in fish PCB concentrations following the 1995 dredging in the vicinity of Alcoa's Outfall 001, which removed about 2,600 cy of sediment that contained some of the highest PCB concentrations measured in the river. The fish sampled in 1995 about 1 to 2 months after the dredging was completed had PCB levels similar to those measured the year before; most were slightly lower, a few were slightly higher. The much shorter duration of the NTCRA field activities may account for this difference.

Between 1995 and 2004, PCB levels have exhibited a downward trend. In fact, in several instances, the PCBs measured in 2004 were the lowest on record (Alcoa, April 2005c). This historic decline was not interrupted by the 2003 ice jam scour event, which moved considerable sediment from an area of the river comparable in size to Work Zone 1; the fish sampled in 2003 about 5 months after the ice jam scour had PCB levels similar to those measured the year before. The increases in 2005 associated with ROPS-related PCB releases provide the only clearly identifiable interruption to this historic downward trend.

3.2.5.2 Releases to the Atmosphere

Air Monitoring Results

Results of over 100 air samples collected during the ROPS indicate that the in-river activities did not have an adverse affect on air quality. All PCB results were below the prescribed action level of 0.1 $\mu g/m^3$. PM_{10}, VOCs and PAHs, which were also monitored during the study, were also below their respective action level criteria in most instances. Follow-up investigations for measurements that exceeded the action level criterion for a particular compound indicated that the cause of the elevated readings was not project related. No corrective actions were necessary during the ROPS.

Calculated PCB Loss to the Atmosphere

As part of the mass balance calculation performed for the ROPS, PCB mass fluxes to the atmosphere (i.e., transported across the air-water interface) were computed on a daily basis and summed over the duration of the dredging activities (June 8 to October 21, 2005) to yield a total PCB mass lost via this mechanism during the ROPS. The daily PCB mass fluxes were computed for two areas: within the containment system and between the containment system and ROPS-WCT14, using the following equations:

$$S_v = k_L A \left(C_{diss} - \frac{C_{air}}{H_e} \right) \qquad (3\text{-}1)$$

where:

S_v = volatilization flux ($M\ T^{-1}$)
k_L = PCB air-water mass transfer coefficient ($L\ T^{-1}$)
A = surface area of river (L)
C_{diss} = dissolved PCB concentration in the water column ($M\ L^{-3}$)
C_{air} = PCB concentration in the atmosphere ($M\ L^{-3}$)
H_e = Henry's constant (dimensionless)

The air-water mass transfer coefficient (k_L) was estimated using Equation 3-2:

$$k_L = \frac{k_l k_g}{k_l + k_g H_e} \qquad (3\text{-}2)$$

where:

k_l = liquid phase mass transfer coefficient (L T^{-1})
k_g = vapor (gaseous) phase mass transfer coefficient (L T^{-1})

The value of k_l was calculated using the following expression:

$$k_l = \sqrt{\frac{D_w u}{h}} \qquad (3\text{-}3)$$

where:

D_w = molecular diffusivity of PCBs in water (L^2 T^{-1})
u = depth-weighted average current velocity (L T^{-1})
h = average water depth (L)

Equations 3-1 through 3-3 are identical to those used in the PCB fate and transport model developed for the lower Grasse River (Alcoa, April 2001; Alcoa, June 2002).

A combination of site-specific data and information from the available literature were used to define the parameters needed to complete the calculation. PCB-specific parameters (H_e, k_g and D_w) were defined using values identical to those used in the PCB fate and transport model developed for the lower Grasse River (Alcoa, April 2001; Alcoa, June 2002): H_e was set to 0.0087, k_g was assigned a constant 100 meters per day (m/day), and D_w was set to 5.2×10^{-10} square meters per second (m^2/s). The PCB concentration in the atmosphere (C_{air}) was assumed to be negligible (i.e., set to zero).

Dissolved phase PCB levels were estimated using the average partition coefficient (90,300 L/kg) determined from paired filtered and unfiltered water samples collected from the river in June 2005 (Section 3.2.5.1.2) and daily total PCB and TSS measurements obtained at D4, located immediately downstream of the containment system. These PCB dissolved estimates at D4 were assumed to be representative of those inside the containment system based on the water column data collected in June 2005 (Section 3.2.5.1.2). Dissolved phase PCB levels between the containment system and ROPS-WCT14 were estimated using the average partition coefficient (90,300 L/kg) and daily total PCB and TSS measurements obtained at ROPS-WCT14. Use of the TSS and PCB data from ROPS-WCT14 likely underestimates the PCB mass lost to the atmosphere from this stretch of the river, but since the settling/partitioning dynamics within this stretch of the river are not known and the overall PCB mass loss due to volatilization is small, this assumption was deemed reasonable.

The surface area (A) of the river area enclosed by the silt containment system and between the containment system and ROPS-WCT14 was determined using ArcGIS software. The average water depths (h) for these areas were computed from the 2003 and/or October 22, 2005 multibeam survey results. Finally, the average current velocity within the containment system was estimated based on river flow data measured at the USGS gage at Chase Mills and an assumed flow through the containment system. Based on the results of the velocity study, two flow scenarios were simulated: one at 20% and one at 40% of the flow entering the lower river from upstream. The average current velocity between the containment system and ROPS-WCT14 was based on river flow data measured at the USGS gage at Chase Mills.

Based on the assumptions described above, the mass of PCBs lost to the atmosphere during the ROPS dredging activities was estimated to be 1.0 kg and 1.2 kg for the 20% and 40% flow scenarios, respectively.

3.2.6 Post-Dredging PCB Residuals

A multibeam bathymetry survey was conducted within the main channel area on October 22, 2005 to document the final post-dredging topography of the river bottom. The results of this survey are presented in Figures 3-29 and 3-30). Sediment core sampling conducted at the same time (October 22, 2005) served as the final during-construction sediment sampling event after dredging was completed and prior to cap placement in Work Zone 1. A total of 28 sediment cores were collected from Work Zone 1 via vibracoring to determine PCB levels and the extent of remaining PCB-impacted materials. These data were also used to assess the relationship between local bottom conditions and post-dredging PCB residual concentrations.

3.2.6.1 Characterization of Remaining Sediments

The PCB-containing sediments remaining in the river after dredging appear to represent a combination of sediment dislodged but not captured by the dredge (termed residual disturbed sediment [RDS]) and sediment never touched by the dredge (termed untouched inventory [UI]). Untouched inventory is visually similar to sediment collected prior to dredging, has a vertical profile of PCBs similar to the bottom portions of baseline sediment cores, and has a grain size composition and bulk density similar to baseline sediments. Residual disturbed sediment is found at the surface of sediment cores, has a muddy appearance not seen in underlying sediments and baseline sediments, and has a grain size composition and bulk density that is different from underlying sediments but generally consistent across disturbed cores. Example photos of baseline sediments, untouched inventory and residual disturbed sediment are provided in Figure 3-31.

Based on the examination of visual appearance, grain size composition, TOC and bulk density, 15 of the 28 post-dredging vibracores collected from Work Zone 1 on October 22, 2005 were classified as containing RDS on top of UI; these cores are presented in Table 3-4. In these cores, the surface sediments are generally less dense (average percent solids of 52% and bulk density of 0.7 g/cm^3), finer-grained (average median particle size [D_{50}] of 0.12 mm), and contain higher TOC levels (average of 3.2%) relative to the underlying sediments. These sediments tend to have less gravel, coarse sand, and clay than the underlying sediments and the baseline sediments (Table 3-4). The RDS range in thickness from 3 to 14 in (average of about 6 in), with the thicker sections predominantly found along the northern and southeastern perimeters of Work Zone 1 (Figure 3-32). The average PCB concentration in the RDS is about 205 ppm (range from 38 to 571 ppm), similar to the average depth-weighted PCB concentration of 228 ppm determined from the baseline sediment cores (i.e., pre-dredging levels). Below the RDS layer are 2 to 26 in of PCB-containing sediments that are characteristic of UI. An overall average DoC of about 16 in (range of 8 to 32 in) was determined for the cores that contained both RDS and UI.

The remaining 13 vibracores contained only sediments that were classified as UI (Table 3-5). The surface sediments in these cores are denser (average percent solids of 79% and bulk density of 1.4 g/cm^3), coarser-grained (average D_{50} of 0.73 mm), and contain lower TOC levels (average of 1.2%) than the surface sediments classified as RDS. DoCs in these cores were similar to those that contained RDS, varying from 3 to 32 in and averaging about 17 in. Surface sediment PCB concentrations in these cores were typically lower than those with RDS. PCB levels at the surface of these cores ranged from 1.3 to 388 ppm, with an overall average of about 76 ppm.

Considering all post-dredging cores collected from Work Zone 1, the DoC averaged about 16 in and the average post-dredging surface PCB concentration was 150 ppm (about 38 times higher than the pre-removal surface sediment PCB concentration of 4.1 ppm for Work Zone 1). Depth-weighted PCBs averaged about 80 ppm (range of 1.3 to 315 ppm), about 3.4-fold lower than estimated prior to dredging (average of about 270 ppm). Based on the PCB mass balance presented in Section 3.2.5.1.1, approximately 16% of the targeted PCB mass remains in Work Zone 1. The lack of overlap between pre-dredging and post-dredging sampling locations precluded a direct location-by-location comparison of PCB levels before and after dredging. No consistent correlations between the remaining DoC and presence of RDS with river area (i.e., side slopes vs. main channel) were observed. However, samples from the main channel generally have surface and depth-weighted PCB concentrations that are about two-fold higher than those from the side slopes.

3.2.6.2 Relationship to Equipment Used

Nine of the vibracores collected during the October 22, 2005 survey were obtained from areas where the cutterhead dredge was tested. Although the cutterhead dredge was used in the vicinity of core 418, this core was not included in the nine mentioned above since removal with the mechanical clamshell was also tested at this location. Seven of these nine cores contained surface sediments classified as untouched inventory (Table 3-5); cores 273 and 561 contained residual disturbed sediment (Table 3-4). The absence of residual disturbed sediments at most locations where the cutterhead operated may suggest that: 1) the cutterhead dredge is more effective then the auger head at removing the sediments disturbed during the dredging process; and/or 2) the cutterhead may provide sufficient energy to disperse disturbed material not captured by the dredge. This latter point is supported by the greater downstream transport of solids when the cutterhead was operating (see Section 3.2.5.1.3).

Comparisons of sediment core data collected immediately before and after application of the cutterhead dredge are provided in Figure 3-33. Application of the cutterhead dredge did not result in consistent reductions in average surface sediment PCB concentrations, DoC or depth-weighted PCB concentrations (the 30% reduction in average surface sediment PCB concentration is not statistically significant). Comparisons on a location-by-location basis exhibited no consistent trend; some locations exhibited lower post-cutterhead DoCs and higher depth-weighted PCB concentrations, while others showed higher post-cutterhead DoCs and lower depth-weighted PCBs. Spatial variability in core results confounds interpretation of the core data; that is, it is difficult to separate spatial variability from temporal variability. It is possible that some sediment along the cut face on the boundary with Work Zone 2 sloughed into the dredge area and influenced the DoC and PCB concentration comparisons. Two of the three cores collected near the cut face exhibited an increase in DoC and contained surface sediments consistent with the upper 2 ft of sediment in Work Zone 2 (i.e., low PCB concentration, high bulk density and high sand content).

Comparison of sediment core data collected prior to and after removal with the mechanical clamshell could not be performed since dredging with both the horizontal auger and mechanical clamshell (and in the instance of core 418, the cutterhead dredge) occurred in these areas between available sediment sampling events, making it impossible to relate any potential differences between pre- and post-dredging conditions to either of the two alternative dredging technologies. However, cores were collected from these locations after sediment removal using the mechanical clamshell. The average DoC at these four locations (cores 179, 183, 381 and 418), after all dredging was completed, was 15 in. Surface and depth-weighted PCBs in these areas averaged 61 ppm (8 to 128 ppm) and 91 ppm (15 to 225 ppm), respectively.

3.2.6.3 Impact of Bottom Conditions

A discussion of the impact of bottom conditions on dredge productivity is provided in Section 3.2.4.2.2. Many of these same conditions account for the difficulties encountered in removing the PCB-containing sediments existing below the elevations at which hard bottom was encountered. Despite the exhaustive removal efforts discussed in Section 3.2.4.2.1, in many areas the bottom elevations remained above both the target elevations indicated by baseline sediment probing and the DoC elevations indicated by the vibracoring conducted during the program. This fact is illustrated in cross-sections of the pre-dredging probing-based estimated hard bottom elevations, the post-dredging bottom elevations measured by multibeam bathymetry and the vibracoring-based DoC elevations (Figures 3-34 shows the cross-section locations and Figures 3-35 and 3-36 show the cross-sectional data). In most cases, the post-dredging bottom elevations are inches to feet higher than the elevations interpreted from the pre-dredging probing, which in turn tend to be inches to feet higher than the DoC elevations at the coring locations. The inability of the dredge to reach the probing-based or DoC elevations is believed to be attributable to the site bottom conditions. Numerous efforts were made to understand those conditions prior to and during the dredging program. These efforts include the following:

- Sub-bottom profiling was attempted prior to the conduct of the work in an effort to provide an understanding of subsurface conditions in the river; however, it was unsuccessful due to site conditions.
- Sediment probing was conducted when the dredgers reported encountering hard bottom and this work indicated the presence of sediments amongst the hard-bottom elements.
- Vibracoring was conducted to determine the PCB levels in the remaining sediments.
- Multibeam survey work was conducted in Work Zone 1 and showed the presence of large boulders, hard ridges, and rock outcrops in a number of areas. In addition to the major rock projections observed on the multibeam survey, a significant number of lesser topographic features are evident on the survey. These features could potentially represent an uneven bedrock surface, an uneven hard glacial till surface, rocks/boulders that are embedded in the native stratigraphy, or some combination of all of these features.
- Divers were deployed to videotape the bottom conditions at the site.
- An attempt was made to conduct sub-bottom profiling in Work Zone 1, after a significant depth of sediments had been removed, in an effort to understand the nature and configuration of the materials underlying the remaining sediments. This was ultimately unsuccessful due to site conditions.

In response to the information generated from the above efforts, the following removal efforts were initiated:

- Dredging with the horizontal auger was continued in Work Zone 1 despite the significant declines in productivity and the significant damage to the dredging equipment.
- Modifications were made to the dredging operation in an effort to remove additional sediments, including repositioning the dredge to run perpendicular to shore, conducting additional dredge passes over the work zone, and changing the dredge forward speed and auger rotation rates.
- A cutterhead dredge was mobilized to the site late in the project to evaluate if this equipment could provide additional sediment removal.
- A mechanical dredge was employed in selected areas on a limited basis.

The results of this work coupled with the post-construction sediment data indicate the following:

- There is variability in bottom conditions across the site which significantly complicates both site characterization efforts and sediment removal efforts.
- Bottom conditions at the site limited the ability of the equipment employed to remove the remaining sediments.
- Factors that are believe to have contributed to the difficulty in removing the targeted sediments include the presence of obstructions in the forms of boulders and rock outcrops/ridges, and hard bottom

conditions which limited the ability of the equipment to access the sediments for removal (as evidenced by the extent and depth of sediments classified as UI).

- There were a limited number of locations (cores 257, 261, 412, and 414) where the dredge was capable of removing sediments down or close to the native underlying stratigraphic interface.
- The nature and extent of hard bottom conditions could not be determined due to the inability of the sub-bottom profiling technology to map the underlying strata. Evidence from the vibracoring work supports the presence of native sediments that can be penetrated by vibracoring techniques in many of the cores collected; however, the information provided by the multibeam survey, the results of other geotechnical investigations in the vicinity of the site, and observations of the dredging operation (contact of hard materials by the dredge head through much of the ROPS area) support that hard bottom conditions exist over a significant portion of the study area.
- The presence of an uneven, discontinuous, hard bottom comprised of some combination of bedrock, hard glacial till, and rocks/boulders that are embedded in the native stratigraphy could account for the various lines of information developed from the ROPS. In this scenario, the residual sediments would be interspersed in the discontinuities between the top elevations of these features. As discussed previously, this scenario could not be confirmed due to the difficulties encountered with the sub-bottom profiling technology.

3.3 Post-Dredge Capping

3.3.1 Productivity

Capping productivity is defined as the volume of cap material placed over a specific time period (i.e., per hour of capping operations or per day) and is reported in cy/hr or cy/day. The volume of cap material placed in the river was estimated as the product of the number of clamshell buckets placed and the known bucket volume; these estimates were made on a daily basis. The number of hours that capping operations were performed was tracked daily and recorded by the field personnel. Daily post-dredge cap production data are provided in Appendix F.12.

3.3.1.1 Main Channel

Post-dredge capping activities in the main channel were conducted between October 22 and November 9, 2005. During this period, cap operations were conducted using a 2-cy bucket for an average of 20 hr/day (range of 10.5 to 24 hr/day). Placement rates ranged from about 25 to 54 cy/hr, with an overall average placement rate of about 39 cy/hr. Daily placement rates ranged from about 300 to 1,200 cy/day, with an overall average of about 780 cy/day.

3.3.1.2 Northern Near Shore

Post-dredge capping in the northern near shore was initially performed between September 12 and September 22, 2005. During this period, cap placement was conducted 11 hr/day. Placement rates ranged from about 7 to 33 cy/hr, with an overall average placement rate of about 20 cy/hr. Daily placement rates during this period ranged from about 81 to 364 cy/day, with an overall average of about 215 cy/day. Monitoring in this area indicated that select areas did not contain an adequate thickness of cap material. As a result, additional capping activities were performed in early November 2005 to satisfy the design cap thickness in these areas. A total of about 180 cy of cap material was placed over the 4-day period during which additional activities were conducted.

3.3.2 In-Place Thickness of Post-Dredge Cap Material

To provide real-time feedback regarding attainment of target cap thickness, manual elevation measurements were taken at each of the ROPS grid nodes in the main channel area immediately after placement of cap material. If the elevation measurement at a particular node indicated a thickness outside the target range of 1.0 to 1.5 ft (12 to 18 in), then either additional cap material was placed at that location (if the cap thickness was less than 1 ft) or the grid node area was graded (if the cap thickness exceeded 1.5 ft). Additional elevation measurements were collected and additional action was taken, as necessary, until the cap thickness at that grid node was within acceptable limits. Measurements of apparent cap thickness in cores taken post-capping and paired sediment elevation measurements from multibeam bathymetry surveys conducted before and after capping (main channel only) provide additional information on the thickness of the in-place cap. Data collected during these monitoring activities are discussed in Appendix A. Cap surface elevation measurement data and the multibeam bathymetry results are provided in Appendices B and O, respectively.

3.3.2.1 Main Channel

Cap material thickness measured at each of the grid nodes immediately after cap placement fell within the 1.0 to 1.5 ft thickness tolerance prescribed by ECN 033 (November 4, 2005; Figures 2-20 and 2-21). The thickness of cap material in the post-capping sediment cores collected between November 28 and December 1, 2005 (after capping was complete) averaged 1.5 ft (range of 0.5 to 2.5 ft) in Work Zones 1 and 2 (Figures 2-20 and 2-21). Three cores (175, 488 and 779) were collected from the side slope portion of the ROPS area; these cores contained 7, 14 and 22 in of cap material. The paired pre-capping[4] and post-capping sediment elevation measurements from multibeam bathymetry surveys that were conducted over the areas for other purposes indicate that capping increased the average elevation in the work zone by 1.1 ft (13 in) (Figure 3-37). This increase equates to approximately 11,600 cy of cap material, which is less than the 13,100 cy estimated during cap placement (Appendix F.12). The volume difference may be attributable to several factors: 1) the assumption of full buckets used to estimate the volume of cap material placed in the river may not be accurate; 2) the cap material and/or native sediment likely underwent some consolidation between placement and measurement; and 3) some cap material was lost to downstream transport during cap placement.

On a point-by-point basis, the multibeam bathymetry data indicate that approximately 57% of the main channel area contains a cap thickness in excess of the 1.0-ft minimum, and about 40% of the area contains a cap thickness within the 1.0- to 1.5-ft tolerance (Figure 3-37). The fact that such variability exists despite the efforts during construction to achieve the target thickness at each ROPS grid node is likely due to: 1) the limited areal extent of the local adjustments to the cap that were made in response to the manual measurements at each grid node; 2) measurement error associated with the manual elevation measurement technique; and 3) consolidation of the in-place cap material and/or native sediment.

3.3.2.2 Northern Near Shore

Comparison of post-placement cap surface elevation measurements to baseline elevations indicated that the required cap thickness was achieved at all grid node locations within the allowable tolerance (Figure 2-19). Cap material in sediment cores taken post-capping (November 28 and December 1, 2005) ranged in thickness from 0

[4] Results from the September 30, 2005 and October 22, 2005 multibeam surveys were used to define pre-capping conditions within the ROPS main channel area. The September 30, 2005 survey was used to define the downstream-most portion of Work Zone 2 since: 1) this area was not surveyed during the October 22, 2005 survey; and 2) no construction activities were conducted in this area between the two surveys.

to 2.2 ft (average of 1.0 ft) in the northern near shore area (Figure 2-19). No multibeam bathymetry work was conducted in the northern near shore area due to the shallow water depths in this area.

3.3.3 Surface Sediment PCB Reduction Due to Post-Dredge Capping

PCB levels measured in cap material/sediment samples collected before and after cap placement were used to evaluate the reduction in surface PCB concentrations associated with post-dredge capping. Details regarding these monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B.

3.3.3.1 Main Channel Area

Sediment core data collected during the September 30 and October 22, 2005 sampling events were used to define post-dredging/pre-capping surface sediment PCB concentrations. The September 30, 2005 sample results are applicable in Work Zone 2 since dredging was not performed in this area after this sampling was conducted. The October 22, 2005 sampling event focused collection efforts solely in Work Zone 1. Sediment cores collected during the November 28 through December 1, 2005 sampling event were used to define post-capping surface PCB concentrations for both areas.

Post-dredging surface sediment PCB concentrations in Work Zone 1 and Work Zone 2 averaged 150 ppm and 114 ppm, respectively. An overall weighted-average surface PCB concentration (based on number of cores collected from each work zone) of 139 ppm was determined for the entire ROPS main channel dredge area. For Work Zone 1, PCB levels measured at the cap surface (post-placement) averaged 8.9 ppm, representing a surface PCB concentration reduction of about 94% relative to post-dredge/pre-cap conditions. A slightly greater reduction (97%) was observed in Work Zone 2, although this reduction is based only on 4 post-capping sediment cores; PCB levels measured at the cap surface (post-placement) averaged 3.3 ppm. Overall, the main channel area (Work Zones 1 and 2) weighted-average post-capping surface PCB concentration is 7.4 ppm, representing a 95% reduction relative to post-dredging conditions (Figure 3-38).

The average post-capping surface PCB concentration of 7.4 ppm represents an approximate two-fold increase from the average surface sediment PCB concentration (3.8 ppm[5]) determined for this area prior to initiation of the ROPS (Figure 3-38). The reduction in surface PCB levels after placement of the post-dredge cap is comparable to that observed after placement of a cap over native sediments in 2001 (95% vs. 92% immediately after cap placement [Alcoa, April 2002] and 97% one year after cap placement [Alcoa, September 2003]). The three cores collected from the side slope portion of the ROPS area contained surface PCB concentrations ranged from 0.27 and 1.0 ppm.

3.3.3.2 Northern Near Shore Area

Sediment grab samples collected from the northern near shore area during the August 19, 2005 survey were used to define the post-dredging surface sediment PCB concentration for this area. From these data, an average post-dredging surface PCB concentration of 1.9 ppm was estimated. PCB levels measured at the cap surface (post-placement based on samples collected between November 28 and December 1, 2005) averaged 0.24 ppm,

[5] This average surface sediment PCB concentration was estimated using baseline sediment data (2003 and 2004) collected from Work Zones 1 and 2. The average PCB concentration of 4.5 ppm used to define the capping criterion in ECN 012 (June 20, 2005) was based on baseline sediment data collected from Work Zones 1, 2 and 3.

representing a surface PCB concentration reduction of about 87% relative to post-dredging conditions. Overall, the post-capping surface PCB concentration of 0.24 ppm represents a 99% reduction relative to baseline conditions (average surface PCB concentration of 19 ppm prior to initiation of the ROPS; Figure 3-38).

3.3.4 PCB Contamination Within the Post-Dredge Cap

PCB concentrations in sediment core samples collected immediately after cap placement were used to evaluate PCB contamination within the post-dredge cap. Post-capping sediment cores were collected from the main channel and northern near shore areas, and segmented every 2 in to the cap/native sediment interface (as determined by visual observation) and then 0 to 3 in, 3 to 6 in, 6 to 12 in, and every 6 in thereafter. A total of 23 sediment cores (representing 186 individual cap samples) were collected from these areas after cap placement. Details of the monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B.

3.3.4.1 Main Channel Area

Approximately 112 (82%) of the 136 in-place cap samples (from the November 28 through December 1, 2005 survey) from the main channel dredge area contained detectable PCBs, much higher than that observed after capping of native (un-dredged) sediments during the 2001 CPS; only 5% of the cap samples collected immediately after cap placement in 2001 contained detectable PCBs (Alcoa, April 2002). In fact, seven of the 15 cores collected from this area (three from Work Zone 1 and all four from Work Zone 2) contained detectable PCBs throughout the entire cap (0.07 to 96.3 ppm). The greater proportion of detectable PCBs throughout the cap material samples is likely the result of mixing/entrainment of contaminated sediments and cap material during placement. The fact that the cap was placed in a single lift (vs. multiple lifts) coupled with the presence of low density PCB-containing dredge residuals at the surface is believed to have contributed to the extent of mixing/entrainment of PCB-containing sediments in the cap. Significant entrainment of PCBs into the cap material was not observed using single lift placement over un-dredged sediments during the 2001 CPS. Placement of the cap in two lifts may help to reduce the extent of contamination within the cap by limiting the mixing/entrainment to the material placed in the first lift.

The concentration and composition of PCBs in the sample intervals immediately above (i.e., bottom of cap) and below (i.e., underlying native sediments) the cap-sediment interface were compared to assess the extent of mixing between the cap material and native sediments during cap placement. In most cores, the highest PCB concentration in the cap material was measured in the bottom 2 in of the cap, which is indicative of mixing of the underlying sediments and the relatively clean cap material during placement. Overall, PCB concentrations in the bottom 2 in of the cap were, on average, 6.2 times lower than those in the sediments being capped. The PCB levels in these cores exhibited no correlation to the location within the work zone, physical and chemical characteristics of the underlying sediments, or cap thickness, and are greater than those observed during the placement of a cap over un-dredged sediment in 2001 (about 23 times lower than that of the underlying sediments; Alcoa, May 2003). The Aroclor distributions of the PCBs measured in the bottom interval of the cap and the underlying sediments were similar in most cores, with Aroclors 1221 and 1242 comprising 85 to 90% of the total PCBs.

3.3.4.2 Northern Near Shore Area

Cap material samples from the northern near shore area typically contained lower levels of PCBs relative to those from the main channel cap area; only 12 (24%) of the 50 in-place cap samples from this area contained

detectable PCBs (range of 0.06 to 5.29 ppm). PCB concentrations and composition suggest that mixing of the underlying sediments and the relatively clean cap material occurred during placement, but this mixing was detectable only in the bottom 2 to 4 in of the cap. PCB levels in this mixing layer at the bottom of the cap were, on average, about 5% of those in the underlying sediments. Two exceptions were noted: 1) Core NNS-4 contained a PCB concentration of 1.19 ppm at the bottom of the cap and 1.69 ppm in the underlying sediments; and 2) Core NNS-8, which contained a higher PCB concentration in the bottom cap sample relative to the underlying sediments (5.29 ppm vs. 0.48 ppm). Cap material located between the cap surface and this bottom mixing layer generally contained PCB levels below the method detection limit.

3.3.5 Solids and PCB Releases During Post-Dredge Capping

Water column data collected during post-dredge capping activities were used to evaluate the solids and PCB releases associated with post-dredge cap construction. Details regarding these monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B.

3.3.5.1 Releases to the Water Column

Water column PCB, TSS and turbidity measurements collected during the main channel post-dredge capping activities exhibit distinct spatial gradients; levels were highest immediately downstream of the work zone (at D4) and decline with distance downstream (Figure 3-39). This spatial pattern is consistent with a source that originates from the work zone. Overall, the average net PCB flux downstream of the work zone (i.e., PCB flux at ROPS-WCT14 minus PCB flux at ROPS-WCT5) during main channel/northern near shore area post-dredge capping was estimated at about 0.6 kilograms per day (kg/d). This net PCB transport is about 40% lower than the 1.0 kg/d estimated to be the average net flux during debris and sediment removal activities. In contrast, the average net TSS flux downstream during post-dredge capping was higher than occurred during sediment and debris removal activities (about 19,000 kg/d versus about 1,500 kg/d). The higher rate of TSS release downstream during post-dredge capping activities (by a factor of 12) was also a function of difficulties associated with the placement of cap material during periods of higher river flow (average of 2,300 cfs vs. an average of 1,100 cfs during debris and sediment removal activities). PCB, TSS and turbidity levels measured during the main channel capping activities were always below the respective action levels.

PCB and TSS transport specific to capping in the northern near shore area could not be assessed because sediment and debris removal activities in Work Zone 1 were being conducted concurrently with these capping activities.

3.4 Thin-Layer Capping in the Southern Near Shore

3.4.1 Thin-Layer Capping Productivity

Capping in the southern shore area was performed in a single lift in accordance with the Operations Plan (Sevenson, May 2005) to obtain a minimum thickness of 3 in and a maximum thickness of 6 in of sand/topsoil. Capping was completed in three days, from November 15-17, 2005, and a total of approximately 300 cy was placed (most material placed on November 15, 2005). Daily thin-layer cap production data are provided in Appendix F.12.

3.4.2 In-Place Thickness of Thin-Layer Cap

Similar to the main channel cap area (Section 3.3.2), manual elevation measurements were conducted in the southern near shore area to provide real-time estimates of the in-place cap thickness in an attempt to achieve the target cap thickness of 0.3 to 0.5 ft (3.6 to 6.0 in; Figure 2-23). Details of these monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B. The shallow water depths in the southern near shore area precluded the collection of multibeam bathymetry data from this region. Cap thickness estimates from the manual elevation measurements taken during capping indicate an average cap thickness of about 0.4 ft (range of 0.3 to 0.5 ft), within the target cap thickness of 0.3 to 0.5 ft (3.6 to 6.0 in; Figure 2-23). Five of the six sediment cores collected during post-ROPS monitoring efforts contained cap material; cap material was not observed in core SNS2-S. The average cap thickness for these five cores was 0.25 ft (range of 0.17 to 0.33 ft, or 2 to 4 in).

3.4.3 Surface Sediment PCB Reduction Due to Thin-Layer Capping

PCB concentrations in sediment core samples collected immediately after cap placement were used to evaluate PCB contamination within the thin-layer cap. Post-capping sediment cores were collected and segmented every 2 in to the cap/native sediment interface (as determined by visual observation) and then 0 to 3 in, 3 to 6 in, 6 to 12 in, and every 6 in thereafter. A total of six sediment cores (representing 8 individual cap samples) were collected from this area. Details of the monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B.

An average pre-capping surface sediment PCB concentration of 8.3 ppm (range of 0.4 to 36.5 ppm) was determined from the six baseline sediment cores collected in 2004. PCB levels measured at the cap surface post-placement were near or below the detection limit in five of the six cores collected from this region. Core SNS-4 contained a surface PCB concentration of 3.34 ppm; however, this sample contained 18.8% gravel, which is much higher than any other cap material sample and more consistent with gravel contents observed in native sediment. The average PCB concentration at the cap surface, excluding core SNS-4, was 0.06 ppm, which represents a 99% reduction in surface PCB concentration. Inclusion of core SNS-4 with the other cores yields a post-cap average PCB concentration of 0.60 ppm at the cap surface (a 93% reduction).

3.4.4 PCB Contamination Within the Thin-Layer Cap

Three of the seven cap material samples from this region contained detectable levels of PCBs; levels in these three samples were low (0.12 to 0.33 ppm). No consistent correlation between Aroclor distributions in the bottom interval of the cap and the underlying sediments was observed. This, coupled with the low and (often non-detect) PCB levels in these samples suggest that little mixing of the cap material and underlying sediments occurred during placement.

3.4.5 Solids and PCB Releases During Thin-Layer Capping

Water column data collected during thin-layer capping activities were used to evaluate the solids and PCB releases associated with thin-layer cap construction. Details regarding these monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B.

Average water column PCB, TSS and turbidity levels measured at the upstream (ROPS-WCT5), local (C1) and downstream (ROPS-WCT14 and ROPS-WC131) monitoring stations during the three days of thin-layer cap

construction in the southern near shore area are presented in Figure 3-40. PCB concentrations remained below the detection limit at all four monitoring stations throughout capping activities. TSS levels indicate there were some solids released around the work zone as levels at the local station were slightly higher than upstream and downstream. However, TSS and turbidity levels at the upstream and downstream stations remained similar throughout capping activities, suggesting that these releases did not have any significant effect on levels further downstream. The PCB, TSS and turbidity action levels were never exceeded.

3.5 Armored Capping

3.5.1 Armored Capping Productivity

Armored cap construction was accomplished over 22 working days between September 23 and October 21, 2005. Capping operations averaged about 10 hr/day (range of 2.5 to 11 hr/day), and a total of about 3,800 cy of capping material was placed during this period. Cap placement rates ranged from about 8 to 39 cy/hr, with an overall average of about 19 cy/hr (does not include October 5, 2005, when capping activity was limited). Daily placement rates ranged from 88 to 389 cy/day, with an overall average of 180 cy/day. Due to the tolerances associated with the filter layers, partial loads within the buckets (to achieve layer thicknesses less than one ft) and difficulty in picking up the heavy stone used for the armor layer, the production rate was considerably less than that achieved during work zone capping. Daily armored cap production data are provided in Appendix F.12.

3.5.2 In-Place Thickness of Armored Cap

In-place cap thickness estimates were obtained using the manual elevation technique employed during the construction of the main channel post-dredge cap (Section 3.3.2). Results of this monitoring effort indicated that the armored caps placed in the main channel were within the 2.1- to 3.1-ft (upstream half) and 1.7- to 2.7-ft (downstream half) target thickness (Figure 2-22). Similar to the assessment performed for the main channel dredge/cap area, multibeam bathymetry results collected prior to (September 13, 2005) and after (October 22, 2005) armored cap construction were compared to provide additional information pertaining to cap thickness in this region. Comparison of the pre- and post-capping multibeam elevation measurements indicated that approximately 2,600 cy of in-place cap material was present on the river bottom (Figure 3-41). Consistent with the findings regarding post-dredging capping (Section 3.3.2.1), this estimate is less than the 3,800 cy estimated during cap placement (based on the volume of the bucket used to place the material and the number of buckets placed). The likely reasons for the volume difference are the same as those discussed in Section 3.3.2.1 for post-dredging capping. These multibeam bathymetry data indicate an average cap thickness of 1.89 ft (22.7 in) in the upstream half of the cap area and 1.33 ft (16 in) in the downstream half of the cap area. Data collected during these monitoring activities are discussed in Appendix A. Cap surface elevation measurement data and the multibeam bathymetry results are provided in Appendices B and O, respectively.

On a point-by-point basis, approximately 35% of the upstream half of the cap area (i.e., with base layer) contains a cap thickness in excess of the 2.1-ft minimum; a similar percentage of the area contains a cap thickness within the 2.1- to 3.1-ft target thickness. For the downstream portion of the cap (i.e., without the base layer), approximately 23% of the cap area contains a cap thickness in excess of the 1.7-ft minimum. The same factors that likely contributed to the differences between the point-by-point comparisons and the manual elevation measurements for the main channel post-dredge cap apply here: 1) local adjustments to the cap (in the event the cap thickness at a particular grid node was not within the prescribed tolerance limits) were limited in areal extent; 2) measurement error associated with the manual elevation measurement technique; and 3) consolidation of the in-place cap material and/or native sediment. Additionally, the uneven nature of the

armored cap surface (and the associated impact on the manual survey) likely contributed to the observed differences.

3.5.3 Solids and PCB Releases During Armored Capping

Water column data collected during armored capping activities were used to evaluate the solids and PCB releases associated with the construction of the armored cap. Details regarding these monitoring activities are discussed in Appendix A, while the data are provided electronically in Appendix B.

PCB and TSS transport during armored capping can only be assessed for 7 of the 22 days of construction activities since debris and sediment removal activities were occurring concurrently with armored cap construction on 15 of the 22 days of operations. Average PCB, TSS and turbidity levels during these 7 days are presented in Figure 3-42. PCB concentrations at all four monitoring locations were generally below the method detection limit throughout capping, with the exception of two days in which detectable levels were relatively low. TSS levels at the local downstream station (C3) averaged about 5.8 mg/L during this period, and were slightly higher than those measured at the upstream (5.5 mg/L at ROPS-WCT14) and downstream stations (5.3 mg/L at ROPS-WC131), suggesting that some solids were released during armored cap construction.

3.6 Project Costs

The ROPS was designed and implemented to develop site-specific information related to the implementation and effectiveness of potential remedial options for the lower Grasse River. The following presents a cost breakdown associated with the 2005 ROPS activities.

Alcoa Grasse River ROPS Project Cost Summary	
Dredge-Related Construction Costs	
Mobilization	$2,625,460
Main Channel Dredging	$3,306,610
Main Channel Post-Dredge Capping	$783,820
Northern Near Shore Dredging	$424,860
Northern Near Shore Post-Dredge Capping	$117,940
Containment System	$1,788,570
Sediment Processing and Transport	$3,853,500
Geotube Study	$236,860
Water Treatment	$639,040
Waste Disposal (on site)	$1,453,900
Waste Disposal (off site)	$135,355
Demobilization	$937,870
Subtotal – Dredge-Related Construction Costs	**$16,303,785**
Environmental Monitoring (EM)	$2,040,990
Project Management (PM) and Quality Assurance/Quality Control (QA/QC)	$1,533,740
Subtotal – Construction Costs + EM + PM +QA/QC	**$19,878,515**

Alcoa Grasse River ROPS Project Cost Summary (cont'd)	
Southern Near Shore Capping	$38,350
Armored Capping	$332,960
Total Project Costs	**$20,249,825**

Note:
1. Waste disposal costs (on site) are derived from the total design capacity of the landfill and incorporate cell construction, waste placement, and final capping costs. Secure Landfill Cell 3 construction costs are approximately $5 million to date.

In nine months, approximately $20.2 million was spent, with the majority of these costs associated with removing, processing, transporting, and disposing of about 26,000 cy of sediment and debris material (in-situ volume) from the river bottom. Approximately 7.3 acres were actively dredged out of the 9.8-acre area originally proposed in the ROPS Work Plan (Alcoa, February 2005); most of the work associated with these expenditures was focused in the 4.1-acre area represented by expanded Work Zone 1. In addition, approximately 18,800 cy of cap material was placed in the river bottom in various locations with a combined area of 8.6 acres.

The cost table below provides approximate unit costs for the major work elements associated with the ROPS. The cost data developed from the study indicated that the unit cost for dredging in the main channel area was approximately $760/cy and that the cost for post-dredge capping in the main channel area was approximately $160,000/acre. Further refinement of these costs will be conducted in support of the revised AA Report.

ROPS Project Unit Cost Breakdown		
Task	**Task Total Cost**	**Unit Cost**
Main Channel Dredging	$18,551,895	$760 /cy in-situ
Main Channel Post-Dredge Capping	$783,820	$160,000 /acre
Southern Near Shore Capping	$38,350	$150,000 /acre
Armored Capping	$332,960	$458,000 /acre

Notes:

1. Costs generated from ROPS Project Cost Summary Table and supporting cost data.
2. Main Channel dredging cost includes mobilization/demobilization, dredging, containment, sediment processing, water treatment, Geotube study, disposal, monitoring, and project management costs.
3. Base construction costs for capping were adjusted by a factor of 1.4 to account for mobilization/demobilization, project management, containment, and monitoring costs.
4. Unit costs for northern near shore capping and dredging are under development.
5. A 20% reduction in volume was observed from in-situ sediment to in-place waste volume at the SLF.

4. Findings

4.1 Attainment of Overall Project Objectives

The piloted remedial options and data collection programs that constitute the ROPS were designed to satisfy the following overall objectives:

- Evaluate remedial options to reduce potential risks associated with exposure to buried PCBs that could be mobilized by a future ice jam-related sediment scour event in the lower Grasse River;
- Develop information to address outstanding issues regarding remedy effectiveness, remedy implementation, and the CSM that impact the analysis of remedial alternatives; and
- Make progress in the lower Grasse River to support final remedy development, evaluation, selection and implementation.

Dredging followed by capping and armored capping were piloted as potential options to address PCB-containing sediment that could be mobilized by a future ice jam-related sediment scour event. Thin layer capping was piloted as a potential option to address moderate sediment PCB concentrations in shallow near shore areas that typically are not affected by ice jam-related scour. The ROPS was designed to address outstanding issues regarding these remedies that pertain to implementability, short-term effectiveness, some aspects of long-term effectiveness and permanence, and cost. With regard to implementability, data were obtained to characterize the progression of each ROPS component and define the extent to which each could be implemented as planned, including meeting physical specifications and production rates. These data also provided a basis to modify the approach to project execution and examine the efficacy of such changes. To address the issues related to short-term effectiveness, quantitative information was generated on the impacts of the remedies on the community, workers, and the environment. The examined environmental impacts include release of sediment-associated PCBs to the water column, increases in fish PCB concentrations and as assessment of the benthic invertebrate community (which will be assessed through post-ROPS monitoring). The long-term effectiveness and permanence issues addressed by the ROPS pertain to residual risk and remedy reliability. Residual risk was assessed by measurement of post-ROPS PCB concentrations in bioavailable sediments. Effectiveness of the remedial options studied will continue to be further assessed through post-ROPS monitoring.

The overall objectives of the ROPS were met in that important new information was generated regarding the implementability and short-term and long-term effectiveness of the tested remedial options. Further, progress was made by removing almost 3,300 kg of PCB from an ice scour prone reach of the river, reducing the PCB concentrations in bioavailable sediments in the northern and southern near shore areas that were remediated, and isolating PCB-containing sediments with an armored cap in an area vulnerable to ice jam-induced scour. This information was presented in Section 3 and is summarized below.

4.2 Findings from Main Channel Dredging/Capping

4.2.1 Attainment of Objectives

Dredging/capping in the main channel and adjacent northern side slope area was conducted to:

- Evaluate dredging as a remedial option to reduce the potential risk that may be posed by future ice jam-related sediment scour events by removing a targeted area of sediments with elevated PCB concentrations in an area of the river that is known to be subject to ice jam-related scour;
- Develop site-specific information related to dredging effectiveness, dredging residuals, dredging production rate, and sediment resuspension that can be used in the development of the revised AA Report;
- Evaluate construction issues pertaining to placement of a cap over the dredged area; and
- Evaluate the potential for incoming clean sediments from upstream of the lower river to provide containment for any residuals that may remain after dredging.

These objectives were partially attained. The ROPS provided a critical evaluation of dredging and post-dredge capping and produced substantive site-specific information related to the effectiveness of dredging and its performance characteristics. The extent of removal targeted in the ROPS Work Plan (Alcoa, February 2005) was not accomplished. The reasons for this are detailed in Section 3 and key points are summarized below. Additionally, the relatively high PCB concentration in post-dredging residual sediments necessitated complete capping of the dredged area, preventing an evaluation of the ability of incoming clean sediments to contain post-dredging residual PCBs. This objective may still be attained by monitoring the ability of incoming clean sediments to cover and contain residual PCBs present in the surface of the post-dredge cap.

Overall, the operational and environmental monitoring data collected through implementation of the ROPS has furthered the understanding of the effectiveness and implementation issues associated with dredging and placement of a post-dredge cap as potential remedial option(s) in the lower Grasse River.

4.2.2 Implementability

Dredging and dredging-related activities included boulder and debris removal, dredging, sediment processing, water treatment, and disposal. Implementation of these activities presented some operational challenges; however, the responses to these challenges provided additional knowledge regarding site-specific characteristics of the river and information related to the impact of changes in approach to operational effectiveness. Modifications were made to the boulder and debris removal operations and dredging activities based on both operational and monitoring data (e.g., dredge slurry, water column, and probing data, etc.) including use of different equipment and approaches. Adjustments were made based on obstacles encountered in the field in an effort to achieve the ROPS objectives and complete as much of the ROPS scope (as defined in the ROPS Work Plan [Alcoa, February 2005]) as possible within the allowable construction season, as well as minimize impacts to the surrounding environment potentially resulting from construction. Principal among these adjustments was the decision to focus efforts on the first of the three work zones that constitute the main channel dredge area (i.e., Work Zone 1).

Difficult site conditions negatively impacted dredging productivity and the ability to remove all PCB-containing sediment. Dredge operations (i.e., effective dredge time) fluctuated greatly due to a combination of factors, including the continual damage to and movement of the silt curtains due to elevated river flows and forces from pressure waves, an irregular river bottom with rocks, boulders and bedrock outcrops present in portions of the work zone, and damage to the dredging equipment during sediment removal. Other factors that are more characteristic of typical dredge operations (e.g., time needed to move the dredge from one location to another, full processing tanks, inclement weather) also contributed to delays and work stoppages.

Prior to encountering hard bottom in mid- to late August, dredge operations with the horizontal auger occurred about 11 hours per day (on average) with an average effective dredge productivity rate of about 38 cy/hr (410 cy/day). These metrics declined as the dredge began to encounter hard bottom. In the last two weeks of

operation of the horizontal auger dredge, dredge operations occurred about 5 hours per day with an average effective dredge productivity rate of about 20 cy/hr (135 cy/day). The average effective dredge time and effective productivity rate for the ROPS were 9 hours and 30 cy/hr (330 cy/day), respectively.

Sediment processing operations were performed successfully, although the capacity to dewater sediments using the filter presses was at times a rate limiting step in the dredging process. Several adjustments were made in the river and on the MPP in an attempt to increase the solids content of the dredge slurry and the flow-through capacity of the system. One such adjustment was the implementation of an innovative technology (i.e., Geotubes) to provide additional dewatering capability during times when filter press operations could not receive slurry discharge. There was no down time due to dewatering when using the Geotubes for alternative slurry discharge. Improvement in effective time using the Geotubes was significant. Unfortunately, these adjustments had little impact on dredge production rates, although some improvements were noted.

Residual sediments with elevated PCB concentrations remain in most locations despite significant efforts at removal. An average of 16 in of PCB-containing sediments remain in Work Zone 1 containing an average post-dredging surface PCB concentration of 150 ppm and a depth-weighted average concentration of about 80 ppm (relative to pre-dredge surface and depth-weighted PCB concentrations of 4.1 ppm and 270 ppm, respectively). On average, 84% of the PCB mass was removed from the expanded Work Zone 1.

The residual sediments were successfully capped using mechanical equipment at an average placement rate of 41 cy/hr (range of 27 to 54 cy/hr). Measurements of apparent cap thickness in cores taken post-capping and paired sediment elevation measurements from multibeam bathymetry surveys conducted before and after capping indicate that the cap ranges in thickness from 0.5 to 2.5 ft (average of 1.5 ft). Thus, the desired cap thickness was attained overall, but the variability in thickness exceeds the design-specified range of 1.0 to 1.5 feet. Placement of the cap material in a single lift, however, resulted in greater entrainment of PCBs within the in-place cap (relative to cap placement over native [un-dredged] sediments during the 2001 CPS). Approximately 82% of the 136 individual in-place cap material samples (from 15 cores) contained detectable PCBs, much higher than the 5% observed after capping of native (un-dredged) sediments during the 2001 CPS (Alcoa, April 2002). Placement of the cap in two lifts may help to reduce the extent of contamination within the cap by limiting the mixing/entrainment to the material placed in the first lift.

Results of water quality monitoring conducted during the work indicated that the operating in an area containing high PCB concentration sediments presented challenges in meeting the water column action level for PCBs, despite the fact that flows in the river during the ROPS were higher than typical. As discussed previously, a high percentage of the PCBs observed in the water column were in soluble form and, therefore, could not be contained by silt curtains.

Silt curtains were effective in diverting river flow around the work zone and in trapping resuspended solids. About 60 to 80% of the river flow moved past the work zone in the bypass channel that comprised about 20% of the river cross-section. When the curtains were in-place as designed, water clarity immediately outside the curtains was not visually different than the clarity upstream of the work area or in the bypass channel. The effectiveness of the curtains in trapping resuspended sediments was compromised by frequent displacement and tearing of the curtains. These difficulties appear to have been caused by hydrodynamic forces attributable to waves generated by the lock operations in the St. Lawrence River and high flow events that occurred during the ROPS.

4.2.3 Short-Term Effectiveness

4.2.3.1 Community and Worker Impacts

Community-related impacts stemming from the ROPS construction activities were minimal. Two complaints regarding odor concerns were received from local citizens during the dredging and landfilling activities; however, in both instances, air monitoring information and prevailing wind direction indicated these odors were not associated with the ROPS activities. No other community-related concerns were reported during the ROPS.

Two of the four recordable injuries which occurred during the project were associated with dredging and dewatering related activities. A third occurred during pre-dredging equipment set up.

4.2.3.2 Environmental Impacts

4.2.3.2.1 Release of Sediments to the River

During sediment and debris removal activities, the net TSS flux downstream averaged about 1,500 kg/d. This flux represents about 10% of the baseline flux entering the ROPS area from upstream during the ROPS. In contrast, the average net TSS flux downstream during post-dredge capping was about 19,000 kg/d, substantially greater than both the baseline flux and the dredging/debris removal flux. The factor of 12 higher rate of TSS release downstream during post-dredge capping activities may be associated with the placement of cap material during periods of relatively high river flow (average of 2,300 cfs versus an average of 1,100 cfs during debris and sediment removal activities). This is consistent with observations during the 2001 CPS, where TSS losses downstream were significantly impacted by elevated flow conditions (Alcoa, April 2002). The results of these two studies suggest that TSS losses are correlated with river flow conditions during the conduct of the work.

4.2.3.2.2 Release of PCBs to the River

Near-Field Transport

PCBs were transported downstream of the silt curtain containment system. This transport was facilitated by the 20 to 40% of the river flow that moved through the ROPS area. PCB concentrations at the near-field monitoring station downstream of the silt curtain system ranged as high as 9.229 µg/L. Most of the PCBs lost to downstream were in the dissolved form, although some fraction of the particulate bound PCBs escaped the containment system, as evidenced by the similar PCB concentration on particles inside and immediately downstream of the containment system and the correlation between particulate PCB concentrations immediately downstream of the containment system (estimated from unfiltered PCB data, TSS data and site-specific PCB partition coefficients) and PCB concentrations on processed dredge material (i.e., filter cake).

PCB Loss Downstream

Approximately 102 kg of PCBs were transported downstream during the ROPS sediment debris and sediment removal activities. Based on the PCB mass balance conducted for the in-river activities, this PCB loss downstream represents about 3% of the total PCB mass in the sediments that were removed from the river. Dissolved PCBs comprised about 69 to 89% of the total PCBs measured downstream.

A correlation exists between the PCB flux at the downstream stations and filter cake PCB data; higher PCB fluxes generally coincide with higher filter cake PCB concentration, while lower PCB fluxes generally coincide with lower filter cake PCB concentrations. The PCB fluxes could not be correlated with debris removal activities due to the variability of the operation and lack of specific information on PCB concentrations and depths encountered during the work; the apparent response at the downstream stations to operational changes in debris removal activities suggests that debris removal contributed to the downstream loss of PCBs. Overall, the correlations between PCB flux downstream of the ROPS work zone and filter cake PCB concentration suggests the PCBs measured downstream of the work zone largely represent releases to the water column during sediment removal activities.

The average net PCB flux downstream of the work zone during main channel/northern near shore area post-dredge capping was estimated at about 0.6 kg/d. This net PCB transport is about 40% lower than the 1.0 kg/d estimated to be the average net flux during debris and sediment removal activities.

4.2.3.2.3 Impacts to Biota

PCB levels measured in three resident fish species in fall 2005 after about 3 months of dredging and debris removal indicate that PCB releases associated with these activities caused an increase in fish PCB levels. Smallmouth bass and brown bullhead had PCB concentrations 2 to 4 times higher than those measured in 2004. YOY spottail shiner collected near Outfall 001 and the Unnamed Tributary had PCB levels 5 to 6 times higher than those measured in 2003 and 2004. The most dramatic increase in PCB concentration occurred for YOY spottail shiner at the confluence with the St. Lawrence River, where the average lipid-normalized PCB concentration in 2005 was 25 times higher than that from 2004.

4.2.4 Long-Term Effectiveness

4.2.4.1 Residual Risk

After cap placement in the main channel dredge area, PCB levels in the surface sediments (i.e., the cap) averaged 7.4 ppm, a reduction of about 95% relative to post-dredging conditions. This percentage reduction by capping is similar to that obtained when native sediments were capped during the 2001 CPS (92% immediately after cap placement [Alcoa, April 2002] and 97% one year after cap placement [Alcoa, September 2003]).

PCBs were detected in approximately 82% (112 of 136) of the cap samples obtained from the 15 cores collected after capping, much higher than that observed during the 2001 CPS where only 5% of the individual cap material samples collected immediately after cap placement contained detectable levels of PCBs (Alcoa, April 2002). Seven of these cores contained detectable PCBs throughout the entire cap (0.07 to 96.3 ppm). Contamination of the upper layers of the cap may have been a consequence of the relatively high PCB concentrations in the residual sediment being capped in conjunction with the physical characteristics of this material and the placement of the cap in a single lift. In most cores, the highest PCB concentration in the cap was measured in the bottom 2 in of the cap, which is indicative of mixing of the underlying sediments and the relatively clean cap material during placement. The PCB concentration in the bottom 2 in of the cap averaged about 16% of the PCB concentration in the residual sediments being capped. The extent of contamination of the cap exhibited no correlation to the location within the work zone, physical and chemical characteristics of the underlying sediments, or cap thickness.

4.2.5 Cost

A total of about 24,400 cy (in-situ) of debris and sediment were removed from the main channel area at a cost of about $18,551,895, or $760/cy (in-situ). This estimate includes mobilization and demobilization, dredging, containment, sediment processing, water treatment, Geotube study, disposal, monitoring, and project management costs. Post-dredge capping of the main channel area totaled about $783,820 (not including associated mobilization/demobilization, project management, QA/QC, containment, and monitoring costs), or about $160,000/acre (adjusted; see Section 3.6).

4.3 Findings from Near Shore Dredging/Capping

4.3.1 Attainment of Objectives

Dredging/capping in the northern near shore area was implemented to:

- Develop site-specific information on the effectiveness and implementability of removal in near shore areas for use in the development of the revised AA Report; and
- Evaluate habitat impacts and recovery in near shore areas which have been dredged and capped.

The first objective was satisfied by the generation of data regarding the nature of the sediment and debris contained within it, the ability of the mechanical excavator to remove both, and the reduction in PCB concentrations attainable by the type of removal and capping activities conducted in the northern near shore area. Quantitative information on the efficacy of the silt curtain containment system was not obtained because of the dominance of the main channel dredging and capping activities on downstream water quality (which occurred concurrently with the northern near shore construction activities).

The second objective will be addressed by post-construction monitoring that will be conducted in 2006 and subsequent years. This monitoring will track the re-colonization of the post-dredge cap by benthic biota, stability of the cap, and the physical and chemical composition of the cap.

4.3.2 Implementability

Hydraulic dredging was planned for the northern near shore area. A visual inspection of the area prior to the initiation of the work indicated the presence of significant woody debris (logs and timbers) and the presence of some rock. Based on this information, coupled with the shallow water nature of the area, the limited cut depth, and access issues, the contractor elected to conduct the work using an open bucket mechanical excavator on a spud barge. Vertical control of the depth of cut was hampered by the variability of the sediment surface elevation and debris. Initial efforts at visual control of the depth of cut by the operator yielded considerable variability around the target cut line and had to be supplemented by manual surveying. As a result of efforts to compensate for the impacts of sediment elevation variability and debris, considerable over-excavation occurred. The average depth of removal, which was targeted to be 1 ft, averaged 1.5 ft and almost twice the design removal volume was taken from the river (1,600 cy vs. 800 cy).

The removal action succeeded in taking out the PCB inventory present in the work zone and leaving relatively low residual PCB concentrations. The average concentration in grab samples collected to characterize the residuals after removal and prior to cap placement was 1.9 ppm, ten times lower than the average pre-dredge PCB concentration of 19 ppm. The site conditions encountered in this area during implementation were much different from the main channel area with significantly lower pre-dredge PCB concentrations and the absence of

significant obstructions and hard bottom conditions within the target cut depth (1 ft). The residual sediments were capped successfully using mechanical equipment at an average placement rate of about 20 cy/hr (range of 7 to 33 cy/hr).

Silt curtains were effective in isolating the work zone. Because of the relatively low velocities in this area and the small size of the containment system, the curtains functioned as designed and did not incur the kind of damage that was observed on the main channel silt containment system. The effectiveness of the curtains in preventing downstream loss of resuspended sediments and PCBs cannot be assessed because near-field monitoring was not conducted and the far-field monitoring stations reflected releases from the main channel dredging and capping operations which were being performed concurrently with the northern near shore area activities. Visual inspection suggested that the curtains were effective in containing resuspended sediments, an expected result given that the fact that the curtains extended from the water surface to the river bottom which was possible to do in this location because of the shallow water depths and limited impact of river currents proximate to the shoreline.

4.3.3 Short-Term Effectiveness

4.3.3.1 Community and Worker Impacts

No community- or worker-related impacts were reported during northern near shore construction activities.

4.3.3.2 Environmental Impacts

As indicated above, an assessment of the environmental impacts resulting from the northern near shore activities cannot be performed since construction activities in the northern near shore and main channel areas were conducted concurrently. However, given the limited area and shorter duration of activities in this area, and the lower PCB concentrations in this area relative to the main channel, environmental impacts associated with the dredging/capping in the northern near shore are likely minor.

4.3.4 Long-Term Effectiveness

4.3.4.1 Residual Risk

After completion of capping, PCB levels in the surface of the cap averaged 0.24 ppm, a PCB concentration reduction of about 87% relative to post-dredging conditions. Overall, the post-capping surface PCB concentration is 99% lower than the average PCB concentration in the northern near shore area prior to initiation of the work, which was 19 ppm.

4.3.5 Cost

A total of about 1,600 cy (in-situ) of debris and sediment were removed from the northern near shore area at a base construction cost of about $424,860 (not including associated mobilization/demobilization, project management, QA/QC, containment, and monitoring costs). Post-dredge capping in this area totaled about $117,940 (not including associated mobilization/demobilization, project management, QA/QC, containment, and monitoring costs). Unit costs for the northern near shore are under development.

4.4 Findings From Near Shore Thin-Layer Capping

4.4.1 Attainment of Objectives

Thin-layer capping in the southern near shore area was implemented to:

- Develop site-specific information on the effectiveness and implementability of thin-layer capping near shore areas for use in the development of the revised AA Report; and
- Evaluate habitat impacts and recovery in near shore areas that have been capped.

The first objective was satisfied by the generation of data regarding the ability to place a thin-layer cap, the efficacy of that cap in isolating the PCB-containing sediments, and the water quality impacts associated with cap placement.

The second objective will be addressed by post-construction monitoring that will be conducted in 2006 and subsequent years. This monitoring will track the re-colonization of the thin-layer cap by benthic biota, stability of the cap, and the physical and chemical composition of the cap.

4.4.2 Implementability

A single lift of cap material was applied using the same equipment as used for the thicker caps installed in the dredged areas to successfully place a thin layer of material. Thickness estimates from manual elevation measurements indicate an average cap thickness of about 0.4 ft (range of 0.3 to 0.5 ft), which is within the target cap thickness of 0.3 to 0.5 ft (3.6 to 6.0 in). Five of the six sediment cores collected during post-construction monitoring in 2005 contained cap material; cap material was not observed in core SNS2-S. The average cap thickness for these five cores was 0.25 ft (range of 0.17 to 0.33 ft, or 2 to 4 in).

4.4.3 Short-Term Effectiveness

4.4.3.1 Community and Worker Impacts

No community- or worker-related impacts were reported during thin-layer capping activities.

4.4.3.2 Environmental Impacts

4.4.3.2.1 Release of Solids to the River

TSS levels indicate some solids release around the work zone as levels at the local monitoring station were slightly higher than those measured upstream and downstream of the capped area. However, these releases did not have any measurable impact outside of the immediate vicinity of the work zone.

4.4.3.2.2 Release of PCBs to the River

No PCB releases were detected during the thin-layer capping activities.

4.4.3.2.3 Impacts to Biota

Thin-layer capping occurred after the resident fish sampling event was conducted, so the effects of these activities on fish PCB levels were not assessed. However, given the absence of detectable PCB releases during thin-layer capping, this activity could not have provided a significant contribution to the increases in fish PCB levels that were observed during the ROPS.

4.4.4 Long-Term Effectiveness

4.4.4.1 Residual Risk

The average PCB concentration at the cap surface (excluding a single core that did not contain cap material) was 0.06 ppm. This concentration is 99% lower than the baseline concentration of 8.3 ppm (range of 0.4 to 36.5 ppm). In all but one of the cores, the surface layer PCB concentration was near or below the detection limit. The single core that apparently did not contain cap material had a surface PCB concentration of 3.34 ppm. Inclusion of this core with the other cores yields a post-cap average PCB concentration of 0.60 ppm at the cap surface (a 93% reduction relative to baseline conditions).

Within the cap, no PCBs were detected in 4 of 7 cores. In the 3 cores containing detectable PCBs in the cap material, concentrations ranged from 0.12 to 0.33 ppm.

4.4.5 Cost

Total costs for thin-layer capping in the southern near shore area were estimated at about $38,350 (not including associated mobilization/demobilization, project management, QA/QC, containment, and monitoring costs), with a unit cost of about $150,000/acre (adjusted; see Section 3.6).

4.5 Findings From Armored Capping

4.5.1 Attainment of Objectives

Placement of an armored cap in the main channel was conducted to:

- Evaluate constructability issues related to placing an armored cap in the river channel; and
- Evaluate the ability of an armored cap to withstand estimated forces from potential future ice jam events (through a laboratory physical model).

The principal constructability issue that the armored capping pilot was designed to address pertains to the ability of the underlying sediments to support the weight of the cap. Ancillary issues relate to the ability to place the layers that comprise the cap and the rates at which this placement takes place. The ROPS was successful in evaluating all of these issues and provided information needed to evaluate armored capping as a remedial alternative.

The second objective will not be attained through the development of a laboratory physical model. It is the judgment of the ice and sediment transport experts that such a model would not provide data translatable to the river because of scaling issues related to turbulence and sediment erosive properties. However, the successful

installation of the armored cap, coupled with the ice, hydraulics, and turbulence modeling work conducted in support of the armored cap design, support the feasibility of this approach as a long-term remedial option for areas of the river subject to ice jam-related scour.

4.5.2 Implementability

The base, filter and armor layers were placed with acceptable accuracy. The average placement rate of 19 cy/hr (range of 8 to 39 cy/hr) was considerably lower than was achieved during the capping of dredged areas. This is attributed to the need to use partially loaded buckets to lay down layers less than 1 ft thick and difficulty in picking up the heavy stone used as the armor layer.

In-place cap thickness estimates obtained by manual elevation measurements indicated that the armored caps were within the 2.1- to 3.1-ft (upstream half) and 1.7- to 2.7-ft (downstream half) target thickness. Multibeam bathymetry measurements collected prior to and after cap construction indicate an average cap thickness of 1.89 ft (22.7 in) in the upstream half of the cap area and 1.33 ft (16 in) in the downstream half of the cap area. These measurements do not account for consolidation of underlying sediments that would cause the estimated thicknesses to underestimate the actual thicknesses.

4.5.3 Short-Term Effectiveness

4.5.3.1 Community and Worker Impacts

No community- or worker-related impacts were reported during armored capping activities.

4.5.3.2 Environmental Impacts

4.5.3.2.1 Release of Solids to the River

PCB and TSS transport during armored capping can only be assessed for 7 of the 22 days of construction activities since debris and sediment removal activities were occurring concurrently with armored cap construction on 15 of the 22 days of operations. TSS levels at the near-field downstream station averaged about 5.8 mg/L during this period, and are slightly higher than those measured at the upstream (5.5 mg/L) and further downstream stations (5.4 mg/L), suggesting that some solids were released during armored cap construction. These TSS levels are lower than those observed during post-dredge capping in the main channel area (7.4 mg/L and 6.5 mg/L at the near-field and far-field downstream stations, respectively).

4.5.3.2.2 Release of PCBs to the River

PCB concentrations at all near-field and far-field locations were generally below the method detection limit throughout armored capping, with the exception of two days in which detectable levels were relatively low. Thus, there was little PCB release during the capping activities.

4.5.3.2.3 Impacts to Biota

Armored capping occurred after the resident fish sampling event was conducted, so the effects of these activities on fish PCB levels were not assessed. However, given the general lack of detectable PCB releases during armored capping, this activity could not have provided a significant contribution to the increases in fish PCB levels that were observed during the ROPS.

4.5.4 Long-Term Effectiveness

4.5.4.1 Residual Risk

No measurements of PCBs within the armored cap were made, but it is expected that the surface armor layer contained little, if any, PCB immediately after placement. The principal residual risk pertains to the ability of the armored cap to withstand the forces that occur during an ice jam. Given the nature of the design, this risk is presumed to be small.

4.5.5 Cost

Total costs for armored capping in the main channel were estimated at about $332,960 (not including associated mobilization/demobilization, project management, QA/QC, containment, and monitoring costs), with a unit cost of about $458,000/acre (adjusted; see Section 3.6).

4.6 Lessons Learned

4.6.1 Refinement of the Conceptual Site Model

The CSM was largely confirmed by the information generated during the ROPS. New insights that refine the CSM relate to sub-bottom conditions in the river, the extent of debris present within and underlying the sediments targeted for removal, and the significance of the pressure waves induced by St. Lawrence River lock operation as forces on remedial action containment systems.

The information gained in the 1995 NTCRA in the vicinity of Outfall 001 and the from the in-river surveys of the impact of the 2003 ice jam on river sediments indicated that the PCB-containing sediments in these areas were underlain by rocks, cobbles and boulders. The ROPS dredging demonstrated that such conditions may be a more common feature of the river than previously thought, and appear to increase in complexity downstream of Outfall 001 in the form of an uneven, highly irregular bottom. The prior dredging of the river in the early 1900s to increase the hydraulic capacity of the river likely contributes to the variability and complexity of bottom conditions at the site. The inability to conduct sub-bottom profiling, which was attempted both prior to and following sediment removal work, precludes a complete understanding of the site sub-bottom conditions. These conditions also complicate efforts to characterize site conditions, such as the depth of contamination, due to the observed variability.

Debris in the form of rocks, cobbles, and boulders was encountered in much of the area subject to debris removal and dredging. Some of this debris was removed through a perforated clamshell bucket and a fabricated debris removal rake. Other debris was either too large for the debris removal equipment, inaccessible to the debris removal equipment (e.g., buried in the native stratigraphy), or missed by the debris removal operations.

About 1,500 cy of debris was removed from the river, accounting for approximately 5.5% of the 26,000 cy of sediment and debris removed from the river. In addition to rocks and boulders, the debris includes a diverse collection of materials, including rubbish such as tires, lumber and trees.

The main channel silt curtains suffered extensive and ongoing damage that was primarily due to high flows and pressure waves. Similar damage was inflicted on the silt curtains during the 2001 CPS in the absence of high flows, and while this was recognized and considered in the design of the ROPS containment system, the design modifications employed were not successful in preventing damage to the containment system. The pressure wave phenomenon both added significant costs to the ROPS and increased worker safety risks associated with the project due to the need for daily diving operations for the duration of the project. Thus, it appears that pressure waves are a significant force that must be properly accounted for in the design of future containment systems.

4.6.2 Establishing Dredge Cut Depth

Sediment probing, manual cores, and vibracores collected during the ROPS dredging activities after several feet of sediment had been removed indicated that the actual depth of contamination in some areas was at variance with the pre-work estimated depths as established by sediment probing. The probing measurements were used to set the target dredging cut lines for the ROPS program. From an operational perspective this did not impact the conduct of the dredging operations as dredging was conducted down to the point where hard bottom conditions were encountered and numerous repeated dredge passes were made in a concerted effort to remove the remaining materials. Additionally, vibracore sampling was implemented once this issue was recognized to address the limitations of the probing measurements.

Based on the identification of the elevation corresponding to the bottom of the PCB-containing sediments and the top of glacial till, 65 to 73% of the 2004 and 2005 baseline probing depths used to set the dredge cut line deviate from the elevation defining the bottom of the PCB-containing sediments by more than 6 in, with 38 to 46% deviating by more than 12 in. The inaccuracy of the baseline estimates appear to be most significant in thick sediment deposits. Additional sediment sampling is planned in 2006 for areas outside of the ROPS area to better understand the relationship between probing-based and core-based estimates of PCB-containing sediment thickness in other reaches of the river.

The ability to establish dredge cut lines is hampered also by the spatial variability that exists in the elevation of the boundary between PCB-containing sediments and underlying strata. This variability is evidenced by variations in the elevation of this interface along transects through the ROPS dredge area that are shown in Figures 3-34 through 3-36. It is also evidenced by variations in the DoC elevation of, on average, 0.65 ft (range of 0.02 to 2.27 ft) that occur over distances of a few feet that were observed among cores taken at the same grid node at various times through the ROPS (Table 4-1). Operational consequences related to the spatial variability in the depth of contamination coupled with the presence of debris and hard bottom conditions include: 1) the potential for areas of contaminated sediments to exist below an established dredge cut line due to spatial variability and practical limitations in pre-work sampling coverage; and 2) the potential for establishment of a dredge cut line which results in the targeted removal of a significant quantity of clean material and/or material that cannot be excavated using conventional dredging techniques due to site bottom conditions.

4.6.3 Estimating Removal Volume

Multibeam surveys are highly accurate and comparisons of pre- and post-removal elevation data provided the best estimate of the actual volume of material removed from the main channel area during the ROPS.

Comparison of sediment elevation changes between pre-removal and post-removal surveys indicates that approximately 24,400 cy (21,000 to 27,800 cy considering measurement uncertainty of 0.31 ft) of sediment and debris were removed from Work Zones 1 and 2 (26,000 cy considering volume of material removed from northern near shore area). However, other methods yielded comparable estimates of removal volumes for the ROPS; the process mass balance of the solids collected on the MPP and in the Geotubes yielded a reasonably accurate result of 28,500 cy (30,100 cy considering volume of material removed from northern near shore area). Cost and turn-around-time associated with the use of multibeam survey techniques support that the use of this technology should be limited to instances where critical information gaps exists and alternative suitable methods are not available.

4.6.4 Impact of Sub-Bottom Conditions on Implementability of Dredging

Difficult site conditions negatively impacted dredge productivity and the ability for the selected dredge plan to remove all PCB-containing sediment. Significant amounts of sediment and PCB remain in the work zone, even after numerous attempts to remove these sediments, including the modification to equipment operation and equipment type, were made. Repeated attempts to remove these remaining sediments were met with limited success; removal volumes were low in comparison to those achieved in the early phases of the program, dredge down time was significant, and productivity rates, in general, were low. Multibeam bathymetry information and diver videotape footage collected during the ROPS indicates the river bottom is irregular with boulders and/or rock outcrops present in some portions of the work zone; these features are likely responsible for the inability to remove sediments in some areas and can also limit the ability to define the depth of contamination targeted for removal. In this scenario, the residual sediments would be interspersed in the discontinuities between the top elevations of these features. As discussed previously, this scenario could not be confirmed due to the difficulties encountered with the sub-bottom profiling technology even after several feet of sediment were removed.

Alternative dredging technologies were evaluated on a limited basis during the ROPS. The cutterhead dredge was used over a period of 10 days in both areas which had been subjected to a significant number of dredging passes by the horizontal auger and in an area where relatively thick deposits of soft sediment remained. The cutterhead did not provide an observable improvement in the removal of remaining sediments in areas that had been previously dredged or in the level of productivity relative to the horizontal auger. The mechanical dredge was used on a very limited basis and, therefore, it is difficult to draw conclusions related to its performance. However, the bottom conditions at the site would be expected to impact the effectiveness of this removal technology as well. Specific considerations in this regard include difficulties in the ability to access the remaining sediments in view of the bottom conditions at the site (presence of rocks/boulders, hard bottom, and irregular bottom conditions) as well as the potential for increased resuspension related to difficulties in achieving bucket closure under these site conditions. A final consideration for all of the dredging technologies is limitations in the ability to characterize the DoC in view of the site bottom conditions. Further discussion related to alternative dredges is provided in Section 4.6.5.

4.6.5 Effect of Alternative Dredging Technologies on Implementability of Dredging

The selection of the contractor and dredging equipment for the site was presented in Section 1.5. In summary, the horizontal auger dredge used for the majority of the site work was recommended by the selected contractor based on their prior experience in the remediation of sediment sites coupled with site condition information provided by Alcoa. Additional information that was considered in the process included the level of experience and results of other sediment remediation work conducted by the contractor, use of similar equipment for both the NTCRA and a previous sediment remediation project on the St. Lawrence River, and the ability to successfully manage all of the other elements in the areas of safety, sediment processing, water treatment,

compliance with water quality action levels, community impacts, etc. that are required to conduct a project of this nature.

As described in Section 3.2.6.3, the site bottom conditions limited the ability of the dredging equipment that was actually used on site to remove a portion of the targeted sediments. The site conditions at the start of dredging were identified as loose fine grain silt and clay sediment (less than 0.7 mm) and loose river sand sediment over denser native sediment composed of glacial deposits, boulders and rock. The elevation of loose sediment was determined by probing as had been done for the NTCRA, with the understanding that it was a reasonable measure of the depth of PCB-containing sediments overlying the hard bottom materials. Difficulties were observed in some areas of the river during the conduct of the ROPS, with the use of probing to provide a reproducible and accurate measure of the DoC. These difficulties led to the DoC in some portions of the ROPS area being underestimated at the outset of the project, and resulted in the use of vibracoring as a sediment sampling approach for the latter portion of the project.

The loose sediment depth (the native sediment elevation) was not as uniform across the ROPS area as was interpreted from the probing. Rock outcroppings, boulders and dense native sediment existed throughout the ROPS area at varied bed elevations within the dredge cut prism. The presence of a significant area of rock, boulders and dense sediment within the dredge cut, coupled with the variability in the depth in the top of native sediment elevation, were the primary factors which limited the ability of the horizontal auger to remove the PCB-containing sediments which remained at the conclusion of the ROPS.

The dredge types used on site included an auger head dredge (hydraulic dredge) with cables, a basket cutterhead dredge (hydraulic) with spuds, and a small bucket dredge (mechanical) on a spud barge. The hydraulic dredges operate by moving along the dredge cut with cables (auger head dredge) or swing across the dredge cut (basket cutter with spuds) removing loose sediment to a constant elevation. The initial dredging by the auger head dredge was started on the surface layers at elevations where less rock, boulders and dense native sediment existed in the dredge prism. The surface areas with rock and boulder material increased as the dredge lowered the cut elevation. Debris removal operations were conducted ahead of the dredging operations in an effort to minimize the impacts of the bottom conditions on the effectiveness of the dredge, but the operation was not able to effectively remove a significant portion of the rocks and boulders encountered due to the extent, size, and nature of the materials, with some of the rock and boulders appearing to be embedded in the denser native sediments.

The rock and dense sub-surface material impacted the dredge capability for removal and positioning, and as the work progressed the dredges proceeded to become less efficient in sediment delivery, the capability to maintain a precise cut positioning as the dredge moves along the cut (horizontal auger), and depth of removal as each lift was completed. The barge size and horsepower of the dredges employed could also be a limiting factor in the density of materials which can be removed by the dredge. However, a fundamental consideration with respect to the use of hydraulic dredges (horizontal auger or cutterhead) at this site is that they cannot excavate rock, boulders and dense native sediments which exist at elevations above and proximate to the target removal depth. Therefore, the use of a larger hydraulic dredge with active cutterhead (auger, basket. or bucket wheel), would be expected to achieve similar results with respect to the degree of effectiveness achieved in the removal of contaminated sediment and associated residual levels.

The mechanical dredge evaluation was based on the use of the 0.5-cy fixed arm bucket for removal of contaminated sediment. This was implemented at the end of the ROPS work period. The bucket was a small bucket, and the mechanical dredge was limited in capability to remove dense sediment by the size of the bucket. Additionally, the work was conducted without the use of an electronic positioning system to track and control the bucket horizontal and vertical position. A fixed arm mechanical dredge, with larger bucket and state-of-the-art electronic positioning of the bucket, could only have provided an increase in the dredge production rate

(cy/hr) while dredging the surface sediments. Removal of boulders up to 3 to 4 ft diameter would also be possible.

A significant increase in volume of removal by a larger mechanical dredge (2- to 3-cy bucket) equipped with state-of-the-art positioning of the bucket, would not be expected based on the bottom conditions encountered at the site. Specific considerations in this regard include the variability and uncertainty associated with the DoC as it impacts the establishment of the dredge cut line, the impact of boulders and other irregular hard bottom features on the ability to access the targeted sediments, the impact of these same conditions on dredging productivity, and the impact of hard bottom features on the ability to achieve bucket closure, with the latter issue potentially impacting both the degree of residuals as well as the ability to meet in-river water quality criteria during the conduct of the work.

As discussed previously the presence of these types of bottom conditions have been identified as factors which can limit the ability to remove contaminated sediments via dredging (USEPA, December 2005). The rock, boulder and dense native sediment conditions at the ROPS site limited the success of contaminated sediment removal by the dredging technology applied. These same bottom conditions will limit the implementability of any existing alternative dredge technology.

4.6.6 Control of PCB Releases During Dredging/Capping

The estimated mass of PCBs released and transported downstream during the study was 102 kg. A comparison of downstream PCB flux levels during periods when both debris removal and dredging were occurring versus periods when dredging alone occurred indicates that a significant portion of the downstream flux was attributable to the dredging operations. Time series comparisons between downstream PCB flux levels and PCB levels in the filter cake derived from dredging operations, and correlations between estimated particulate PCB concentrations at location D4 and filter cake PCB concentrations also support this finding. However, the apparent response at the downstream stations to operational changes in debris removal activities made in response to elevated downstream PCB concentrations suggest that debris removal did contribute to the downstream loss of PCBs. Analysis of filtered and unfiltered samples collected during the ROPS indicates that the majority of the PCBs released downstream (66 to 89%) were in soluble form.

The cutterhead dredge released more solids to the water column than did the horizontal auger. Although the horizontal auger released more PCBs than the cutterhead, this appears to be a consequence of the greater PCB concentration in the sediments dredged.

A primary finding related to the observed water quality monitoring results from the study is that the rate of production for debris removal/dredging at the site could be limited by the need to comply with the water quality action level for PCBs. Despite significant efforts in the study planning to address resuspension, the water quality action level was exceeded 8 times over the course of the ROPS with a single dredge and single piece of debris removal equipment in operation. As discussed previously, a majority of the PCBs released downstream were in soluble form and, therefore, were not contained by the silt curtain system.

The PCB releases to the water column during ROPS dredging activities caused a significant increase in fish tissue PCB levels. Increases in PCB levels (relative to 2004) were observed in all three fish species; 2- to 4-fold increases in average lipid-normalized PCB levels were observed in smallmouth bass and brown bullhead, while 5- to 25-fold increases were observed in YOY spottail shiner.

4.6.7 Post-Dredging Residual PCB Contamination

The main channel dredging was unable to attain low surface sediment PCB concentrations despite multiple dredge passes. The post-dredging surface sediments are a mix of residual disturbed sediments and untouched inventory. As discussed previously, features such as rocks and boulders prevented the dredge from reaching sediments at lower elevations.

4.6.8 Overall Project PCB Mass Balance

Approximately 2,800 kg and 500 kg of PCBs were removed from Work Zones 1 and 2, respectively. These removal estimates represent about 84% and 30% of the target PCB masses for Work Zone 1 and Work Zone 2, respectively (note, in an effort to maximize dredging in Work Zone 1, dredging in Work Zone 2 was terminated before dredging had progressed to hard bottom). All of the targeted PCB mass in the northern near shore area was removed during the ROPS as the objective for this area was to remove the top 1 ft of sediments. Overall, about 3,300 kg (66%) of the 5,000 kg of targeted PCB mass were removed during the ROPS. About 3% of the total PCB mass removed from the river bottom was lost downstream (i.e., about 100 kg). Between 1.0 and 1.2 kg of PCBs were estimated to have been lost to the atmosphere.

4.6.9 Addressing Post-Dredging Residuals by Capping

Capping was shown to be an effective means of reducing surface sediment PCB concentrations. Differences were observed in the level of PCBs entrained in the cap between areas which had been dredged (main channel) and areas which had not been dredged (southern near shore and 2001 CPS). For the main channel area where the cap was placed post-dredging, a single lift of 1 ft thickness appears to be capable of achieving about a 95% reduction in PCB concentration.

It is expected that placing a 1 ft cap in 0.5 ft lifts will achieve greater concentration reductions in areas which have been previously dredged. Moreover, the use of multiple lifts may reduce the spatial variability in cap thickness that occurred with a single lift. The necessity of multiple lifts in areas which have been dredged depends on the PCB concentration of the sediments being capped. In areas with relatively low PCB concentrations, a single lift may be sufficient to achieve the desired target PCB concentration. Results of the 2001 CPS indicated that placement of a cap in a single 1 ft lift over an area which had not been dredged did not result in any significant entrainment of PCBs in the cap material.

4.6.10 Attaining Specified Cap Thickness

The protocol employed in the field to address cap deficiencies (i.e., add or remove cap material so that the in-place target cap thickness was achieved) only considered an area proximate to the affected grid node and, as a result, did not address deficiencies between grid node locations. Adjustments to the cap over a larger area around each affected grid node (e.g., half the distance between adjacent grid nodes) would have resulted in a greater percentage of the work zone having a cap within the prescribed 1.0- to 1.5-ft thickness. Although the comparison of multibeam surveys provides the most accurate estimation of sediment elevation differences (and, thus, cap thickness), this technology is not amenable for use during cap construction since it cannot provide real-time measures of cap thickness; that is, the time needed to collect, process and interpret the data would require construction crews to remain inactive for days and/or weeks, depending on the size of the capped area. Further, costs associated with the conduct of multiple multibeam surveys for this purpose would be prohibitive. Daily

surveys using a single beam fathometer and DGPS would provide the real-time data needed to improve control of cap material placement throughout the work zone.

PCBs and TSS were released during the main channel post-dredge capping activities. The PCB transport downstream of the work zone during these activities were about 40% lower, on average, than those during sediment and debris removal activities. However, TSS losses downstream were much higher than those during debris and sediment removal activities. The greater loss of TSS, but not PCBs, suggests the solids measured downstream likely consisted of cap material that escaped the work zone during placement and not the resuspension and release of PCB-containing sediments. The higher flows experienced during the post-dredge capping activities likely contributed to the loss of solids from the work zone.

4.6.11 Project Costs

The total cost to implement the ROPS was approximately $20.2 million, not including the cost for construction of Cell 3 at the Secure Landfill. This overall cost included approximately $19.9 million related to dredging and capping efforts in the main channel and northern near shore (including all mobilization/demobilization, containment, monitoring and project-management related costs), approximately $333,000 for placing the armored cap, and $40,000 for placing the thin-layer cap in the southern near shore area. Considering these costs in terms of each area addressed results in the following approximate unit costs:

- Main Channel (dredging, dewatering, and disposal): $760/cy (in-situ)
- Main Channel (post-dredge capping): $160,000/acre
- Armored Capping: $458,000/acre
- Southern Near Shore (thin-layer capping): $150,000/acre

Note: Northern near shore unit costs for dredging/capping are still under development.

An estimated area-based unit cost for the main channel dredging can also be developed from the ROPS cost information based on the volumetric unit cost presented above, the volume of sediment removed from expanded Work Zone 1 where the majority of the dredging activity was focused, and the approximate 4.1-acre footprint for expanded Work Zone 1. This calculation provides a per acre dredging, dewatering, and disposal cost of approximately $3.8 million/acre during the ROPS inclusive of mobilization/demobilization, monitoring, and project management. This estimate would vary depending on the depth of sediment targeted for removal in conjunction with other factors such as opportunities to increase production rates and the level of effort employed to address PCB residuals. Further refinement of these costs will be conducted in support of the revised AA Report.

4.7 Summary

The ROPS was successful in a variety of ways despite the numerous difficulties encountered during the work. First, significant information was developed regarding the uniqueness and complexity of the site conditions as they relate to the implementability and effectiveness of long-term remedial options. The additional site-specific knowledge gained during 2005 will be important in the development and assessment of potential long-term remedial options.

Second, progress was made in the river, as a significant quantity of PCB-containing sediments was removed from an area of the river that is prone to ice jam-related scour. Residual PCBs were effectively isolated under caps, and a wealth of new site-specific monitoring data was collected.

Third, a wide variety of response actions were undertaken in an effort to both understand and address new project-related issues as they were identified. This included efforts related to maintaining the silt curtains, developing a better understanding of site bottom conditions, increasing dredging productivity while continuing to remove remaining PCB-containing sediments in the work area, and optimizing the sediment dewatering process. Even though many of these actions met with limited success, the information developed will be useful in formulating and evaluating long-term remedial options for the river.

Fourth, it is clear that potential remedial options that include a dredging component will need to be developed considering the tradeoffs that exist among issues such as:

- production rates and resuspension control;
- dredging productivity and level of effort necessary to address residual PCBs, particularly in view of the site bottom conditions;
- cost and effort to maintain a complex containment system, considering its effectiveness in preventing (or minimizing) downstream releases of soluble PCBs during removal activities;
- environmental benefits and impacts of dredging, particularly related to residual PCB levels in the surface sediments and observed PCB levels in fish; and
- the impacts of many of these factors as they relate to maintaining a safe work environment while balancing the project goals, efficiency, schedule, and cost.

Finally, it appears that a variety of cap configurations can be placed successfully in different areas of the river. The implementation of capping operations on the lower Grasse River was not affected by any of the tradeoffs that were identified above associated with the dredging operations. There is room for improvement with respect to achieving the targeted cap thickness across the entire cap area, and the longer-term monitoring efforts will be used to verify that the caps continue to effectively isolate PCB-containing sediments. The assessment of potential remedial options involving capping as part of the revisions to the 2002 AA Report will need to include consideration of the issue of ice jam-related scour for the section of the river that is prone to this phenomenon. In addition to the armored cap evaluated as part of the ROPS, an evaluation of both short- and long-term management options for ice-related impacts is ongoing.

The primary goal of a final remedy for the lower Grasse River is to lower PCB concentrations in the surface sediments to reduce PCB levels in fish. The results of the ROPS program as they relate to the effectiveness of the various remedial approaches employed in achieving this objective will be a primary consideration as the 2002 AA Report is revised and long-term remedial options for the river are developed and evaluated. The substantial site-specific experience gathered to date indicates that efforts to reduce PCB concentrations in surface sediments through removal are inherently difficult due to the unique, complex site conditions in the lower Grasse River coupled with the challenges associated with the construction implementation tradeoffs as described above.

5. References

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Tables

Table 1-1
Overview of ROPS Components

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Component	Location	Surface Area [1] (acres)	Length of Shoreline [1] (ft)	In-Situ Volume Removed [2,3] (cy)	Volume of Cap Material Placed [2,4] (cy)
Main channel dredging/capping [5]	Vicinity of T7 – main channel and adjacent northern side slope area	6.7	NA	24,400	11,600
Northern near shore dredging/capping	Between T6 and T7 – northern near shore	0.5	700	1,600	1,700
Southern near shore thin-layer capping	Between T8.5 and T9.5 – southern near shore	0.4	500	NA	300
Main channel armored capping	Between T15 and T16 – main channel	1.0	NA	NA	2,600
	Total:	8.6	1,200	26,000	16,200

Notes:
1. Surface area and length of shoreline are approximate and representative of the actual area addressed.
2. Volumes presented are the actual quantity removed/placed.
3. The in-situ volume removed for each component was estimated by comparing the following:
   - Main channel: pre-dredging (2003 survey) and post-dredging (October 22, 2005 for Work Zone 1 and upsteam portion of Work Zone 2; September 30, 2005 for downstream portion of Work Zone 2) multibeam bathymetry survey results; and
   - Northern near shore: pre-dredging (April 2005) and post-dredging (August 17-22, 2005) sediment elevation measurements.
4. The volume of cap material placed for each component was estimated by comparing the following:
   - Main channel: post-dredging/pre-capping (October 22, 2005 for Work Zone 1 and upsteam portion of Work Zone 2; September 30, 2005 for downstream portion of Work Zone 2) and post-capping (November 18, 2005) multibeam bathymetry survey results;
   - Northern near shore: post-dredging/pre-capping (August 17-22, 2005) and post-capping (September 22-23/November 1-7, 2005) sediment elevation measurements;
   - Southern near shore: pre-capping (April 2005) and post-capping (November 15-17, 2005) sediment elevation measurements; and
   - Main channel (armored cap area): pre-capping (September 13, 2005) and post-capping (October 22, 2005) multibeam bathymetry survey results.
5. Original extent of dredging/capping area was reduced as described in Section 2.

cy = cubic yards
ft = feet
NA = not applicable

Table 2-1
Summary of IQAT Forms and Distribution

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Form #	Title	Purpose	Responsible Party	Distribution Mechanism	Comments
ENVIRONMENTAL DATA DOCUMENTATION					
1	Water Column Monitoring	Documentation of daily water column sampling events pre-, during-, and post-construction	BBL	Hard copy filed in construction trailer	Data collected in field via PDA and downloaded on to web portal with information distributed electronically to QEA for inclusion in ROPS database (Appendix B) and completion of Form 8A; forms filed include a print out of the PDA download (containing the same information as Form 1 of the IQAT Plan [Alcoa, March 2005], but in a different format)
2A	Air Monitoring for PCB Samples (Obtained from USEPA Method TO-4A)	Documentation of high volume PCB air sampling events pre- and during-construction	BBL	Hard copy filed in construction trailer	Pertinent data (e.g., calibration data, run times, data file numbers, etc.) for DustTrak and PID meters logged in bound field books (stored with BBL)
2B	Air Monitoring for PAH Samples (Obtained from USEPA Method TO-13A)	Documentation of high volume PAH air sampling events pre- and during-construction	BBL	Hard copy filed in construction trailer	
2C	Air Monitoring for VOC Samples (Obtained from USEPA Method TO-15)	Documentation of high volume VOC air sampling events pre- and during-construction	BBL	Hard copy filed in construction trailer	
3	Main Channel Sediment Sampling - Following Production/Cleanup Pass	Document during-construction sediment sampling	BBL	Hard copy filed in construction trailer	Approach to dredging altered to eliminate production pass/cleanup pass approach; pertinent data recorded in bound field books and information distributed electronically to QEA for inclusion in ROPS Database (Appendix B); modification of Form 3 (Form 3A) utilized for northern near shore sampling
4	Cap Material Sampling	Documentation of during-construction cap material sampling for the sand/topsoil layer	BBL	Hard copy filed in construction trailer	
5	Sediment Probing/Elevation Measurements	Documentation of during-construction sediment probing and elevation measurements	BBL	---	Data compiled in field via PDAs and downloaded on to web portal with information distributed to QEA for inclusion in ROPS Database (Appendix B); throughout the project figures were progressively generated in the field showing the progress of dredging and capping operations
6	Wastewater Treatment Sampling Documentation	Documentation of weekly sampling and analysis for PCB and TSS	CDM	Hard copy filed in construction trailer	
7	Dredge Material Stockpile Sampling	Documentation of during-construction dredge material sampling	BBL	Hard copy filed in construction trailer	
---	Geotube Field Notes	Documentation of filtrate and sediment sampling associated with Geotubes	BBL	---	Information recorded in bound field books (stored in BBL field trailer)
DECISIONAL DOCUMENTATION					
8A	Daily Water Data Summary	Provides a summary of information contained in Form 1 along with laboratory results and an assessment of corrective action triggers	QEA	Distributed via email to Agencies as data became available	Adapted version of Form 8 of the IQAT Plan (Alcoa, March 2005) to accommodate timing of data receipt from air and water laboratories
8B	Air Monitoring Data Summary - Expanded Sampling Event	Used to report field and laboratory data associated with high volume sampling for PAHs, PM_{10}, VOCs and associated PCBs as well as wind direction and speed	QEA	Distributed via email to Agencies as data became available	Adapted version of Form 8 of the IQAT Plan (Alcoa, March 2005) to accommodate timing of data receipt from air and water laboratories
8C	Continuous Air Monitoring Data Summary	Used to report field and laboratory data associated with daily during-construction air monitoring for dust and PCBs (weekly) as well as wind direction and speed	QEA	Distributed via email to Agencies as data became available	Adapted version of Form 8 of the IQAT Plan (Alcoa, March 2005) to accommodate timing of data receipt from air and water laboratories
8D	Weekly Summary of Dredge Return Water Discharge and Internal Process Sample Results	Used to report field and laboratory data associated with wastewater treatment sampling (Form 6)	QEA	Distributed via email to Agencies as data became available	Form added after completion of IQAT Plan (Alcoa, March 2005)
9	Dredging Subunit Data Summary	Intended to report data associated with Phase 1 and 2 decision tree	---	---	Form eliminated from use due to changes in dredging approach (see Section 2.3)
9B	Dredge Material Stockpile Data Summary	Used to report laboratory data associated with during-construction dredge material sampling (Form 7)	QEA	Distributed via email to Agencies as data became available	Form added after completion of IQAT Plan (Alcoa, March 2005)

Table 2-1
Summary of IQAT Forms and Distribution

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Form #	Title	Purpose	Responsible Party	Distribution Mechanism	Comments
OPERATIONAL DOCUMENTATION					
10	Daily Report	Summary of health and safety, construction activities, and noise and light monitoring	CDM	Hard copy filed in construction trailer	
11	Mass Balance Method of Determining In-Situ Volume of Sediments Removed	Daily summary of volume/mass associated with various dredging processes	CDM	Hard copy filed in construction trailer	Form altered from IQAT Plan (Alcoa, March 2005) to accommodate additional information and processes (e.g., Geotubes)
12	Cap Material Placement Documentation	Daily summary of cap material placed by ROPS component	CDM	Hard copy filed in construction trailer	Form altered from IQAT Plan (Alcoa, March 2005) to accommodate additional information
DISPOSAL DOCUMENTATION					
13	Waste Placement/Field Grid Contents Summary	Tracking source, disposal location, and degree of compaction for material placed in the SLF	CDM	Hard copy filed in construction trailer	
14	Landfill Cap Material Placement/Field Density Summary	Documentation of field moisture/density testing of sand placed between the waste and geomembrane	CDM	Hard copy filed in construction trailer	Form was replaced by the Troxler Moisture-Density Test Log
15	HDPE Cap Panel Numbers	Documentation of geomembrane panel dimension and manufacturer's roll number for each panel placed	CDM	Hard copy filed in construction trailer	Form was replaced by the Panel Placement Sheet
16	HDPE Field Seaming Log	Documentation of panel seaming and non-destructive testing data	CDM	Hard copy filed in construction trailer	Form was modified and replaced by the 60-mil HDPE Geomembrane Field Seaming Log
17	HDPE Repair Report Log	Documentation of non-destructive testing of repairs performed	CDM	Hard copy filed in construction trailer	Form was replaced by the 60-mil HDPE Geomembrane Vacuum Testing Log
18	Secure Landfill Cell 3 Operations Quality Control Daily Inspection Report	Daily checklist of landfill operations parameters	CDM	Hard copy filed in construction trailer	
19	Secure Landfill Cell 3 Operations Quality Control Weekly Inspection Report	Weekly checklist of landfill conditions	CDM	Hard copy filed in construction trailer	
CORRECTIVE ACTION DOCUMENTATION					
20	Corrective Action Documentation	Identified need and action taken to mitigate corrective action situation	---	---	Corrective actions discussed with Agency personnel and documented in weekly meeting minutes and various emails
OTHER DOCUMENTATION					
--	Silt Curtain Inspection Logs, Daily Dredge Reports, Process Logs	Document silt curtain inspection results, and summarize dredging and sediment processing data	CDM, Sevenson	Hard copy filed in construction trailer	Forms not originally included in IQAT Plan (Alcoa, March 2005)

Notes:
BBL = Blasland, Bouck & Lee, Inc.
CDM = Camp Dresser & McKee
DustTrak = DuskTrak meter
HDPE = high density polyethylene
IQAT = Independent Quality Assurance Team
IQAT Plan = Independent Quality Assurance Team Plan (Alcoa, March 2005)
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PDA = personal digital assistant
PID = photoionization detector
PM_{10} = particulate matter less than 10 microns
QEA = Quantitative Environmental Analysis, LLC
ROPS = Remedial Options Pilot Study
Sevenson = Sevenson Environmental Services, Inc.
SLF = Alcoa's Secure Landfill
TSS = total suspended solids
USEPA = United States Environmental Protection Agency
VOC = volatile organic compound

Reference:
Alcoa Inc. (Alcoa). March 2005. *Independent Quality Assurance Team Plan* .

Table 2-2
Documentation of Waste Volumes Disposed in Secure Landfill Cell 3

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Waste Source	Uncompacted Waste Volume [1] (cubic yards)	Compacted Waste Volume [2] (cubic yards)
Grasse River		
Filter Cake and Sand	12,285	9,785
Filter Cake	2,760	2,199
Cyclone-Separated Sand	5,745	4,577
Geotube Sediment	1,155	920
Grasse River Debris	3,015	2,402
River Total	**24,960**	**19,883**
Residuals		
Pad and Containment Residuals	1,410	1,124
Pump Containment Area Stone	165	131
Residuals Total	**1,575**	**1,255**
Bulking Agents		
Common Fill	660	526
Sand	45	36
Bulking Total	**705**	**562**
Grand Total	**27,240**	**21,700**

Notes:
1. The uncompacted waste volume was determined using truckload tickets.
2. Compacted waste volume was determined by a final field survey of waste material in Cell 3. This survey resulted in a compacted waste volume of 21,700 cubic yards. Based on this total, the reduction in total waste volume due to compaction is 20.3%. Therefore, the truckload volumes for each waste component (i.e., from the river and residuals) were proportionally adjusted to yield the compacted volumes provided in the table.

Table 2-3
Cap Thickness Based on Grid Node Surface Elevation Measurements

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Cap Component		Target Thickness	Average Thickness (ft)[1]	Minimum Thickness (ft)[1]	Maximum Thickness (ft)[1]
Northern Near Shore[2]		Restore to original elevation within +/- 3 in (0.3 ft)	0.0	-0.3	0.3
Work Zone 1		12 in with a tolerance of +6 in (1.0 ft + 0.5 ft)	1.3	1.0	1.5
Work Zone 2		12 in with a tolerance of +6 in (1.0 ft + 0.5 ft)	1.2	1.0	1.5
Armored Cap Area Upstream	Base Layer	6 in with tolerance of +6 in (0.5 ft + 0.5 ft)	0.7	0.5	1.0
	Filter Layer	6 in with tolerance of +3 in (0.5 ft + 0.3 ft)	0.6	0.5	0.7
	Armored Layer	13 in with tolerance of +6 in (1.1 ft + 0.5 ft)	1.3	1.1	1.6
	Total Cap	25 in with tolerance of +12 in (2.1 ft + 1.0 ft)	2.5	2.1	3.1
Armored Cap Area Downstream	Filter 2 Layer	3 in with tolerance of +3 in (0.3 ft + 0.3 ft)	0.4	0.3	0.5
	Filter 1 Layer	3 in with tolerance of +3 in (0.3 ft + 0.3 ft)	0.4	0.3	0.5
	Armored Layer	13 in with tolerance of +6 in (1.1 ft + 0.5 ft)	1.3	1.1	1.6
	Total Cap	19 in with tolerance of +12 in (1.6 ft + 1.0 ft)	2.1	1.7	2.5
Southern Near Shore		3 to 6 in (0.3 to 0.5 ft)	0.4	0.3	0.5

Notes:
1. As described in Section 2.3.6, the actual thicknesses (i.e., average, maximum, and minimum) are provided to the nearest tenth of a ft as the survey rod used to measure water depths (and ultimately calculate cap material thickness) only reads to a tenth of a ft.
2. Values provided under average, minimum, and maximum thickness represent the difference between the original and final elevations.
3. Cap thickness at all grid nodes are shown on Figures 2-19 through 2-23.
3. Protocol for determining cap thickness is detailed in Appendix A.

ft = feet
in = inches

Table 3-1
Environmental Data Library for ROPS-related Monitoring Results

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Survey	Component	Data Table in Appendix B	Other [1]
2003	Multibeam bathymetry surveys	---	Draft CCLGR Addendum
2004 Baseline	Probing/elevation measurements	sed_probe_ROPS	2004 ROPS Baseline Report
	Sediment sampling	sed_aro_ROPS, sed_char_ROPS	
	Water column monitoring	water_aro_ROPS, water_field_ROPS	
	River flow and stage measurements	ChaseMills_ROPS	
	Geotechnical investigation	---	
	Ecological monitoring	benthic_comm_ROPS, fish_comm_ROPS, veg_aquatic_ROPS, veg_floodplain_ROPS	
2005 Baseline	Probing/elevation measurements	sed_probe_ROPS	---
	Water column monitoring	water_aro_ROPS, water_field_ROPS	IQAT Form 8A in Appendix H
	River flow and stage measurements	ChaseMills_ROPS	---
	Air monitoring	air_field, air_realtime_PM10, air_realtime_VOC, air_lab	IQAT Forms 2A thru 2C, 8B & 8C in Appendix H
	Ecological monitoring	benthic_comm_ROPS	Appendix A
During-Construction	Probing/elevation measurements	sed_probe_ROPS	---
	Multibeam bathymetry surveys	---	Appendix O
	OSI Velocity Surveys	---	Appendix P
	Sediment sampling	sed_aro_ROPS, sed_char_ROPS	Appendix N; IQAT Form 3A in Appendix H
	Water column monitoring	water_aro_ROPS, water_field_ROPS	IQAT Form 8A in Appendix H
	River flow and stage measurements	ChaseMills_ROPS	---
	Air monitoring	air_field, air_realtime_PM10, air_realtime_VOC, air_lab	IQAT Forms 2A thru 2C, 8B & 8C in Appendix H
	Ex-situ dredge material sampling	dredge_material_ROPS	IQAT Form 9B in Appendix H
	Effluent discharge monitoring	treated_effluent_discharge_lab_ROPS	IQAT Form 8D in Appendix H
	Geotube sampling	geotube_study_ROPS	Appendix K
	Cap material sampling	cap_material_ROPS	IQAT Form 4 in Appendix H; Appendix J
Post-Construction	Sediment sampling	sed_aro_ROPS, sed_char_ROPS	Appendix N
	Probing/elevation measurements	sed_probe_ROPS	---
	Multibeam bathymetry surveys	---	Appendix O
	Water column monitoring	water_aro_ROPS, water_field_ROPS	IQAT Form 8A in Appendix H
	Ecological monitoring [2]	---	---

Notes:
1. Draft CCLGR Addendum - Alcoa, April 2004; 2004 ROPS Baseline Report - Alcoa, April 2005b; all others refer to 2005 ROPS Documentation Report
2. The post-construction ecological monitoring event was not conducted because ROPS construction was not completed until late fall and thus, would have delayed sample collection until late November/early December when environmental conditions differ from those in September, the month when the 2004 baseline samples were collected. It is anticipated that the first post-dredging/capping benthic sampling event will occur in spring 2006.

Table 3-2
ROPS Data Quality Objectives and Monitoring Components

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Overall Data Quality Objective[1]	Monitoring Objective[1]	Monitoring Component[1,2,3]
ALL COMPONENTS		
Develop refined understanding of the pre-construction physical and chemical conditions within the river areas targeted for possible dredging and/or capping (i.e., main channel, side slopes, near shore areas)	Determine pre-construction sediment depths and/or elevations in all targeted areas	Manual probing/sediment elevation measurements (baseline)
	Document spatial and vertical distributions of PCBs, TOC, bulk density, and grain size in sediments within targeted dredging areas	Sediment core/grab sample collection (baseline)
Determine system-wide impacts of construction activities, if any, on PCB levels in the water column and fish	Document the spatial and temporal variations in water column PCB concentrations and compare to data collected from previous years	Routine water column PCB monitoring (SRS program - 2005)
	Document the spatial and temporal variations in fish tissue PCB concentrations and compare to data collected from previous years	Routine resident fish trend monitoring (SRS program - fall 2005)
DREDGING COMPONENT		
Quantify the downstream transport of PCBs that occurs as a result of dredging activities	Compute net PCB flux transported to lower river during dredging activities	Water column monitoring at upstream, local, and downstream sampling locations (during construction)
Determine PCB levels and sediment volumes that remain after dredging	Determine post-dredging PCB levels and sediment elevations (to estimate volumes)	Manual probing/sediment elevation measurements (baseline, during construction)
	Compare post-dredging sediment PCB concentrations to pre-dredging conditions	Sediment core collection (during construction, post construction)
Assess the relationship between local conditions and post-dredging PCB residual concentrations to the extent possible	Determine post-dredging sediment elevations and PCB concentrations and compare to river bottom characteristics, pre-dredging PCB concentration profiles, other operational parameters	Manual probing/sediment elevation measurements (baseline, during construction)
		Sediment core collection (baseline, during construction)
Determine the effectiveness of post-dredging capping as a means to isolate PCB-containing residual sediment	Determine post-capping PCB concentration profiles in residual sediments/cap	Manual probing/sediment elevation measurements (baseline, during construction, post construction)
	Compare profiles to post-production dredging PCB levels	Sediment core collection (post construction)
Determine impacts of dredging activities, if any, on PCB concentrations in the air	Compare during-construction PCB concentrations in air to baseline conditions	Air monitoring (baseline, during construction)

Table 3-2
ROPS Data Quality Objectives and Monitoring Components

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Overall Data Quality Objective[1]	Monitoring Objective[1]	Monitoring Component[1,2,3]
ARMORED CAP COMPONENT		
Determine the ability of the native sediments to support an armored cap designed to withstand the forces (observed during the 2003 event) imposed by water flowing under an ice jam	Compare post-construction cap surface elevations to pre-capping conditions	Sediment elevation measurements (baseline, during construction, post construction)
	Further evaluate geotechnical properties of sediments in relation to armor cap design	Geotechnical core collection (baseline)
Assess impacts of capping activities, if any, on the downstream transport of PCBs in the water column	Compare during-construction PCB concentrations in water to baseline conditions	Water column monitoring at upstream, local and downstream sampling locations (during construction)
NEAR SHORE AREA COMPONENT		
Quantify the downstream transport of PCBs that occurs as a result of dredging activities and assess impacts of capping activities, if any, on the water column	Compute net PCB flux transported to lower river during dredging activities and compare during-construction PCB concentrations in water to baseline conditions	Water column monitoring at upstream, local and downstream sampling locations (during construction)
Determine the ability of thin-layer capping to isolate PCB-containing sediments in the near shore areas	Compare post-construction cap surface elevations to pre-capping conditions	Sediment elevation measurements (baseline, during construction, post construction)
	Determine vertical PCB profiles in sediment cores and compare to pre-capping conditions	Sediment core collection (post construction)
Document changes in habitat caused by dredging or thin-layer capping in near shore areas	Assess post-construction invertebrate community study results (RBP metrics) and compare to pre-construction conditions	Invertebrate community assessment (baseline, post construction)
	Assess post-construction habitat characteristics and compare to pre-construction conditions	Habitat characterization (baseline, post construction)
Evaluate sedimentation rates in near shore areas of the river	Estimate deposition rates from vertical concentration profiles of PCBs and/or cesium-137	High-resolution sediment core collection (baseline)
	Compare deposition rates to those estimated for main channel samples	
Determine impacts of dredging activities, if any, on PCB concentrations in the air	Compare during-construction PCB concentrations in air to baseline conditions	Air monitoring (baseline, during construction)

Notes:
1. Details on the Data Quality Objectives, monitoring objectives, and monitoring components are provided in Appendix A.
2. A longer-term monitoring program is being developed in coordination with the Agencies pending the results of the monitoring components identified above. This program will be initiated in 2006.
3. In addition to the monitoring components listed above, cap material, water treatment effluent, and dredge material stockpile sampling were performed. Also, meteorological conditions were obtained during construction, as possible.

PCB = polychlorinated biphenyl
RBP = Rapid Bioassessment Protocol
SRS = Supplemental Remedial Studies
TOC = total organic carbon

Table 3-3
2004/2005 ROPS Data Collection Summary

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Media	Number of Sampling Events	Number of Locations	Number of Samples or Measurements [1]	Analyses
2004 BASELINE MONITORING				
Sediment Cores	1	44	318	PCBs, bulk density, moisture content, TOC, grain size
Sediment Elevation/Probing Measurements [2]	2 grid elevation 1 upstream survey/probing	1,156 probing 1,427 elevation 273 probing 557 elevation	1,274 probing 2,850 elevation 273 probing 557 elevation	---
Geotechnical Investigation [3]	1	2	4	Moisture content, grain size, USCS classification, direct shear, standard penetration
Ecological [4]	1	45	53	Invertebrate species composition and biomass, grain size, TOC
2005 BASELINE MONITORING				
Sediment Elevation/ Probing Measurements	1	1,163 probing 1,435 elevation	1,163 probing 1,435 elevation	---
Water Column	2	3 transects	6	PCBs, TSS
Air	3 1	6 6	18 6	PCBs PAHs, PM_{10}, VOCs
Ecological	1	18	18	Invertebrate species composition and biomass, grain size, TOC
2005 DURING-CONSTRUCTION MONITORING				
Water Column [5]	129	up to 3 transects up to 15 local locations	867	PCBs, TSS
Sediment Elevation/ Probing Measurements [6]	continuous	752	continuous	---
Sediment Cores [7]	2 northern near shore 6 main channel	16 northern near shore 94 main channel	16 northern near shore 680 main channel	PCBs, bulk density, moisture content, TOC, grain size
Air [8]	36	up to 7 locations	86 12 18	PCBs PAHs, PM_{10} VOCs
Ex-Situ Dredge Material [9]	32	2	64 56 58	PCBs TOC grain size
Water Treatment Effluent [10]	outfall discharge internal processing	1 4	108 20	pH, TSS, TDS, PCBs, full suite PCBs, TSS
Geotube Sampling [11]	4 Geotube filtrate 11 Geotube sediment 4 Combined filtrate	4 12 ports 4	4 14; 78 4; 1	PCBs, TSS PCBs; percent solids PCBs, TSS; full suite
Cap Material [12]	8	1	8	TOC and grain size
2005 POST-CONSTRUCTION MONITORING				
Sediment Cores	1	29	314	PCBs, bulk density, moisture content, TOC, grain size
Sediment Elevation Measurements	1	389	389	---
Water Column	1	3 transects	3	PCBs, TSS

Table 3-3
2004/2005 ROPS Data Collection Summary

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Grasse River Study Area, Massena, New York

Notes:

1. Count does not include QA/QC samples (i.e., duplicates and matrix spike/matrix spike duplicates). Count does not include replicates of the same samples analyzed for various parameters.
2. Two rounds of measurements were conducted along the grid, with each round including both probing and elevation measurements; the number of measurements include those from both rounds.
3. Moisture content, grain size, and USCS classification analyses were performed on all 4 samples, SPT was performed on the 2 borings locations (which included all sample intervals).
4. Ecological monitoring includes benthic community sampling and aquatic habitat characterization.
5. Water column monitoring was performed at select transects and local monitoring locations depending on the construction activity as described in Appendix A. The number of transects and local water column locations represents the total number of each monitoring location. If stratification was present, samples were collected above and below the demarcation of stratification (i.e., 2 samples). Turbidity measurements (and other parameters) were collected during water column sampling and on other days as requested by the Agencies (e.g., air curtain use, movement of scows, etc.) as described in Section 2 and Appendix A.
6. Sediment elevation/probing measurements were conducted continuously to provide real-time information during construction activities as described in Appendix A. The number of probing and elevation measurements represents the total number of locations within the targeted ROPS areas.
7. Sediment cores were collected during multiple events as described in Appendix A. The number of locations represents the total number of cores collected. Two additional sediment core collection events were completed with cores visually observed (i.e., no samples submiitted for laboratory analysis).
8. Air monitoring included the collection of high volume samples for PCBs daily (transitioning to weekly) during intrusive activities, PAHs and PM_{10}, and VOCs during three events. Dust monitoring also occurred daily and total VOC monitoring occurred during the three events where high volume samples were collected for VOCs using real-time monitoring via meters. Additional details are provided in Appendix A.
9. The filter cake and sand ex-situ material dredge piles were sampled via three grab samples composited into one and submitted initially for PCB analysis only; ECN 009 Revision #1 and Revision #2 resulted in TOC and grain size analysis later in the sampling program.
10. Dredge return water monitoring included collection of samples from the outfall discharge and during the wastewater treatment process (internal processing). Full suite of analyses included total aluminum, total cyanide, total fluoride, and individual PAH analyses. The effluent flow rate was also monitored during days when the outfall was in operation (~daily).
11. Geotube monitoring included collection of filtrate and sediment samples from each of the four Geotubes, and the combined filtrate (sump). Geotube sediment was collected from three ports along each Geotube. Full suite of analyses included total cyanide, pH, fluoride, and SPDES permit analyses.
12. The cap material stockpile was sampled via three grab samples composited into one and submitted for TOC and grain size analysis.

ECN = Engineering Change Notice
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
PM_{10} = particulate matter less than 10 microns
QA/QC = quality assurance/quality control
ROPS = Remedial Options Pilot Study
SPDES = State Pollutant Discharge Elimination System
SPT = Standard Penetration Test
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
USCS = Unified Soil Classification System
VOCs = volatile organic compounds

Table 3-4
Post-Dredging Vibracores (October 22, 2005) with Sediment Classified as Residual Disturbed Sediment Over Untouched Inventory

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Grid Node ID	Start Depth (in)	End Depth (in)	Total PCB Amount (µg/g)	Total Solids (%)	Total Organic Carbon (%)	Bulk Density (g/cm^3)	Grain Size [%]				
							Gravel	Sand	Silt	Clay	d50 (mm)
Work Zone 1											
177	0	3	37.70	77.00	2.50	0.64	N/A	N/A	N/A	N/A	N/A
	3	6	154.00	41.80	0.75	1.30	10.80	69.80	19.20	0.20	0.168
	6	12	17.90	77.40	0.29	1.60	0.20	91.90	7.90	0.00	0.276
	12	18	5.16	82.70	0.18	1.80	40.90	41.60	5.70	11.80	2.970
	18	24	ND	90.40	0.18	1.80	2.70	42.60	48.40	6.30	0.063
	24	30	ND	90.80	0.19	1.90	3.30	42.70	45.50	8.50	0.059
	30	32	ND	90.40	0.12	1.90	11.60	49.00	17.60	21.80	0.153
185	0	3	237.00	41.40	9.10	0.46	2.40	52.20	44.60	0.80	0.084
	3	6	86.00	65.20	4.10	0.95	1.30	79.10	18.60	1.00	0.212
	6	12	40.60 (0.92)	76.60 (81.60)	1.00 (1.40)	1.10 (1.30)	1.50 (1.10)	87.10 (87.80)	9.00 (11.10)	2.40 (0.00)	0.199 (0.243)
	12	15	36.10	75.80	0.32	1.20	26.60	68.40	4.10	0.90	0.300
	15	21	15.10	80.40	0.40	1.20	34.30	31.20	27.00	7.50	0.468
	21	27	1.70	74.20	0.23	1.70	19.30	33.40	40.50	6.80	0.100
	27	29	ND	82.70	0.45	1.50	24.60	36.10	23.50	15.80	0.204
265	0	3	111.00	48.40	4.00	0.73	0.60	69.10	27.30	3.00	0.130
	3	6	9.48	82.90	0.45	1.50	0.40	92.90	6.30	0.40	0.252
	6	12	4.65	93.20	0.39	1.50	52.20	46.90	0.90	0.00	5.190
	12	18	3.65	90.80	0.54	1.50	39.30	58.70	2.00	0.00	3.450
	18	24	0.13	86.70	0.32	1.50	38.40	58.90	2.70	0.00	2.910
	24	30	0.11	80.40	0.19	1.70	2.30	56.60	27.00	14.10	0.121
	30	36	ND	90.50	0.24	1.80	0.50	53.40	41.60	4.50	0.088
	36	42	ND	84.80	0.11	1.80	1.00	59.40	39.20	0.40	0.139
	42	49	ND	85.70	0.23	1.60	0.00	51.80	44.40	3.80	0.080
273	0	3	41.60	40.30	2.40	0.51	0.40	56.70	42.90	0.00	0.087
	3	6	43.60	42.10	1.70	0.52	0.30	56.60	40.80	2.30	0.089
	6	12	20.10	61.10	0.96	0.80	2.20	69.20	25.70	2.90	0.135
	12	18	7.88	57.10	0.22	0.80	1.20	71.10	25.20	2.50	0.137
	18	24	5.71	60.60	0.51	0.85	0.40	68.80	30.80	0.00	0.118
	24	29	23.50	58.10	0.99	0.68	0.00	58.20	40.20	1.60	0.089
	29	32	3.58	76.70	0.98	1.30	3.30	82.60	13.20	0.90	0.289
	32	38	ND	77.60	0.20	1.10	4.40	86.70	4.40	4.50	0.337
	38	42	ND	73.90	0.28	1.00	0.00	74.80	22.00	3.20	0.269
	42	48	ND	79.80	0.16	1.30	2.20	93.40	2.60	1.80	0.416
	48	55	ND	80.10	0.14	1.40	0.00	94.90	3.60	1.50	0.359
	55	59	ND	75.40	0.70	1.40	5.10	61.40	31.40	2.10	0.213
	59	66	ND	75.10	0.44	1.30	0.50	96.60	2.70	0.20	0.416
335	0	3	305.00	36.40	4.30	0.49	4.10	49.40	46.50	0.00	0.081
	3	6	280.00	55.70	1.50	0.70	8.80	60.80	28.20	2.20	0.168
	6	11	142.00	71.50	0.81	1.10	2.70	80.60	15.80	0.90	0.314
	11	17	13.90 (17.30)	91.90 (88.40)	0.31 (0.61)	1.50 (1.60)	23.90 (29.50)	73.50 (67.70)	2.60 (2.80)	0.00 (0.00)	1.650 (2.020)
	17	23	0.08	63.30	0.37	0.97	0.60	14.20	79.70	5.50	0.049
	23	26	ND	62.70	0.47	0.91	3.60	8.70	87.40	0.30	0.054
	26	32	ND	69.20	0.32	1.10	12.80	42.40	44.80	0.00	0.251
	32	36	ND	80.80	0.30	1.40	35.40	35.70	23.20	5.70	1.090
343	0	3	86.20	36.80	2.40	0.40	N/A	N/A	N/A	N/A	N/A
	3	6	87.10	51.60	0.84	0.56	0.10	74.90	25.00	0.00	0.146
	6	8	9.86	78.30	0.27	1.40	0.00	90.30	9.70	0.00	0.212
381	0	5	128.00	26.20	17.00	0.25	N/A	N/A	N/A	N/A	N/A
	5	10	26.00	81.80	0.23	1.40	9.80	83.40	5.40	1.40	0.424
	10	16	ND	93.00	0.24	1.90	8.20	49.10	42.70	0.00	0.130
	16	22	ND	91.70	0.10	2.00	13.20	46.90	39.90	0.00	0.151
	22	28	ND	87.60	0.08	2.00	15.20	46.20	38.60	0.00	0.161
	28	33	ND	89.20	0.12	1.90	8.20	38.70	46.20	6.90	0.065
418	0	3	73.00	79.60	0.50	1.40	1.90	80.60	16.60	0.90	0.254
	3	6	19.20	89.50	0.20	1.80	25.40	65.80	8.80	0.00	0.801
	6	12	0.67 (1.11)	92.00 (90.60)	0.18 (0.30)	2.10 (1.70)	37.00 (14.20)	46.40 (61.80)	14.00 (23.60)	2.60 (0.40)	1.080 (0.355)
	12	18	ND	94.40	0.12	1.70	45.90	44.00	7.80	2.30	4.190
	18	24	ND	94.10	0.47	1.90	67.10	24.10	8.30	0.50	11.500
422	0	3	163.00	46.60	4.30	0.65	0.00	62.20	32.60	5.20	0.102
	3	6	101.00	60.30	1.60	0.85	1.40	76.50	18.50	3.60	0.150
	6	12	10.60 (11.60)	83.60 (87.90)	0.60 (0.54)	1.40 (1.50)	33.20 (35.70)	61.10 (59.00)	5.70 (5.30)	0.00 (0.00)	0.990 (0.969)
	12	18	ND	92.20	0.33	1.40	4.50	51.70	35.40	8.40	0.100
	18	20	ND	93.10	0.21	1.50	37.50	31.10	27.00	4.40	0.300

(continued)

Table 3-4
Post-Dredging Vibracores (October 22, 2005) with Sediment Classified as Residual Disturbed Sediment Over Untouched Inventory

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Grid Node ID	Start Depth (in)	End Depth (in)	Total PCB Amount (µg/g)	Total Solids (%)	Total Organic Carbon (%)	Bulk Density (g/cm^3)	Grain Size [%]				
							Gravel	Sand	Silt	Clay	d50 (mm)
488	0	3	37.60	64.20	1.70	0.95	0.40	66.90	28.40	4.30	0.111
	3	7	38.90	67.60	0.29	1.10	0.50	72.20	27.30	0.00	0.124
	7	10	2.54	86.70	0.21	1.50	14.70	70.30	15.00	0.00	0.335
	10	15	0.08	91.70	0.07	1.90	10.00	58.80	25.60	5.60	0.211
	15	16	ND	86.80	0.12	1.40	3.00	89.10	7.90	0.00	0.551
	16	19	ND	91.10	0.08	1.80	3.70	47.10	47.40	1.80	0.078
490	0	3	598.00	46.80	4.40	0.52	0.40	32.70	66.90	0.00	0.061
	3	6	307.00	56.60	0.38	0.73	0.20	43.60	56.20	0.00	0.069
	6	11	119.00	68.90	2.20	0.92	1.20	63.50	35.30	0.00	0.108
	11	14	14.10	89.70	0.39	1.60	20.90	69.70	7.50	1.90	0.786
	14	21	0.48	92.20	0.21	1.80	7.80	45.60	44.90	1.70	0.089
494	0	3	487.00	40.20	8.10	0.52	2.70	66.80	30.50	0.00	0.174
	3	6	655.00	51.80	4.80	0.73	4.20	77.60	15.30	2.90	0.272
	6	12	13.10	86.80	0.23	1.70	36.60	53.00	9.90	0.50	0.630
	12	18	0.06	88.70	0.21	1.70	1.20	33.30	65.50	0.00	0.064
	18	24	ND	90.10	0.11	2.00	0.60	62.20	30.20	7.00	0.158
	24	30	0.05	91.30	0.12	1.90	3.80	60.10	30.40	5.70	0.157
	30	36	0.07	95.90	0.24	1.80	14.70	52.70	26.30	6.30	0.190
498	0	3	281.00	39.50	1.50	0.47	0.00	43.50	56.50	0.00	0.068
	3	6	261.00	43.10	1.80	0.55	1.10	56.20	42.70	0.00	0.087
	6	12	113.00	59.80	1.00	1.00	0.40	76.30	22.40	0.90	0.185
	12	14	45.20	75.30	0.42	1.30	0.80	84.30	4.30	10.60	0.232
	14	20	8.73	85.30	0.14	1.70	26.60	64.40	2.80	6.20	0.578
	20	26	0.07	93.00	0.14	1.80	22.80	44.90	32.30	0.00	0.249
	26	32	ND	92.00	0.18	1.90	37.10	37.20	20.70	5.00	0.609
	32	38	ND	91.10	0.11	1.60	43.90	31.00	25.10	0.00	0.825
	38	44	ND	90.80	0.22	1.60	1.60	40.90	54.50	3.00	0.055
561	0	3	328.00	53.90	3.30	0.71	0.30	40.40	59.30	0.00	0.065
	3	6	318.00	56.40	2.40	0.73	0.00	40.20	59.80	0.00	0.065
	6	10	156.00	75.10	0.68	1.20	0.00	64.80	34.30	0.90	0.124
	10	17	28.40	82.30	0.34	1.50	11.30	75.00	13.70	0.00	0.227
	17	23	0.32	90.90	0.23	1.80	12.40	50.90	27.80	8.90	0.187
	23	29	ND	88.90	0.16	1.60	13.70	46.50	37.40	2.40	0.129
	29	36	ND	90.90	0.20	1.70	36.30	31.40	29.80	2.50	0.233
572	0	3	299.00	43.10	3.10	0.53	1.40	61.50	37.10	0.00	0.104
	3	6	1160.00	34.80	1.50	0.40	0.70	53.50	41.70	4.10	0.082
	6	10	222.00	55.70	2.30	0.70	0.80	65.00	34.00	0.20	0.111
	10	12	27.90	77.00	0.71	1.30	0.00	85.10	14.90	0.00	0.200
	12	17	4.87 (5.37)	86.90 (86.00)	0.24 (0.20)	1.30 (1.50)	4.30 (9.40)	90.90 (90.00)	4.80 (0.60)	0.00 (0.00)	0.398 (0.398)
	17	23	0.51	92.70	0.76	1.40	55.80	42.50	1.70	0.00	5.840
	23	28	0.07	92.70	0.11	1.70	58.90	39.50	1.60	0.00	6.400

Notes:
1. Units: Total PCB = micrograms/gram, Bulk Density = grams/cubic centimeter, d50 = millimeters
2. Samples with PCB concentrations below the detection limit are shown as 'ND'.
3. Duplicate values are shown in parenthesis.
4. 'N/A' = Not Available; Grain size testing could not be performed as each sample was made up of organic matter.
5. Grey shaded portions represent the Residual Disturbed Sediments (RDS).
PCBs = polychlorinated biphenyls
d50 = diameter at which 50% of material passes through sieve

Table 3-5
Post-Dredging Vibracores (October 22, 2005) with Sediment Classified as Untouched Inventory

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Grid Node ID	Start Depth (in)	End Depth (in)	Total PCB Amount (µg/g)	Total Solids (%)	Total Organic Carbon (%)	Bulk Density (g/cm^3)	Grain Size [%]				
							Gravel	Sand	Silt	Clay	d50 (mm)
Work Zone 1											
175	0	3	145.00	53.50	3.30	0.83	1.40	65.70	32.70	0.20	0.125
	3	6	51.90	61.30	3.20	0.75	1.00	77.30	21.70	0.00	0.192
	6	12	43.60	65.30	2.60	1.20	1.30	80.10	17.60	1.00	0.237
	12	18	18.40 (22.10)	73.80 (72.80)	1.60 (1.20)	1.10 (1.20)	5.20 (4.70)	81.10 (82.80)	6.80 (9.10)	6.90 (3.40)	0.256 (0.265)
	18	24	22.70	72.80	2.00	1.20	9.80	74.70	15.50	0.00	0.240
	24	30	4.48	89.30	0.35	1.70	4.30	43.70	45.00	7.00	0.069
181	0	3	388.00	34.90	7.60	0.38	0.60	50.70	47.80	0.90	0.077
	3	6	248.00	50.30	3.80	0.59	0.50	63.80	34.50	1.20	0.100
	6	12	103.00 (97.20)	60.90 (63.80)	2.50 (2.20)	1.00 (1.00)	6.60 (7.20)	74.30 (75.10)	18.00 (16.90)	1.10 (0.80)	0.277 (0.296)
	12	14	68.90	70.00	0.54	1.10	13.00	59.40	27.10	0.50	0.156
	14	20	79.30	54.40	4.80	0.50	N/A	N/A	N/A	N/A	N/A
	20	26	47.50	20.20	14.00	0.21	N/A	N/A	N/A	N/A	N/A
	26	29	23.20	50.90	2.10	0.65	N/A	N/A	N/A	N/A	N/A
257	0	3	6.59	92.00	0.21	1.50	31.80	66.90	1.30	0.00	2.900
	3	6	5.12	94.20	0.28	1.50	45.00	53.90	1.10	0.00	4.040
	6	12	5.74	91.60	0.26	1.60	36.40	62.40	1.20	0.00	3.090
	12	17	0.17	90.60	0.27	1.60	30.00	68.10	1.90	0.00	2.380
	17	23	ND	89.10	0.11	1.50	29.30	69.50	1.20	0.00	2.010
	23	30	ND	88.80	ND	1.50	10.80	87.40	1.80	0.00	0.830
	30	35	ND	87.50	0.15	1.60	28.80	52.50	9.90	8.80	0.312
	35	41	ND	88.20	0.26	1.90	24.70	17.10	45.60	12.60	0.043
	41	47	0.06	88.30	0.15	1.80	3.00	37.50	45.60	13.90	0.027
	47	53	ND	88.20	0.17	1.90	5.80	35.40	45.90	12.90	0.036
	53	57	ND	89.80	0.23	1.90	15.90	37.60	30.20	16.30	0.101
261	0	4	4.65	87.50	0.62	1.60	38.80	54.60	6.60	0.00	3.030
	4	6	0.70	71.40	0.38	1.10	1.60	13.00	56.70	28.70	0.010
	6	12	0.09	77.70	0.68	1.40	11.10	20.00	40.80	28.10	0.012
	12	15	ND	73.60	0.32	1.50	1.10	28.50	48.60	21.80	0.032
	15	21	ND	85.70	0.32	1.90	4.20	45.80	44.70	5.30	0.075
	21	27	ND	88.60	0.26	1.70	8.00	50.10	34.40	7.50	0.113
	27	33	ND	86.50	0.09	1.50	4.90	60.20	34.90	0.00	0.130
	33	36	ND	90.60	0.11	1.90	1.00	61.20	36.10	1.70	0.141
	36	42	ND (ND)	84.40 (88.20)	0.10 (0.11)	1.50 (1.50)	0.40 (0.20)	74.30 (73.60)	20.80 (26.20)	4.50 (0.00)	0.182 (0.187)
	42	48	ND	85.70	0.19	1.50	0.00	89.80	6.70	3.50	0.260
	48	54	ND	88.90	0.33	2.00	0.10	57.70	41.40	0.80	0.123
	54	57	ND	91.70	0.32	1.80	1.40	56.60	34.40	7.60	0.120
298	0	3	228.00	59.70	1.80	0.90	1.70	72.20	23.10	3.00	0.170
	3	6	186.00	58.40	2.10	0.86	3.80	77.50	17.50	1.20	0.264
	6	12	97.00	75.40	1.00	1.20	10.40	76.10	10.60	2.90	0.357
	12	15	24.50	73.80	1.40	1.20	16.20	66.30	12.80	4.70	0.402
	15	21	0.09	80.90	0.17	1.40	10.50	34.20	45.10	10.20	0.063
	21	27	0.08	89.50	0.07	1.60	6.00	47.20	42.10	4.70	0.089
	27	33	0.08	82.80	-0.10	1.70	8.70	46.10	38.40	6.80	0.097
	33	39	ND	90.70	0.25	1.90	23.70	40.10	27.20	9.00	0.200
	39	45	ND	91.20	0.18	2.00	19.50	48.70	25.00	6.80	0.237
331	0	3	2.89	79.90	0.33	1.40	0.00	84.90	15.10	0.00	0.173
	3	6	2.70	78.90	0.29	1.40	0.00	87.30	6.40	6.30	0.186
	6	12	1.93	80.70	0.27	1.40	0.00	89.30	4.70	6.00	0.185
	12	16	1.47	82.90	0.97	1.30	1.00	89.10	9.80	0.10	0.209
	16	21	ND	54.90	0.96	0.73	0.10	56.00	43.90	0.00	0.091
	21	27	ND	71.00	0.66	1.30	0.90	86.00	10.80	2.30	0.289
	27	33	ND	75.30	0.57	1.30	0.40	92.20	4.80	2.60	0.380
	33	39	ND	73.60	1.40	1.20	0.00	85.50	11.10	3.40	0.308
339	0	3	84.20	82.00	0.78	1.30	9.50	84.90	5.60	0.00	0.437
	3	6	54.90	79.10	0.79	1.40	11.20	81.60	6.80	0.40	0.490
	6	12	71.50 (60.00)	77.60 (82.20)	1.40 (1.90)	1.20 (1.20)	39.00 (40.60)	56.90 (54.50)	3.40 (3.80)	0.70 (1.10)	2.060 (2.330)
	12	15	100.00	54.70	2.40	1.30	10.20	51.30	38.50	0.00	0.104
	15	17	51.20	62.80	0.52	0.79	8.50	59.80	31.70	0.00	0.191
	17	20	2.49	88.80	0.20	1.70	16.40	78.00	5.60	0.00	3.090
	20	26	0.29	90.10	0.11	1.70	35.90	22.00	35.80	6.30	0.200
	26	32	3.09	86.90	0.13	1.70	11.80	29.80	49.80	8.60	0.040
	32	38	0.12	86.20	0.15	1.70	6.60	29.80	58.30	5.30	0.030
	38	44	0.37	86.50	0.07	1.80	3.40	32.40	56.50	7.70	0.029
	44	50	ND	88.40	0.42	1.90	3.00	40.00	48.60	8.40	0.041
	50	56	ND	88.10	0.10	1.80	5.60	39.10	51.60	3.70	0.056
	56	58	0.26	89.40	0.07	1.80	8.20	40.20	47.90	3.70	0.065

(continued)

Table 3-5
Post-Dredging Vibracores (October 22, 2005) with Sediment Classified as Untouched Inventory

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Grid Node ID	Start Depth (in)	End Depth (in)	Total PCB Amount (µg/g)	Total Solids (%)	Total Organic Carbon (%)	Bulk Density (g/cm^3)	Grain Size [%]				
							Gravel	Sand	Silt	Clay	d50 (mm)
351	0	3	2.14	80.90	0.92	1.20	1.20	36.70	56.40	5.70	0.052
	3	6	48.70	64.80	1.50	1.00	0.00	54.10	44.60	1.30	0.087
	6	12	0.28	66.10	2.60	1.00	0.10	78.10	20.60	1.20	0.359
	12	16	0.93	84.70	0.28	1.60	48.60	47.90	3.50	0.00	3.110
	16	20	0.08	66.80	2.00	1.00	13.90	44.60	35.70	5.80	0.107
	20	26	ND	86.30	0.16	1.50	0.80	95.00	4.20	0.00	0.464
	26	28	ND	80.70	0.13	1.40	1.10	96.90	1.80	0.20	0.475
	28	31	ND	94.80	0.16	1.80	6.30	41.50	41.00	11.20	0.064
377	0	3	107.00	79.20	1.00	1.10	0.50	88.30	8.30	2.90	0.264
	3	6	225.00	67.00	1.00	1.20	3.30	80.40	13.10	3.20	0.280
	6	12	63.40	81.50	0.49	1.30	0.70	95.40	1.50	2.40	0.439
	12	18	113.00 (111.00)	75.90 (76.30)	0.91 (0.24)	1.30 (1.20)	1.30 (1.20)	89.50 (94.20)	7.30 (4.60)	1.90 (0.00)	0.366 (0.450)
	18	24	112.00	75.80	0.78	1.20	2.40	91.40	4.30	1.90	0.414
	24	31	15.20	88.40	1.60	1.50	32.40	64.30	3.30	0.00	1.400
	31	37	ND	81.20	0.22	1.60	20.60	32.10	41.30	6.00	0.096
	37	43	ND	90.20	0.15	1.90	9.90	30.50	55.30	4.30	0.055
412	0	3	2.25	86.90	0.73	1.70	3.50	59.60	34.90	2.00	0.138
	3	6	1.24	87.10	0.23	1.80	14.70	42.60	37.50	5.20	0.132
	6	9	2.15	86.30	0.75	1.80	22.00	34.40	34.00	9.60	0.128
	9	12	ND	90.30	1.10	1.80	25.50	31.70	28.70	14.10	0.151
	12	17	0.33	91.00	0.21	1.90	8.60	36.40	45.10	9.90	0.057
414	0	3	1.28	86.00	0.11	1.80	4.10	67.90	28.00	0.00	0.176
	3	6	0.20	89.90	0.12	1.80	57.60	19.60	16.90	5.90	20.800
	6	12	ND (ND)	87.60 (85.40)	ND (0.2)	1.80 (1.70)	2.50 (5.10)	35.30 (31.90)	61.70 (56.50)	0.50 (6.50)	0.047 (0.043)
	12	18	ND	84.70	0.15	1.50	1.90	79.00	19.10	0.00	0.202
	18	24	ND	86.50	0.19	1.50	7.30	80.70	10.80	1.20	0.274
	24	30	ND	90.80	0.17	1.40	2.80	37.40	57.10	2.70	0.059
	30	35	ND	90.70	0.34	1.80	1.90	35.80	62.30	0.00	0.062
564	0	4	7.93	83.70	0.15	1.30	0.00	87.40	12.60	0.00	0.199
	4	6	66.40	81.10	0.20	1.20	1.90	81.00	17.10	0.00	0.255
	6	12	10.80	84.80	0.33	1.50	1.80	86.50	11.70	0.00	0.286
	12	13	27.50	86.70	0.32	1.50	19.90	70.10	7.80	2.20	0.380
	13	19	3.81	89.50	0.13	1.60	6.10	50.40	31.10	12.40	0.099
	19	24	0.08	91.00	0.30	1.60	8.00	56.40	24.70	10.90	0.130
568	0	3	8.68	84.90	0.40	1.60	0.20	84.00	12.90	2.90	0.286
	3	6	28.10	79.70	0.24	1.50	7.90	85.70	4.00	2.40	0.405
	6	12	54.00 (51.90)	78.80 (79.90)	0.81 (0.94)	1.20 (1.20)	3.80 (29.00)	83.30 (62.00)	10.90 (9.00)	2.00 (0.00)	0.275 (0.424)
	12	18	7.92	90.70	0.51	1.30	13.50	49.80	31.60	5.10	0.185
	18	24	0.33	92.70	0.08	1.70	28.10	51.90	20.00	0.00	0.466
	24	30	ND	89.60	0.20	1.80	15.00	61.50	20.90	2.60	0.255
	30	34	ND	91.80	1.20	1.80	12.50	60.30	27.20	0.00	0.211

Notes:

1. Units: Total PCB = micrograms/gram, Bulk Density = grams/cubic centimeter, d50 = millimeters

1. Samples with PCB concentrations below the detection limit are shown as 'ND'.

2. Duplicate values are shown in parenthesis.

3. 'N/A' = Not Available; Grain size testing could not be performed as each sample was made up of organic matter.

PCBs = polychlorinated biphenyls

d50 = diameter at which 50% of material passes through sieve

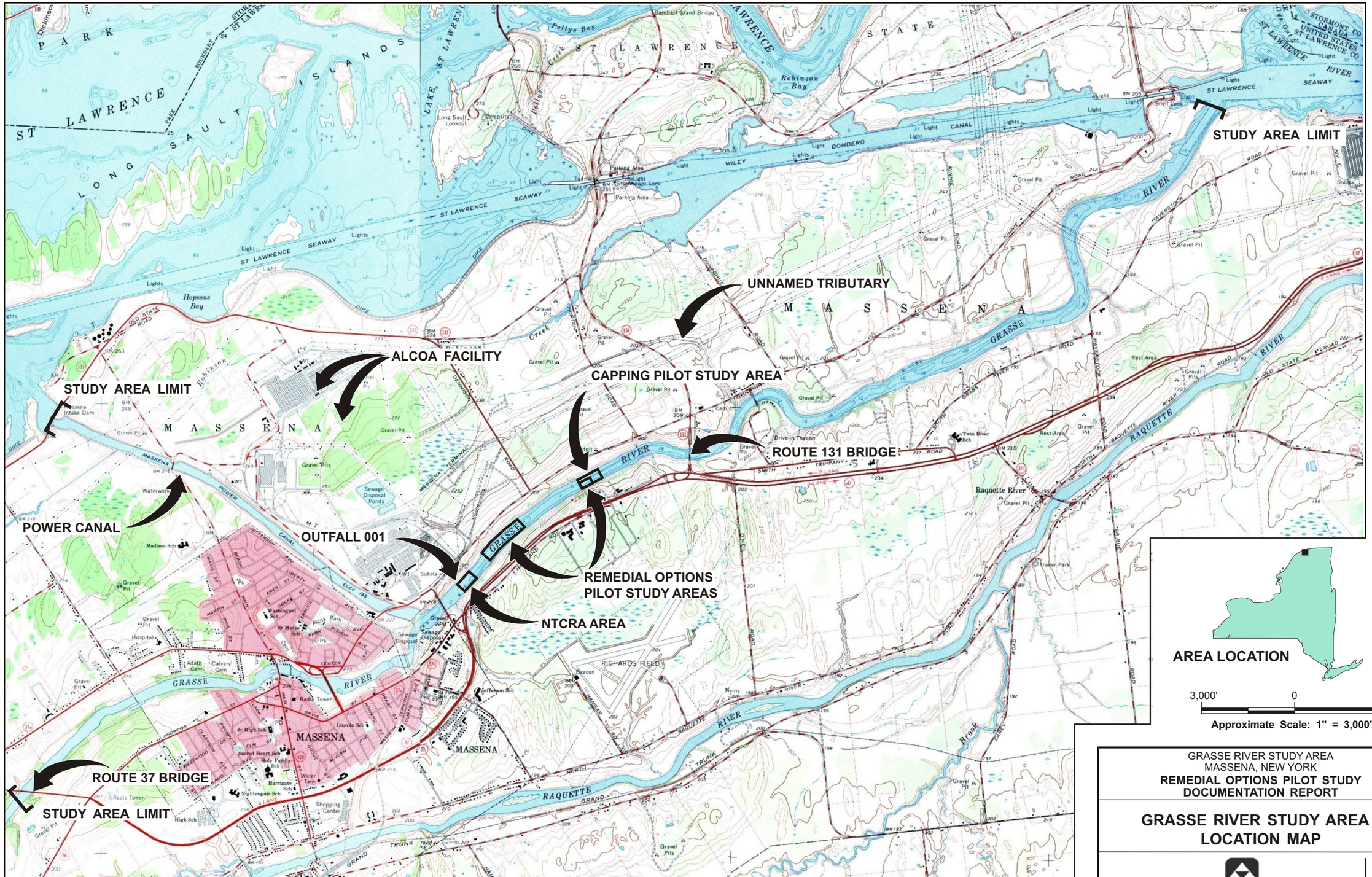
Table 4-1
Comparison of DoC Elevations for Closely-Spaced Sediment Cores Collected During the ROPS

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Grid Node	Survey #1		Survey #2		Absolute Difference in DoC Elevation (ft)
	Date	DoC Elevation (ft)	Date	DoC Elevation (ft)	
177	10/21	138.40	11/28	138.68	0.28
179	8/30	139.50	10/12	137.23	2.27
183	9/13	137.55	10/11	137.63	0.08
225	9/13	136.90	10/10	136.33	0.57
257	10/12	139.65	10/21	139.90	0.25
257	8/30	140.70	10/12	139.65	1.05
257	8/30	140.70	10/21	139.90	0.80
261	10/22	138.97	11/28	138.25	0.72
273	9/12	142.30	10/21	142.53	0.23
298	10/11	139.27	10/22	139.05	0.22
298	8/25	139.30	10/11	139.27	0.03
298	8/25	139.30	10/22	139.05	0.25
335	10/21	139.88	11/28	140.17	0.29
339	9/13	137.90	10/22	137.13	0.77
343	8/30	139.10	10/10	138.17	0.93
377	10/11	139.30	10/22	138.62	0.68
418	10/12	136.78	10/21	137.70	0.92
418	10/12	136.78	11/28	137.05	0.27
418	10/21	137.70	11/28	137.05	0.65
418	8/30	138.30	10/12	136.78	1.52
418	8/30	138.30	10/21	137.70	0.60
418	8/30	138.30	11/28	137.05	1.25
422	10/12	137.58	10/21	137.60	0.02
422	9/12	137.98	10/12	137.58	0.40
422	9/12	137.98	10/21	137.60	0.38
488	10/21	148.57	11/28	148.13	0.44
490	10/21	140.93	11/28	141.22	0.29
492	8/30	138.70	10/11	137.90	0.80
561	10/11	142.47	10/22	144.48	2.01
564	10/11	139.28	10/22	139.52	0.24
568	10/10	138.37	10/22	137.40	0.97
568	10/10	138.37	11/28	136.93	1.44
568	10/22	137.40	11/28	136.93	0.47
572	10/10	136.72	10/22	136.68	0.04
			Number of Comparisons		*34*
			Average		*0.65*
			Range		*0.02 - 2.27*

Notes:
1. Depth of Contamination (DoC) is based on a 1 ppm limit for all cores.
2. Elevations based on USLS 1935 Datum.
3. Cores collected on 8/25 manually; all other cores collected using Vibracoring techniques.

Figures



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY DOCUMENTATION REPORT

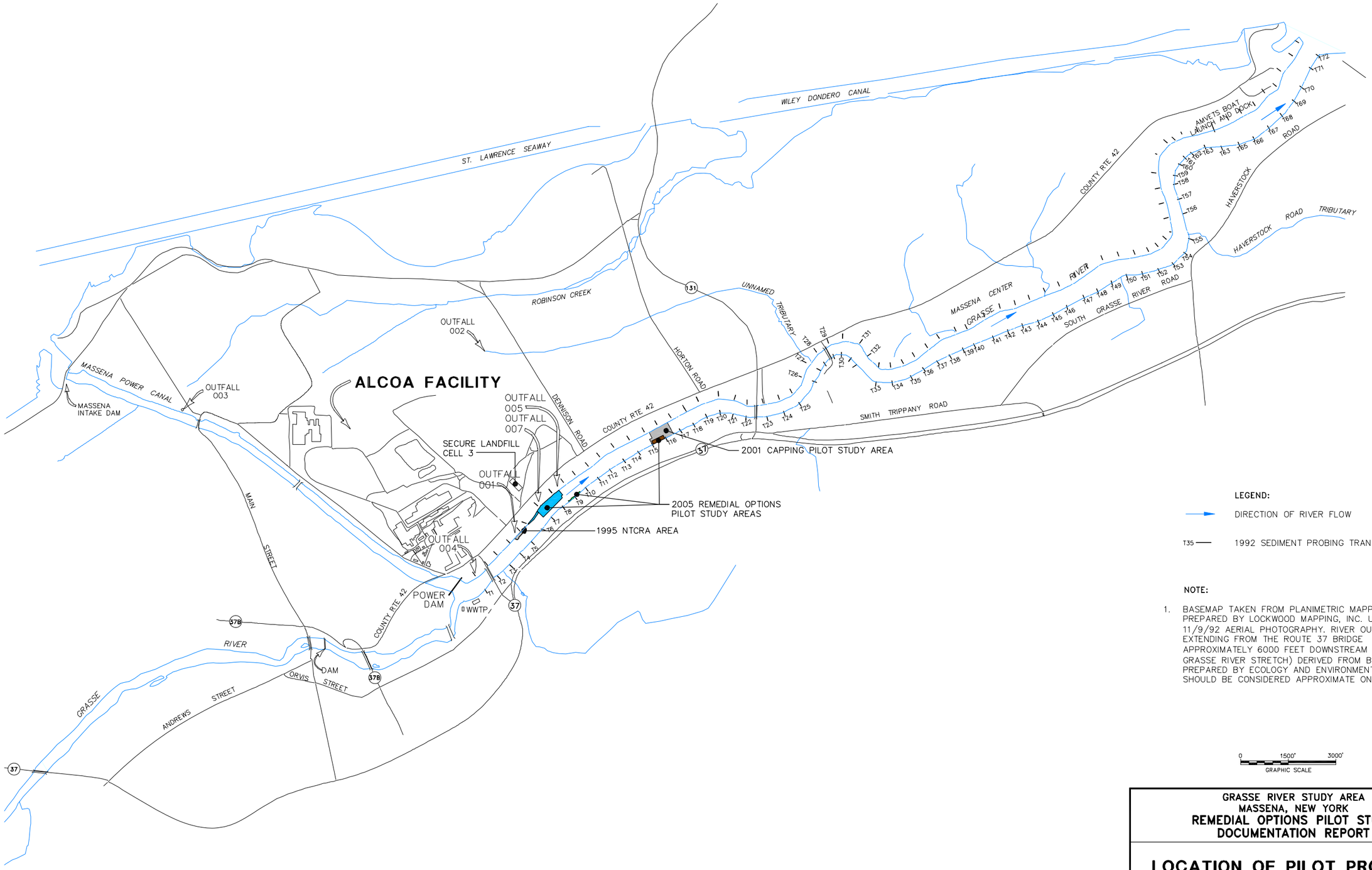
GRASSE RIVER STUDY AREA - LOCATION MAP

ALCOA

FIGURE 1-1

12/29/05 SYR-D85-DJH
10809001/10809n01.cdr

REFERENCE: MASSENA, NEW YORK-ONTARIO USGS QUAD. 1964 RAQUETTE RIVER, NEW YORK-ONTARIO USGS QUAD. 1964



LEGEND:

DIRECTION OF RIVER FLOW

T35 — 1992 SEDIMENT PROBING TRANSECTS

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. RIVER OUTLINE EXTENDING FROM THE ROUTE 37 BRIDGE APPROXIMATELY 6000 FEET DOWNSTREAM (SOUTHWEST GRASSE RIVER STRETCH) DERIVED FROM BASEMAP PREPARED BY ECOLOGY AND ENVIRONMENT, INC. AND SHOULD BE CONSIDERED APPROXIMATE ONLY.

0 1500' 3000'
GRAPHIC SCALE

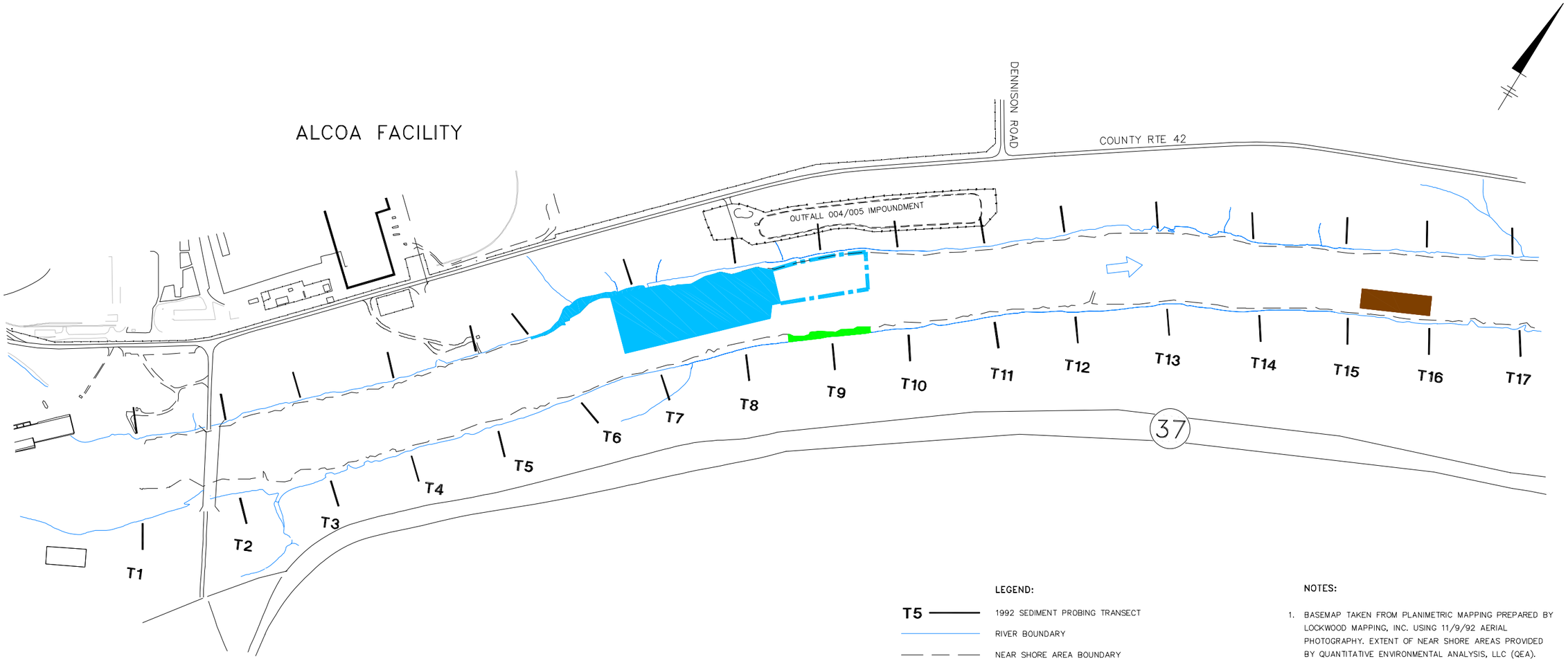
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

LOCATION OF PILOT PROJECTS

ALCOA

FIGURE
1-2

X: 10809X05.DWG, X01.DWG, 10809X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/PLT-DL2B1
5/15/06 SYR-85-DMJ TJR BGP
10809001/10809G02.DWG



LEGEND:

- T5 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE DREDGING/CAPPING AREA
- APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
- APPROXIMATE ARMORED CAPPING AREA
- APPROXIMATE THIN-LAYER CAPPING AREA
- DIRECTION OF RIVER FLOW

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.

0 300' 600'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

OVERVIEW OF CONSTRUCTION COMPONENTS

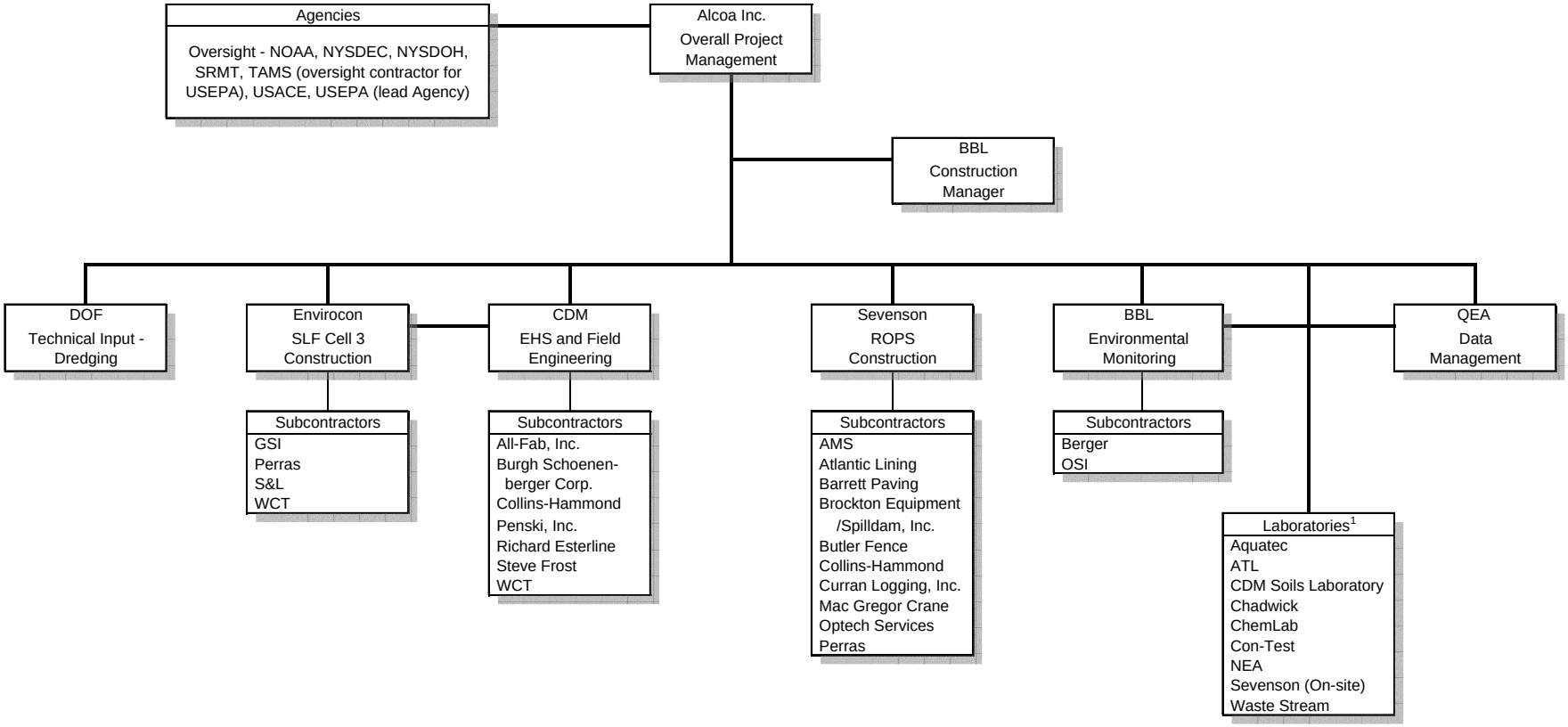
ALCOA

FIGURE
1-3

X: 10809X01, X02.DWG, 10809X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/PLT-D2BL
5/15/06 SYR-85-CBM TJR BGP
10809001/10809G22.DWG

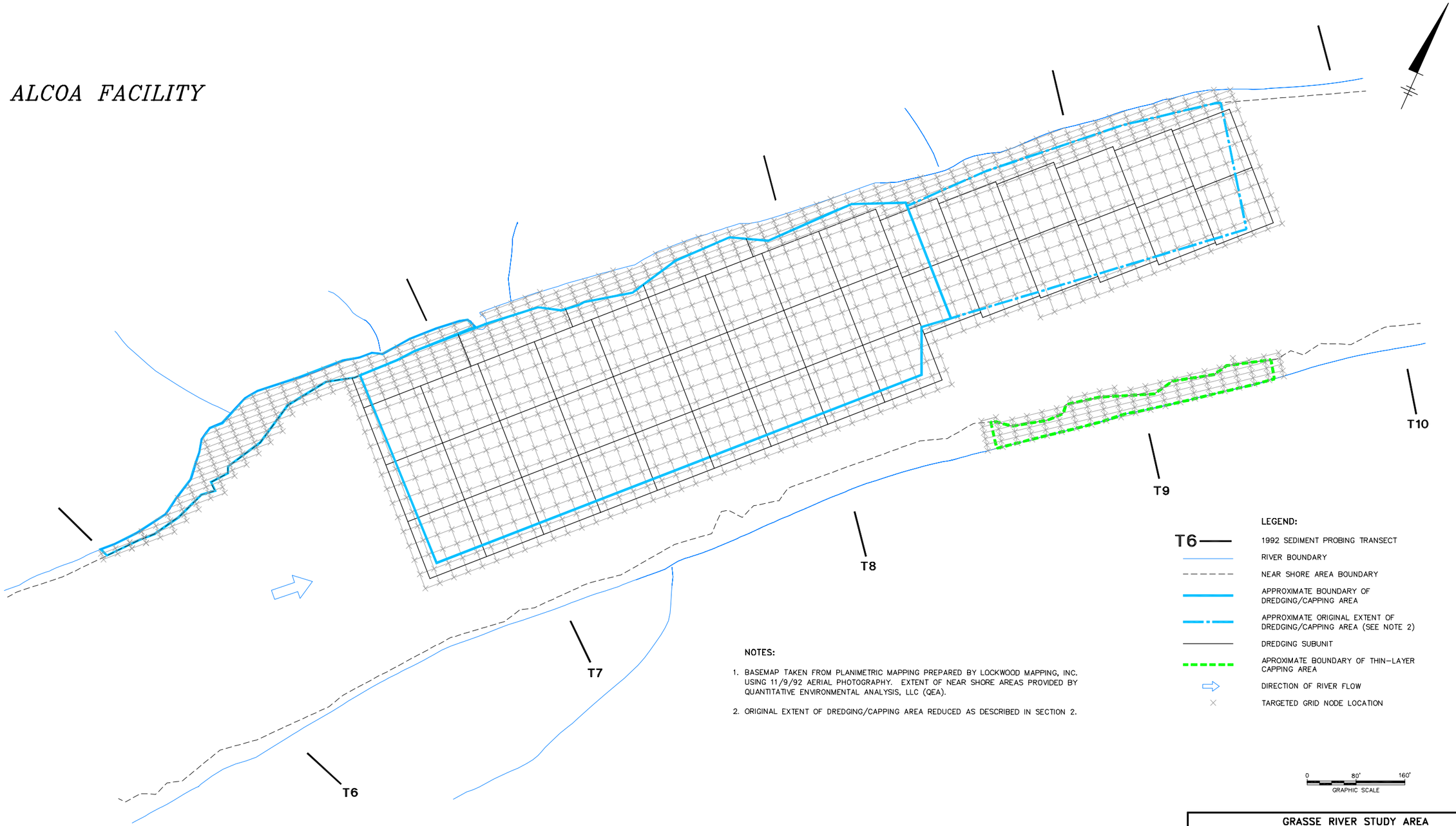
Figure 1-4
ROPS Organization Chart

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York



Notes:
1. Laboratories listed herein were subcontracted to various ROPS team members.

AMS	Allen Marine Services	DOF	Dalton, Olmsted & Fuglevand, Inc.	OSI	Ocean Surveys, Inc.
Aquatic	Aquatic Biological Services, Inc.	EHS	Environmental Health and Safety	QEA	Quantitative Environmental Analysis, LLC
ATL	Atlantic Testing Laboratories	Envirocon	Envirocon, Inc.	Sevenson	Sevenson Environmental Services, Inc.
Barrett Paving	Barrett Paving Materials, Inc.	GSI	Geo-Synthetics, Inc.	S&L	S&L Electric
BBL	Blasland, Bouck & Lee, Inc.	NEA	Northeast Analytical, Inc.	SRMT	St. Regis Mohawk Tribe
Berger	The Louis Berger Group, Inc.	NOAA	National Oceanic and Atmospheric Administration	TAMS	TAMS/EarthTech
CDM	Camp Dresser & McKee	NYSDEC	New York State Department of Environmental Conservation	USACE	United States Army Corps of Engineers
Chadwick	Chadwick & Associates, Inc.	NYSDOH	New York State Department of Health	USEPA	United States Environmental Protection Agency
ChemLab	Alcoa Massena ChemLab	Perras	Perras Environmental & Excavating	WCT	Wilhelm Chattelle & Towne
Collins-Hammond	Collins-Hammond Electrical Contractors, Inc.			Waste Stream	Waste Stream Technologies
Con-Test	Con-Test Analytical Laboratories				



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

2. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.

LEGEND:

- T6 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
- DREDGING SUBUNIT
- APROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
- DIRECTION OF RIVER FLOW
- TARGETED GRID NODE LOCATION

0 80' 160'
GRAPHIC SCALE

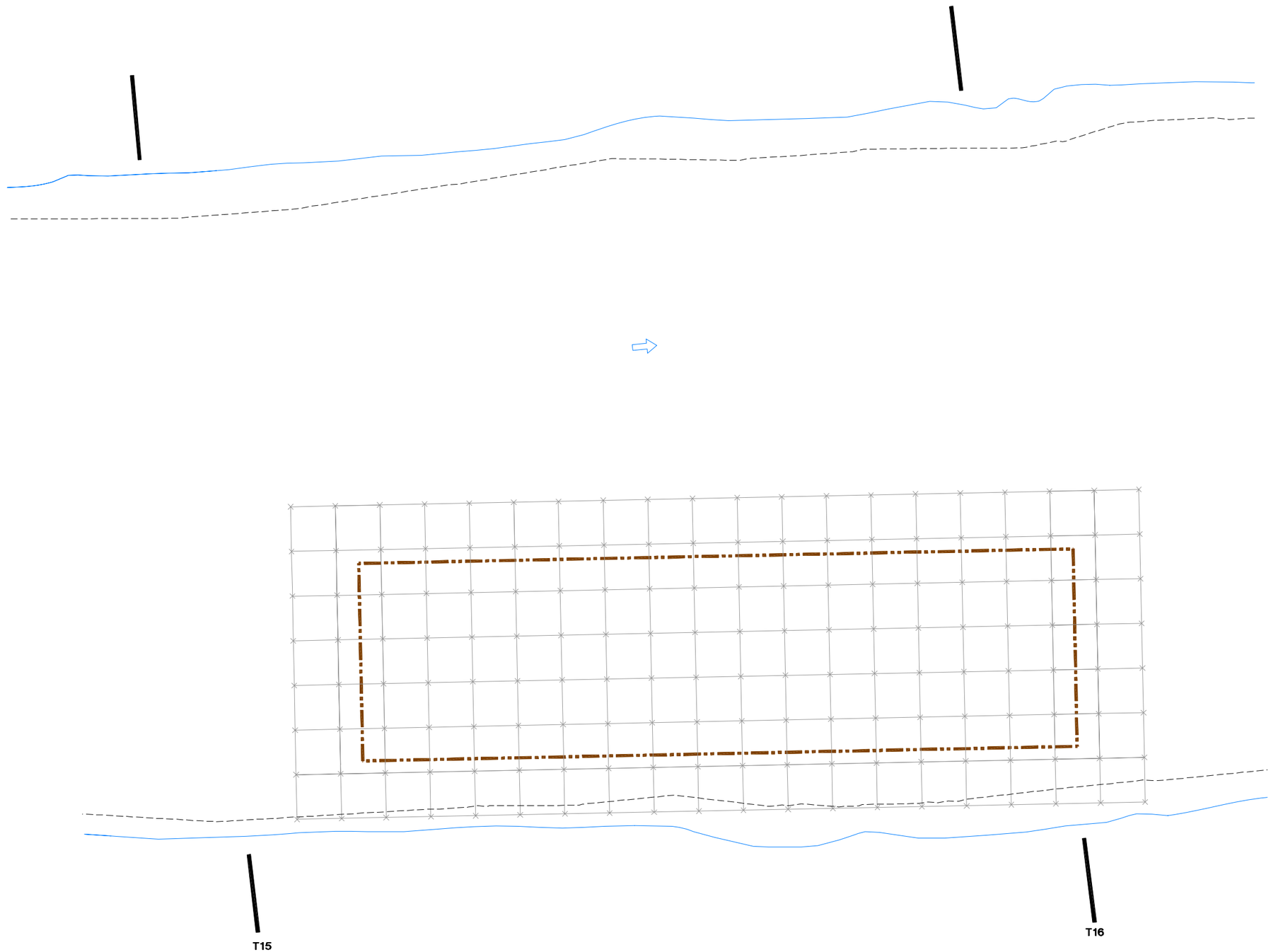
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

GRID NODE LOCATIONS FOR ELEVATION/PROBING MEASUREMENTS IN DREDGING/CAPPING AND THIN-LAYER CAPPING AREAS

ALCOA

FIGURE
2-1

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/16/06 SYR-85-NES TJR BGP
10809001/10809B01.DWG



LEGEND:

- T15 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
- TARGETED GRID NODE LOCATION
- DIRECTION OF RIVER FLOW

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

GRID NODE LOCATIONS FOR ELEVATION MEASUREMENTS IN ARMORED CAPPING AREA

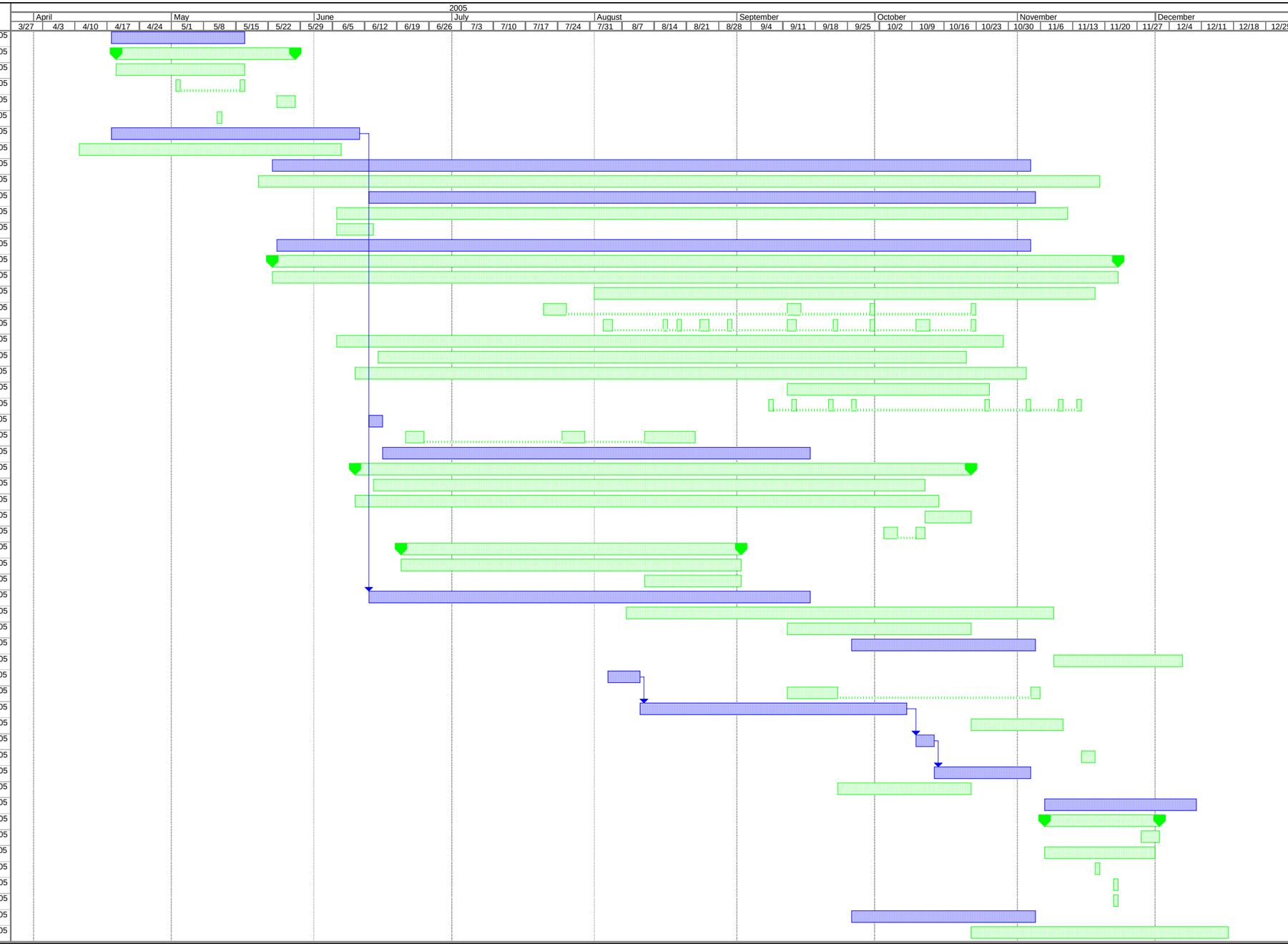
ALCOA

FIGURE
2-2

X: 10809X01.DWG, X02.DWG, X01.TIF
L: ON=*, OFF=REF*
P: PAGESET/SYR-DL2B1
5/16/06 SYR-85-NES TJR BGP
10809001/10809B02.DWG

Figure 2-3 - ROPS Schedule: Proposed vs. Actual
Remedial Options Pilot Study Documentation Report
Grasse River Study Area
Massena, New York

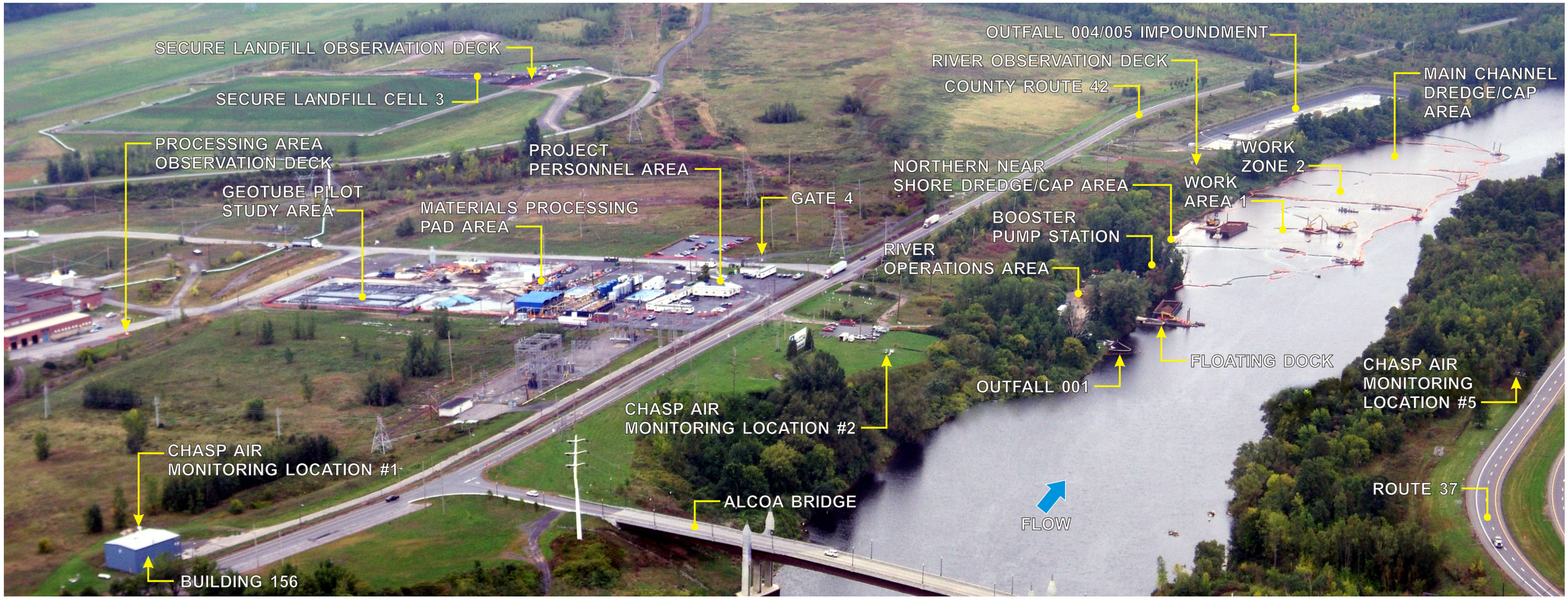
ID	Activity	Initiation Date	Completion Date
1	2005 Baseline Monitoring	Mon 4/18/05	Mon 5/16/05
2	2005 Baseline Monitoring	Tue 4/19/05	Fri 5/27/05
3	Sediment Elevation and Probing Measurements	Tue 4/19/05	Mon 5/16/05
4	Water Column Monitoring	Mon 5/2/05	Mon 5/16/05
5	Air Monitoring	Tue 5/24/05	Fri 5/27/05
6	Ecological Monitoring	Wed 5/11/05	Wed 5/11/05
7	Mobilization/Site Preparation	Mon 4/18/05	Fri 6/10/05
8	Mobilization/Site Preparation	Mon 4/11/05	Mon 6/6/05
9	Containment System	Mon 5/23/05	Thu 11/3/05
10	Containment System	Fri 5/20/05	Fri 11/18/05
11	Sediment Processing/Water Treatment	Mon 6/13/05	Fri 11/4/05
12	Sediment Processing/Water Treatment	Mon 6/6/05	Fri 11/11/05
13	Equipment Testing/Dredge System Shake-Out	Mon 6/6/05	Mon 6/13/05
14	During-Construction Monitoring	Tue 5/24/05	Thu 11/3/05
15	During-Construction Monitoring	Mon 5/23/05	Tue 11/22/05
16	Water Column Monitoring	Mon 5/23/05	Tue 11/22/05
17	Sediment Elevation and Probing Measurements	Mon 8/1/05	Thu 11/17/05
18	OSI Surveys	Thu 7/21/05	Sat 10/22/05
19	Sediment Sampling	Wed 8/3/05	Sat 10/22/05
20	Air Monitoring	Mon 6/6/05	Fri 10/28/05
21	Ex-situ Dredge Material Sampling	Wed 6/15/05	Thu 10/20/05
22	Treated Effluent Discharge Monitoring	Fri 6/10/05	Wed 11/2/05
23	Geotube Sampling	Mon 9/12/05	Tue 10/25/05
24	Cap Material Sampling	Thu 9/8/05	Mon 11/14/05
25	Excavation/Debris Removal - Northern Near Shore	Mon 6/13/05	Wed 6/15/05
26	Excavation/Debris Removal - Northern Near Shore	Tue 6/21/05	Mon 8/22/05
27	Dredging - Main Channel	Thu 6/16/05	Fri 9/16/05
28	Dredging - Main Channel - Expanded Work Zone 1	Fri 6/10/05	Fri 10/21/05
29	Horizontal Auger Dredge Operation	Tue 6/14/05	Tue 10/11/05
30	Debris Removal	Fri 6/10/05	Fri 10/14/05
31	Swinging Ladder Cutterhead Dredge System Shake-Out and Operation	Wed 10/12/05	Fri 10/21/05
32	Mechanical Removal	Mon 10/3/05	Tue 10/11/05
33	Dredging - Main Channel - Work Zone 2	Mon 6/20/05	Thu 9/1/05
34	Horizontal Auger Dredge Operation	Mon 6/20/05	Thu 9/1/05
35	Debris Removal	Fri 8/12/05	Thu 9/1/05
36	Placement of Materials in SLF	Mon 6/13/05	Fri 9/16/05
37	Placement of Materials in SLF	Mon 8/8/05	Tue 11/8/05
38	Geotube Pilot Study	Mon 9/12/05	Fri 10/21/05
39	Install Temporary Cap - SLF	Mon 9/26/05	Fri 11/4/05
40	Install Temporary Cap - SLF	Wed 11/9/05	Tue 12/6/05
41	Capping - Northern Near Shore	Thu 8/4/05	Wed 8/10/05
42	Capping - Northern Near Shore	Mon 9/12/05	Sat 11/5/05
43	Backfill Channel - Main Channel	Thu 8/11/05	Fri 10/7/05
44	Capping - Main Channel (Work Zones 1 and 2)	Sat 10/22/05	Thu 11/10/05
45	Thin-Layer Capping - Southern Near Shore	Mon 10/10/05	Thu 10/13/05
46	Thin-Layer Capping - Southern Near Shore	Tue 11/15/05	Thu 11/17/05
47	Armored Cap Installation - Main Channel	Fri 10/14/05	Thu 11/3/05
48	Armored Cap Installation - Main Channel	Fri 9/23/05	Fri 10/21/05
49	2005 Post-Construction Monitoring	Mon 11/7/05	Fri 12/9/05
50	2005 Post-Construction Monitoring	Mon 11/7/05	Thu 12/1/05
51	Sediment Sampling	Mon 11/28/05	Thu 12/1/05
52	Sediment Elevation Measurements	Mon 11/7/05	Wed 11/30/05
53	Multibeam Bathymetry	Fri 11/18/05	Fri 11/18/05
54	Water Column Monitoring	Tue 11/22/05	Tue 11/22/05
55	Underwater Video - Main Channel (Armored Cap)	Tue 11/22/05	Tue 11/22/05
56	Site Restoration/Demobilization	Mon 9/26/05	Fri 11/4/05
57	Site Restoration/Demobilization	Sat 10/22/05	Fri 12/16/05



Project: ROPS schedule - 051506
Date: Thu 6/8/06

Proposed Duration | Actual Duration | Split | Summary

Notes:
1. Proposed durations consistent with the Operations Plan (Sevenson, May 2005).
2. Durations presented may not reflect continuous activities, but rather represent the start and end dates of activities.



NOTE:
1. AERIAL PHOTO TAKEN SEPTEMBER 15, 2005.

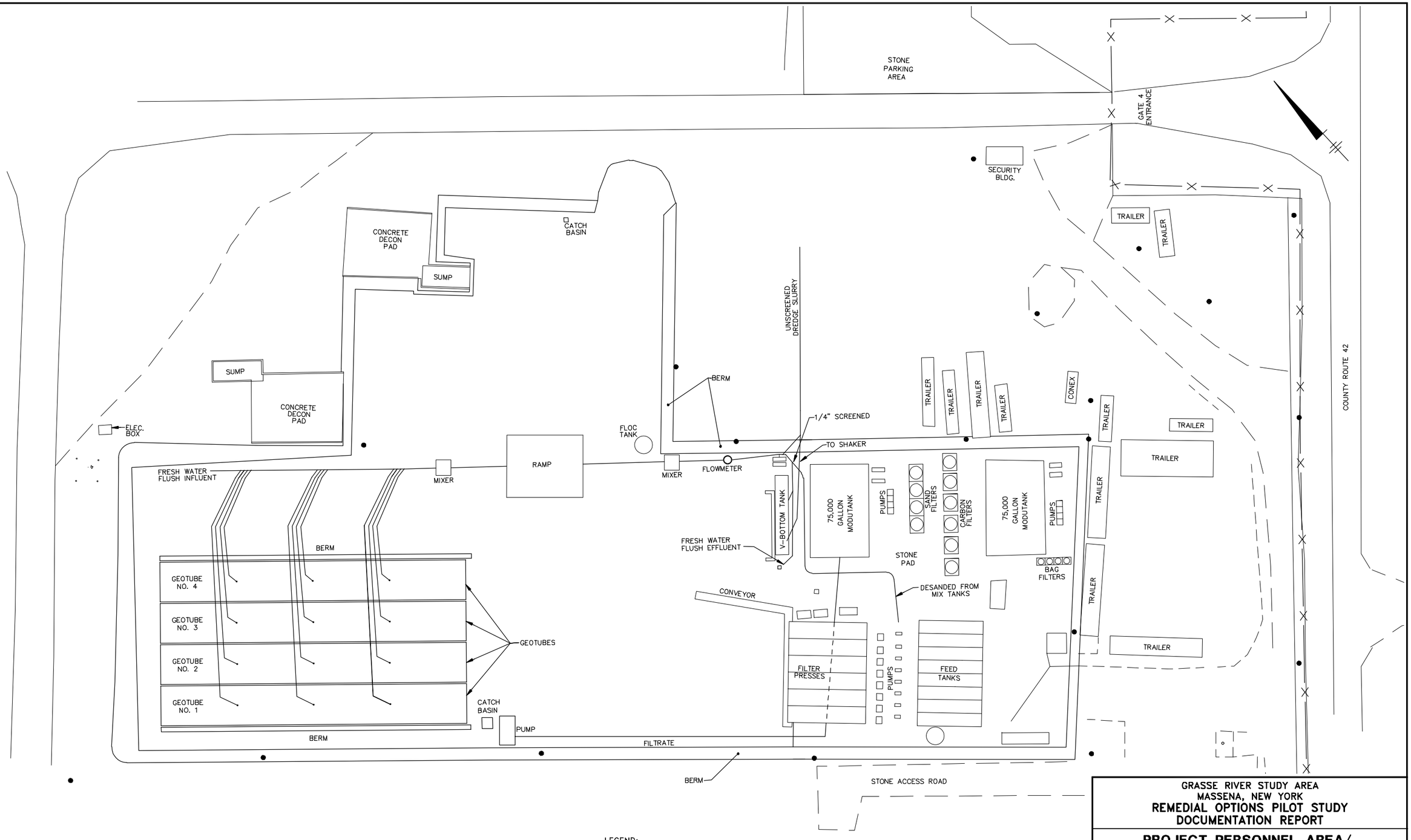
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY DOCUMENTATION REPORT

AERIAL VIEW OF ROPS

ALCOA

FIGURE 2-4

04/04/06 SYR-D85-DJH
10809001/10809g02.cdr



LEGEND:

● UTILITY POLE

0 30' 60'
GRAPHIC SCALE

X: 10809X01.DWG, 10809X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/PLT-D2B1
5/23/06 SYR-85-BGP
10809001/10809G29.DWG

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

PROJECT PERSONNEL AREA/ MATERIALS PROCESSING PAD LAYOUT

ALCOA

FIGURE
2-5

SECURE LANDFILL CELL 3

PROCESSED SEDIMENT HAUL ROUTE

DENNISON ROAD

COUNTY ROUTE 42

EXPANSION AREA

PROCESSING & SUPPORT AREA

DREDGE DISCHARGE PIPELINE

EXISTING CULVERT

OUTFALL 004/005 IMPOUNDMENT

TRAILER LOCATIONS

EXISTING 24" BOX CULVERT

OUTFALL 007

BOOSTER PUMPS

GRASSE RIVER

BLDG 156

GATE 4

TREATED EFFLUENT

STAGING & TRANSFER AREA

OUTFALL 001

OUTFALL 004

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16 T17 T

LEGEND:

T5	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA BOUNDARY
	APPROXIMATE DREDGING/CAPPING AREA
	APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
	APPROXIMATE ARMORED CAPPING AREA
	APPROXIMATE THIN-LAYER CAPPING AREA
	DIRECTION OF RIVER FLOW

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. LAND-BASED FEATURES PROVIDED BY CAMP, DRESSER, & McKEE. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ORIGINAL EXTENT OF DREDING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.

0 300' 600'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

OVERALL ROPS SITE PLAN

ALCOA

FIGURE
2-6

X: 10809X01, X02.DWG, 10809X01.TIF
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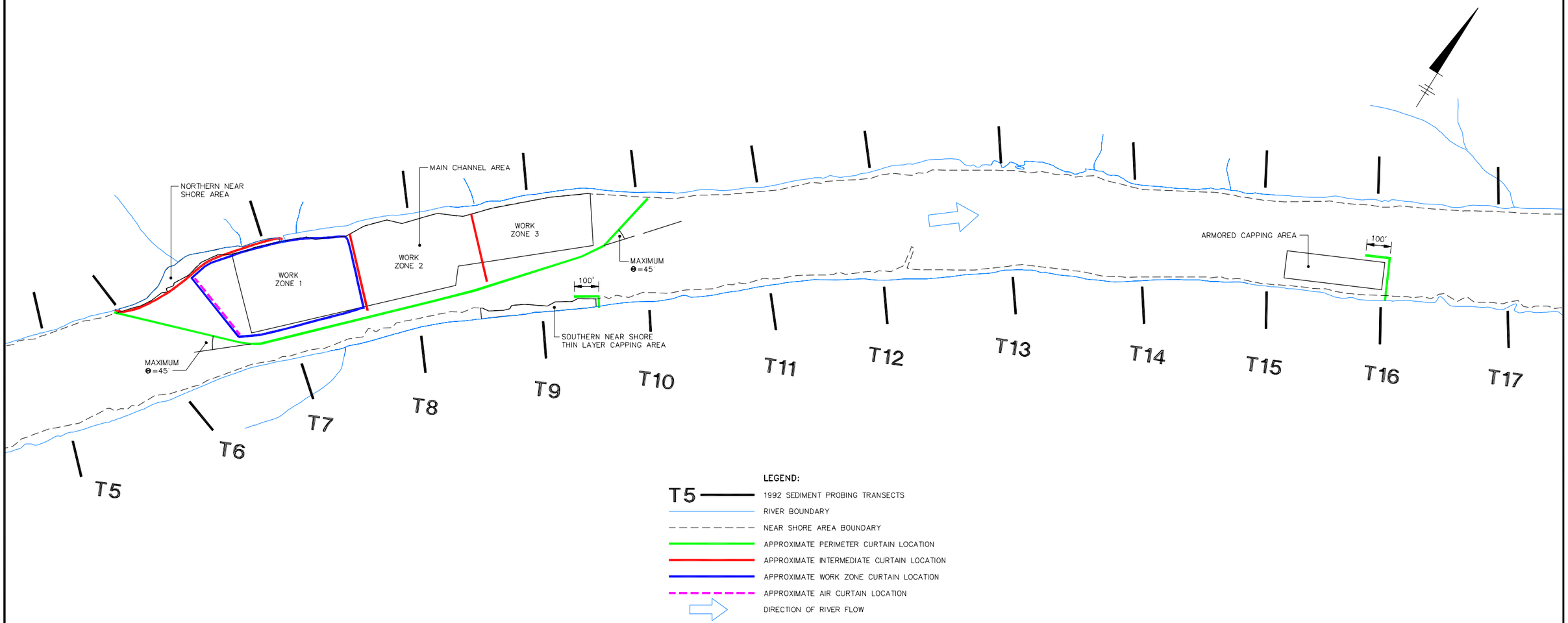
P: PAGESET/PLT-D2B1
5/18/06 SYR-85-BGP
10809001/10809G32.DWG



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

SILT CURTAIN LAYOUT - NORTHERN NEAR SHORE, MAIN CHANNEL, AND SOUTHERN NEAR SHORE AREAS

ALCOA

FIGURE
2-7

X: 10809X01, X07.DWG, 10809X01.TIF
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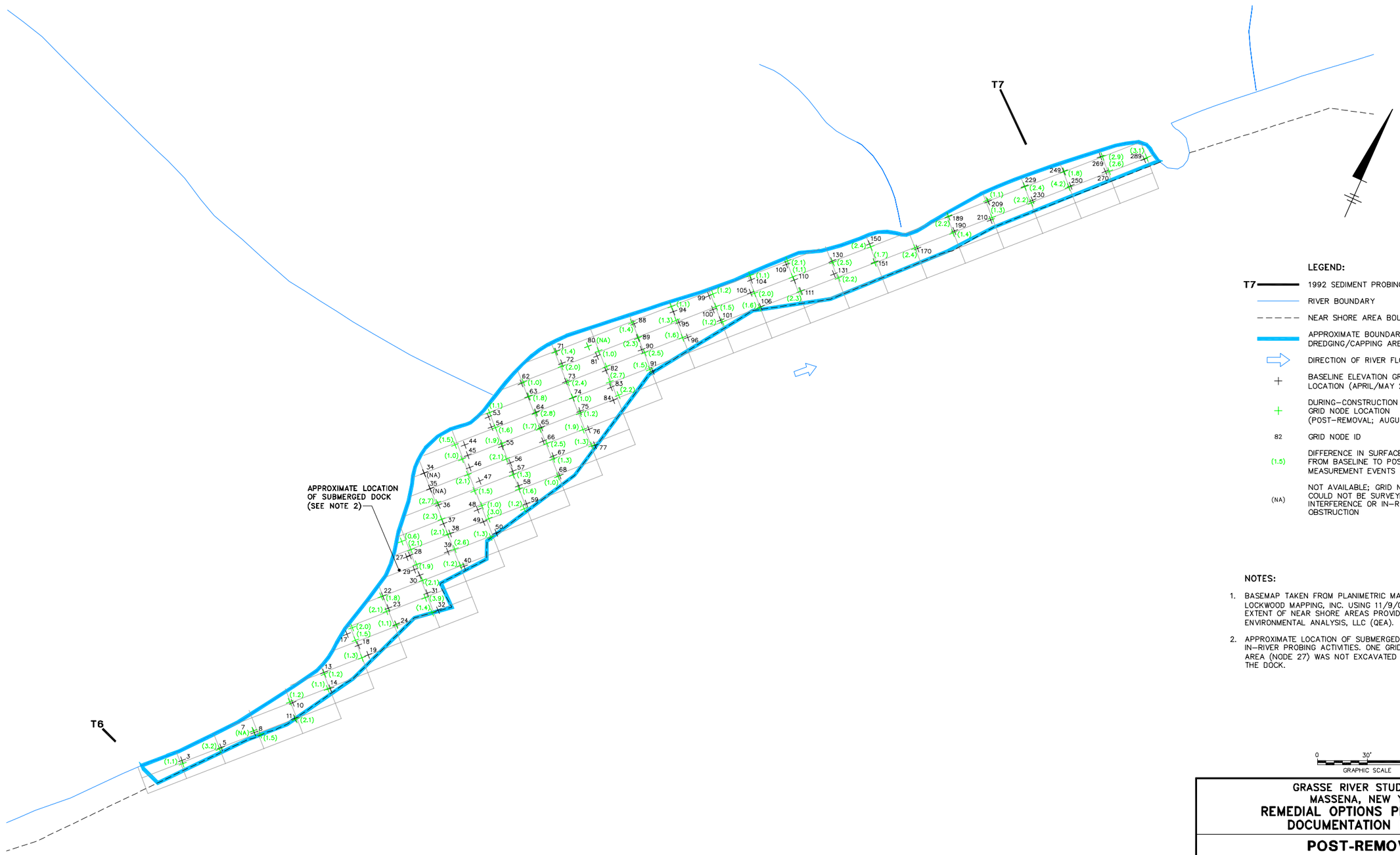
P: PAGESET/PLT-D2B1
5/23/06 SYR-85-BGP
10809001/10809G31.DWG



LEGEND:

T7	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA BOUNDARY
	APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
	DIRECTION OF RIVER FLOW
+	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
+	DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-REMOVAL; AUGUST 2005)
82	GRID NODE ID
(1.5)	DIFFERENCE IN SURFACE ELEVATION FROM BASELINE TO POST-REMOVAL MEASUREMENT EVENTS (FT)
(NA)	NOT AVAILABLE; GRID NODE LOCATION COULD NOT BE SURVEYED DUE TO INTERFERENCE OR IN-RIVER OBSTRUCTION

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. APPROXIMATE LOCATION OF SUBMERGED DOCK DEFINED THROUGH IN-RIVER PROBING ACTIVITIES. ONE GRID NODE IN SUBMERGED DOCK AREA (NODE 27) WAS NOT EXCAVATED TO DESIRED DEPTH DUE TO THE DOCK.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-REMOVAL ELEVATION MEASUREMENT RESULTS FOR THE NORTHERN NEAR SHORE AREA

ALCOA

FIGURE
2-8

X: 10809X01, ...X02.DWG, ...X01.TIF
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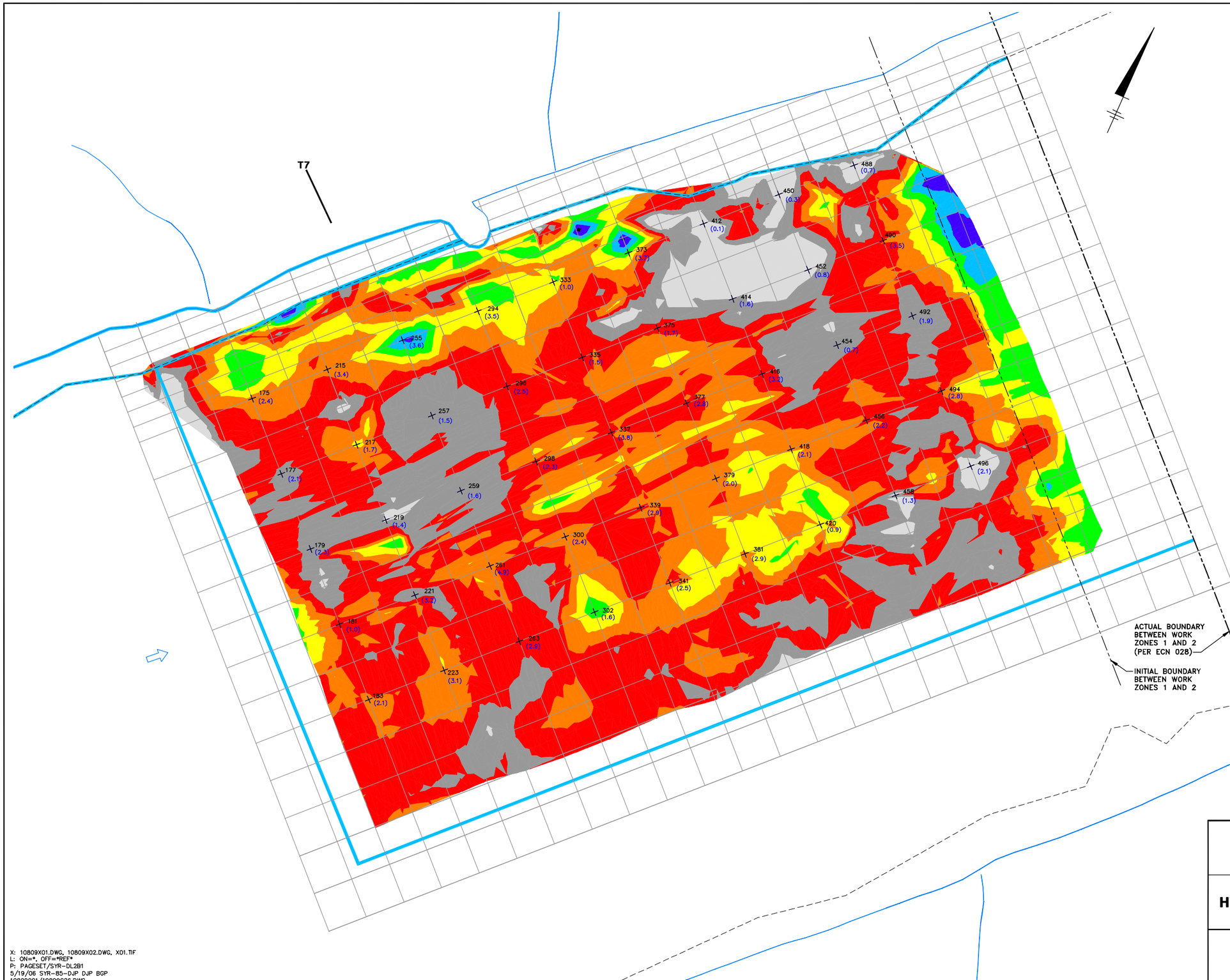
5/22/06 SYR-85-NES PGL BGP
10809001/10809G21.DWG



HYPACK DATA LEGEND:

DIFFERENCE IN ELEVATION BETWEEN APRIL/MAY 2005 BASELINE "HARD BOTTOM" AND AUGUST 2005 HYPACK SURFACE

- 0.0'
- 0.0' TO 0.5'
- 0.5' TO 1.0'
- 1.0' TO 1.5
- 1.5' TO 2.0'
- 2.0' TO 2.5'
- 2.5' TO 3.0'
- 3.0' +

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DIRECTION OF RIVER FLOW
- + APPROXIMATE DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (AUGUST 17, 2005)
- 420 GRID NODE ID
- (2.4) DEPTH OF SEDIMENT PROBED (FT) – AUGUST 17, 2005

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. HYPACK DATA COLLECTED BY SEVENSON ENVIRONMENTAL SERVICES, INC. (SEVENSON) ON 8/12/05.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

DURING-CONSTRUCTION MONITORING HYPACK AND ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 1

ALCOA

FIGURE
2-9

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/19/06 SYR-85-DJP DJP BGP
10809001/10809G26.DWG

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- AUGUST 24–25, 2005 MANUAL COLLECTION LOCATION
- AUGUST 30, 2005 VIBRACORE COLLECTION LOCATION
- SEPTEMBER 12–13, 2005 VIBRACORE COLLECTION LOCATION
- SEPTEMBER 22–23, 2005 MANUAL CORE COLLECTION LOCATION
- OCTOBER 10–12, 2005 VIBRACORE COLLECTION LOCATION
- OCTOBER 22, 2005 VIBRACORE COLLECTION LOCATION
- 572 — GRID NODE ID (SEE NOTE 2)
- APPROXIMATE LOCATION OF SEPTEMBER 25, 2005 DIVER VIDEO COVERAGE AREA (ACTUAL VIDEO COVERAGE INCLUDED IN APPENDIX J)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. GRID NODE IDs ARE PROVIDED FOR IDENTIFICATION PURPOSES.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

DURING-CONSTRUCTION MONITORING SEDIMENT CORE COLLECTION LOCATIONS AND APPROXIMATE DIVER VIDEO AREA - WORK ZONE 1

ALCOA

FIGURE
2-10

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES TJR BGP
10809001/10809G23.DWG

LEGEND:

- T8 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- APPROXIMATE BOUNDARY OF AREA PROPOSED FOR THIN-LAYER CAPPING
- DIRECTION OF RIVER FLOW
- AUGUST 30, 2005 VIBRACORE COLLECTION LOCATION
- SEPTEMBER 30, 2005 VIBRACORE COLLECTION LOCATION
- 750 — GRID NODE ID (SEE NOTE 3)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. WORK ZONE 2 WAS NOT DREDGED TO ITS ORIGINAL EXTENT AS DESCRIBED IN SECTION 2.
3. GRID NODE IDs ARE PROVIDED ONLY NEAR VIBRACORE LOCATIONS FOR IDENTIFICATION PURPOSES.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

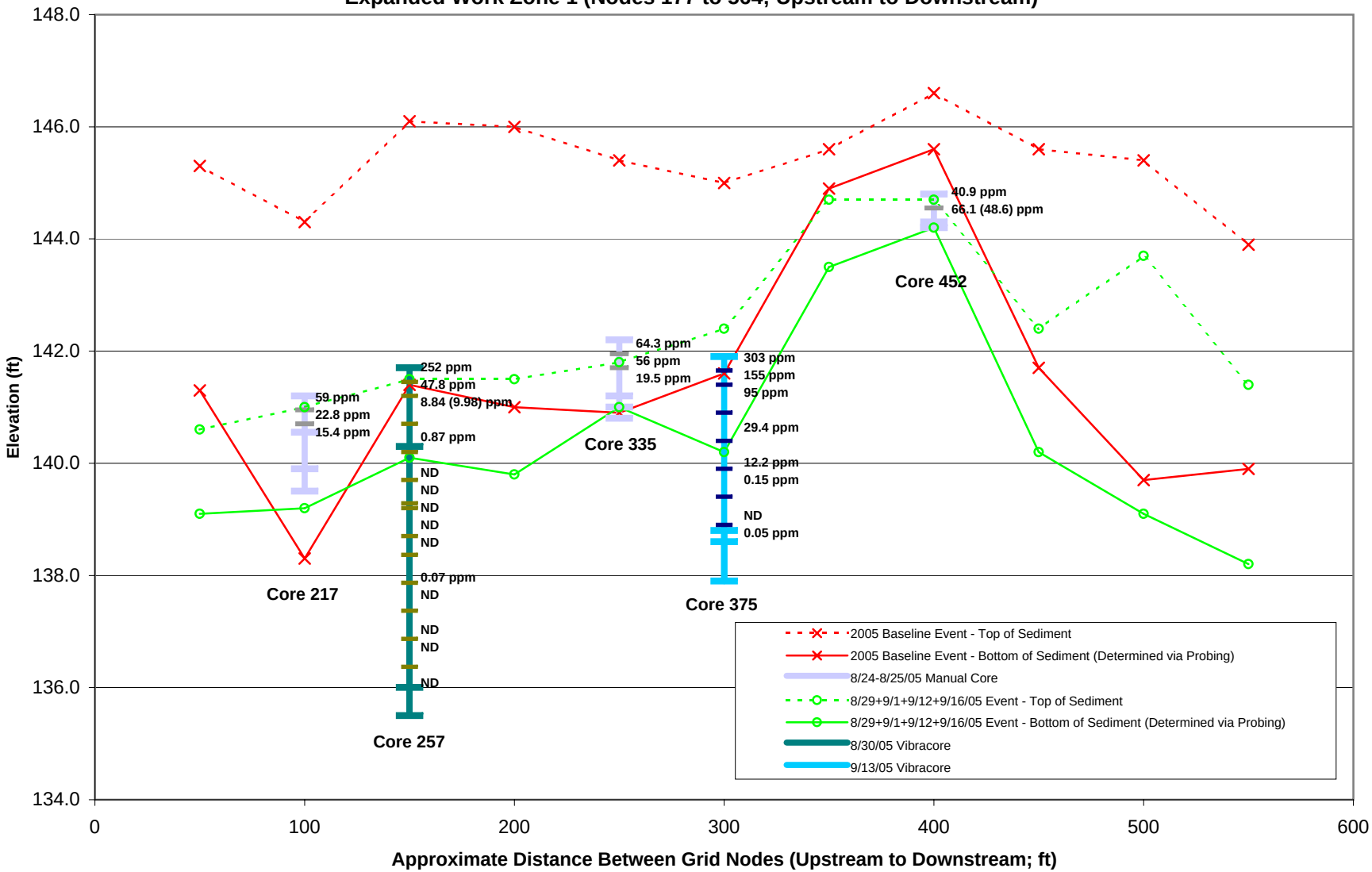
DURING-CONSTRUCTION MONITORING SEDIMENT CORE COLLECTION LOCATIONS - WORK ZONE 2

ALCOA

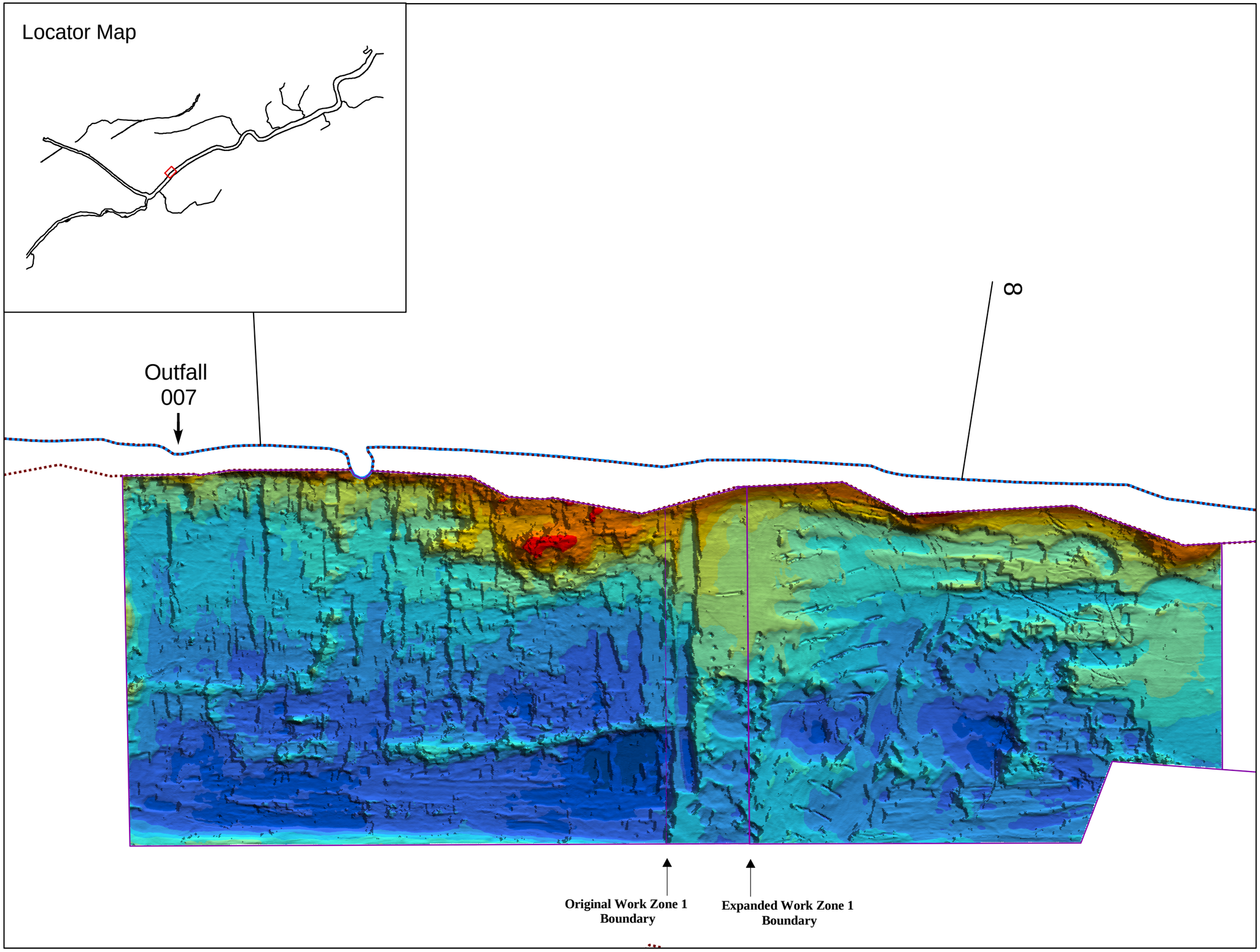
FIGURE
2-11

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/23/06 SYR-85-NES TJR BGP
10809001/10809G24.DWG

Figure 2-12
Example Cross-Section of Sediment Bed Elevation for Various Measurement Events
Expanded Work Zone 1 (Nodes 177 to 564; Upstream to Downstream)



Note:
1. Elevations based on United States Lake Survey (USLS) 1935.



N

GRAPHIC SCALE
Feet
0 25 50 100

LEGEND

Elevation (ft)
- 151 - 152
- 150 - 151
- 149 - 150
- 148 - 149
- 147 - 148
- 146 - 147
- 145 - 146
- 144 - 145
- 143 - 144
- 142 - 143
- 141 - 142
- 140 - 141
- 139 - 140
- 138 - 139
- 137 - 138
- 136 - 137
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

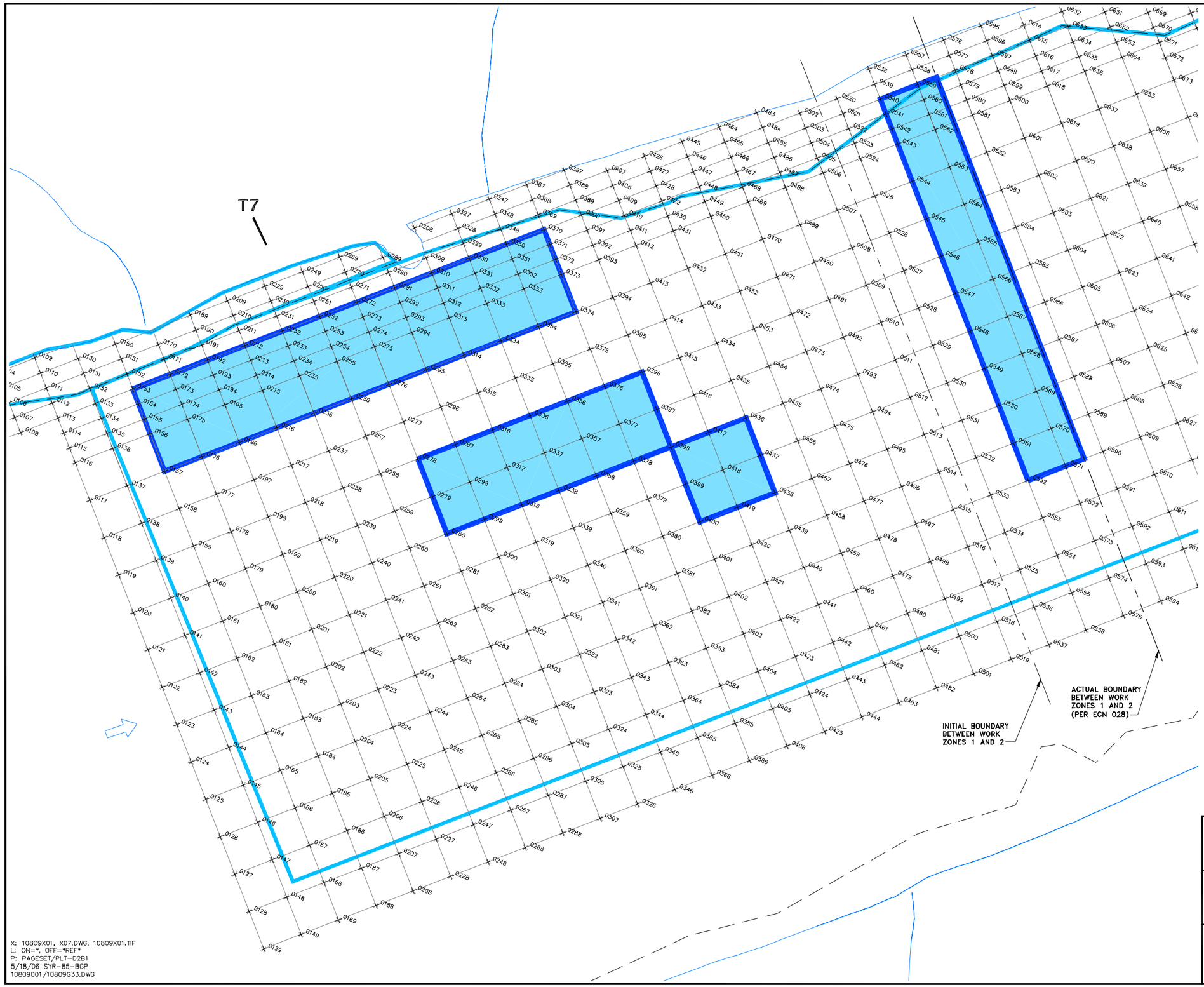
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 2-13
Sediment Elevations Measured
During September 12-13
Multibeam Survey

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



LEGEND:

- AREAS WHERE CUTTERHEAD DREDGE WAS EMPLOYED
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- T5 — 1992 SEDIMENT PROBING TRANSECTS
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- DIRECTION OF RIVER FLOW

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

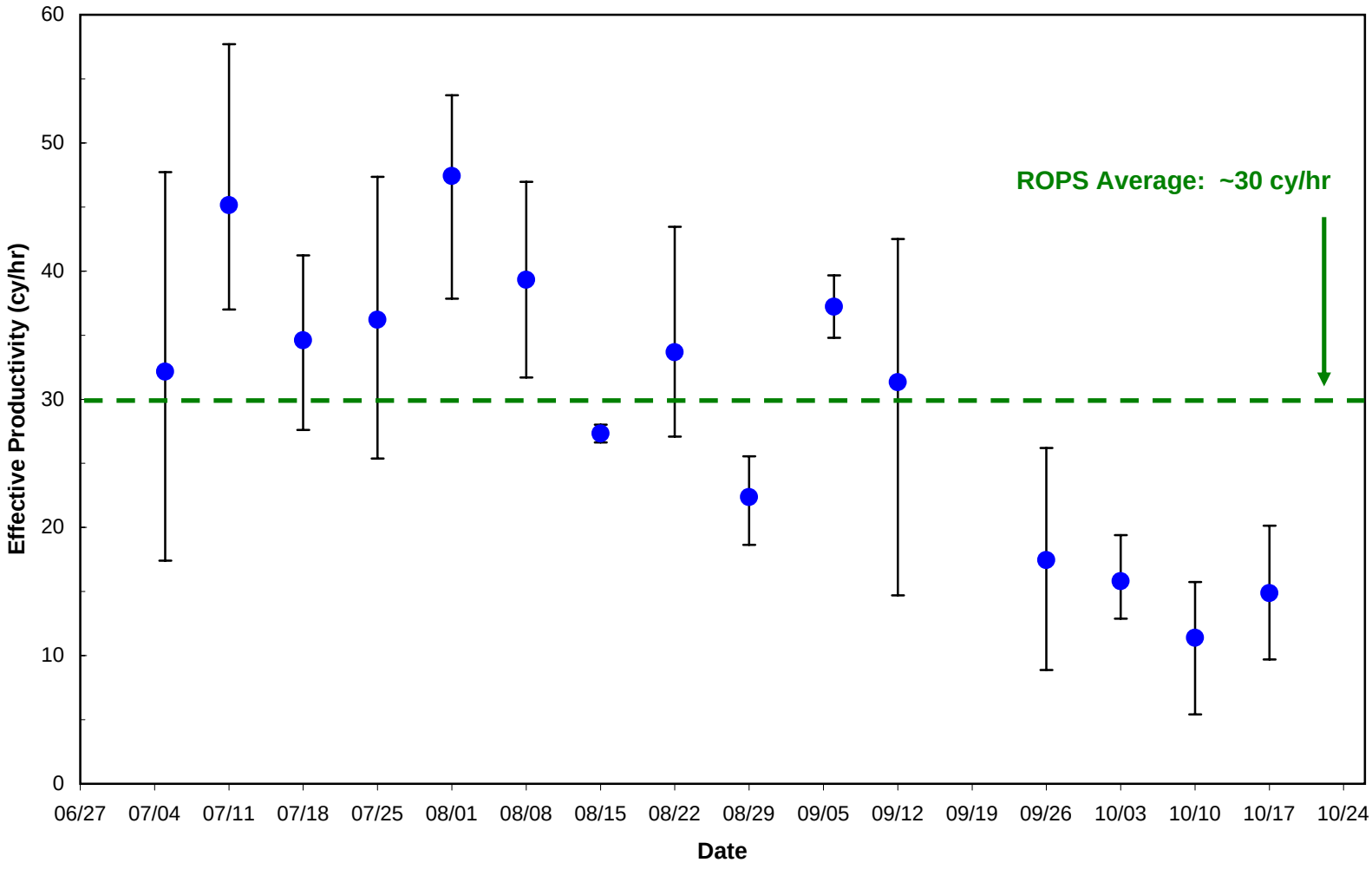
CUTTERHEAD DREDGE SEDIMENT REMOVAL AREAS

ALCOA

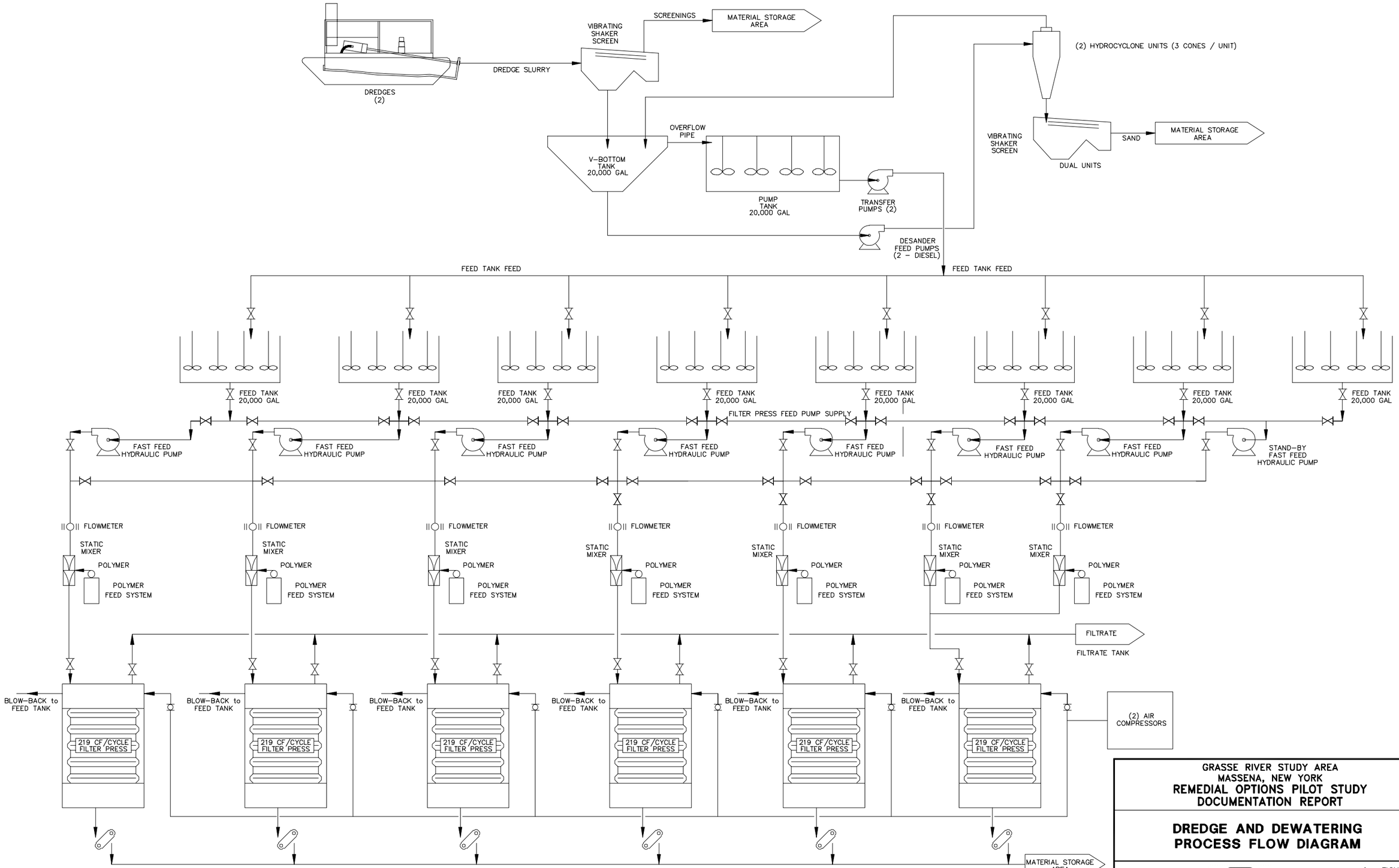
FIGURE
2-14

X: 10809X01, X07.DWG, 10809X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/PLT-D2B1
5/18/06 SYR-85-BGP
10809001/10809G33.DWG

Figure 2-15
Production Rates Over Time
(Weekly Average Production Rates for Work Zone 1)



Notes:
1. Bars shown represent minimum and maximum production rates.
2. Production rates not estimated for 6/14 to 7/1 due to unreliable dredge up times estimates.
3. Data from 9/12 to 10/21/05 include volume of material sent to Geotubes.



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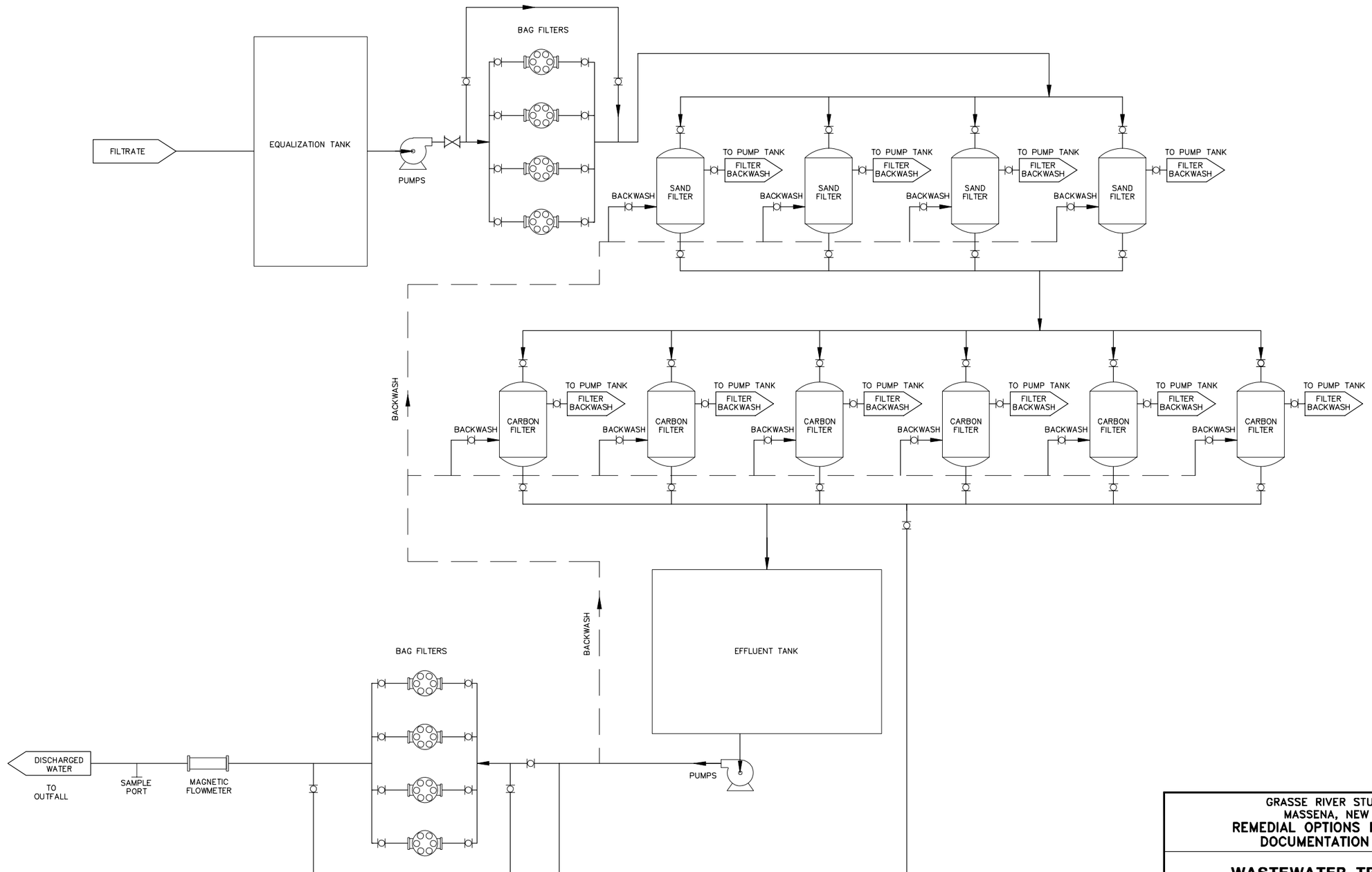
P: PAGESET/PLT-D2B1
5/18/06 SYR-85-BGP
10809001/10809G27.DWG

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

DREDGE AND DEWATERING PROCESS FLOW DIAGRAM

ALCOA

FIGURE
2-16



X: 10809X01.DWG, 10809X01.TIF
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5/18/06 SYR-85-BGP
10809001/10809G28.DWG

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

WASTEWATER TREATMENT PROCESS FLOW DIAGRAM

ALCOA

FIGURE
2-17

DIVERSION BERM

GV11

GV10

CELL 3

LIMIT OF INTERIM CAP

CELL ACCESS RAMP

CELL ACCESS RAMP

STORMWATER SPILLWAY

STORM DRAIN

ACCESS ROAD

MH-R3

MH-R4

CB 2

CB 3

L2A L3 L4 L5 L6 L7 L8

E 3000

LEGEND

254 — EXISTING GROUND CONTOURS

280 — CELL 3 INTERIM CAP CONTOURS

GV10 — INTERIM CAP GAS VENT LOCATION

NOTE:

1. SURVEY DONE BY WCT SURVEYORS USING ALCOA PLANT DATUM PER THE 87 AERIAL. ELEVATIONS ARE IN FEET.

ALCOA

1" = 100'

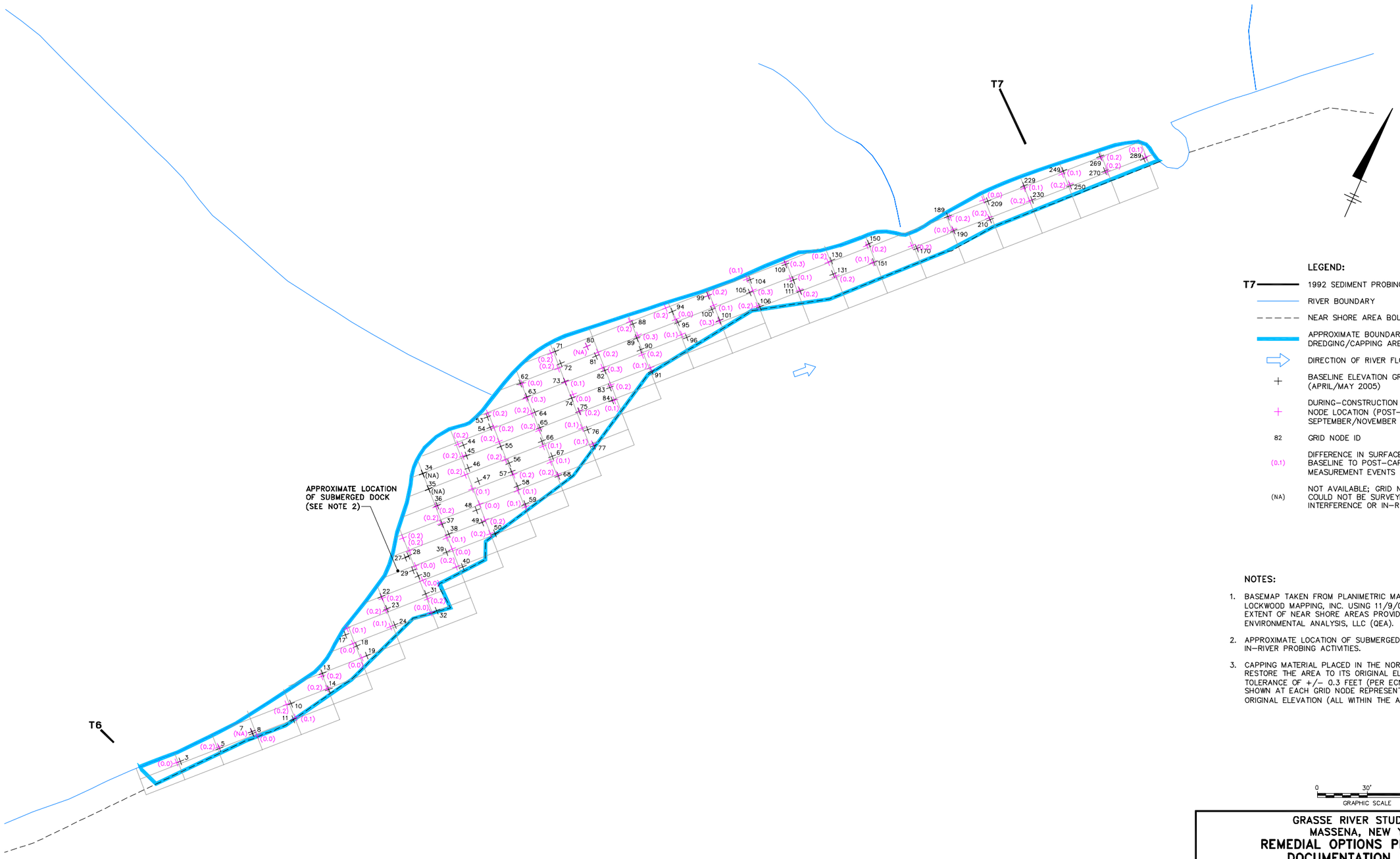
50 0 100

Alcoa Inc. (West Plant) – Massena, New York

CELL 3
FINAL CONTOURS

FIGURE 2–18

L:\ALCOA\Massena West\Grasse River\ROPS Report\FIGURES\ 2-18 05/18/06 16:30 koskiar



LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DIRECTION OF RIVER FLOW
- + BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
- + DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-CAPPING; SEPTEMBER/NOVEMBER 2005)
- 82 GRID NODE ID
- (0.1) DIFFERENCE IN SURFACE ELEVATION FROM BASELINE TO POST-CAPPING MEASUREMENT EVENTS (FT; SEE NOTE 3)
- (NA) NOT AVAILABLE; GRID NODE LOCATION COULD NOT BE SURVEYED DUE TO INTERFERENCE OR IN-RIVER OBSTRUCTION

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. APPROXIMATE LOCATION OF SUBMERGED DOCK DEFINED THROUGH IN-RIVER PROBING ACTIVITIES.
3. CAPPING MATERIAL PLACED IN THE NORTHERN NEAR SHORE TO RESTORE THE AREA TO ITS ORIGINAL ELEVATION WITHIN A TOLERANCE OF +/- 0.3 FEET (PER ECN 022). THE DIFFERENCE SHOWN AT EACH GRID NODE REPRESENTS THE CHANGE FROM THE ORIGINAL ELEVATION (ALL WITHIN THE ALLOWABLE TOLERANCE).

0 30' 60'
GRAPHIC SCALE

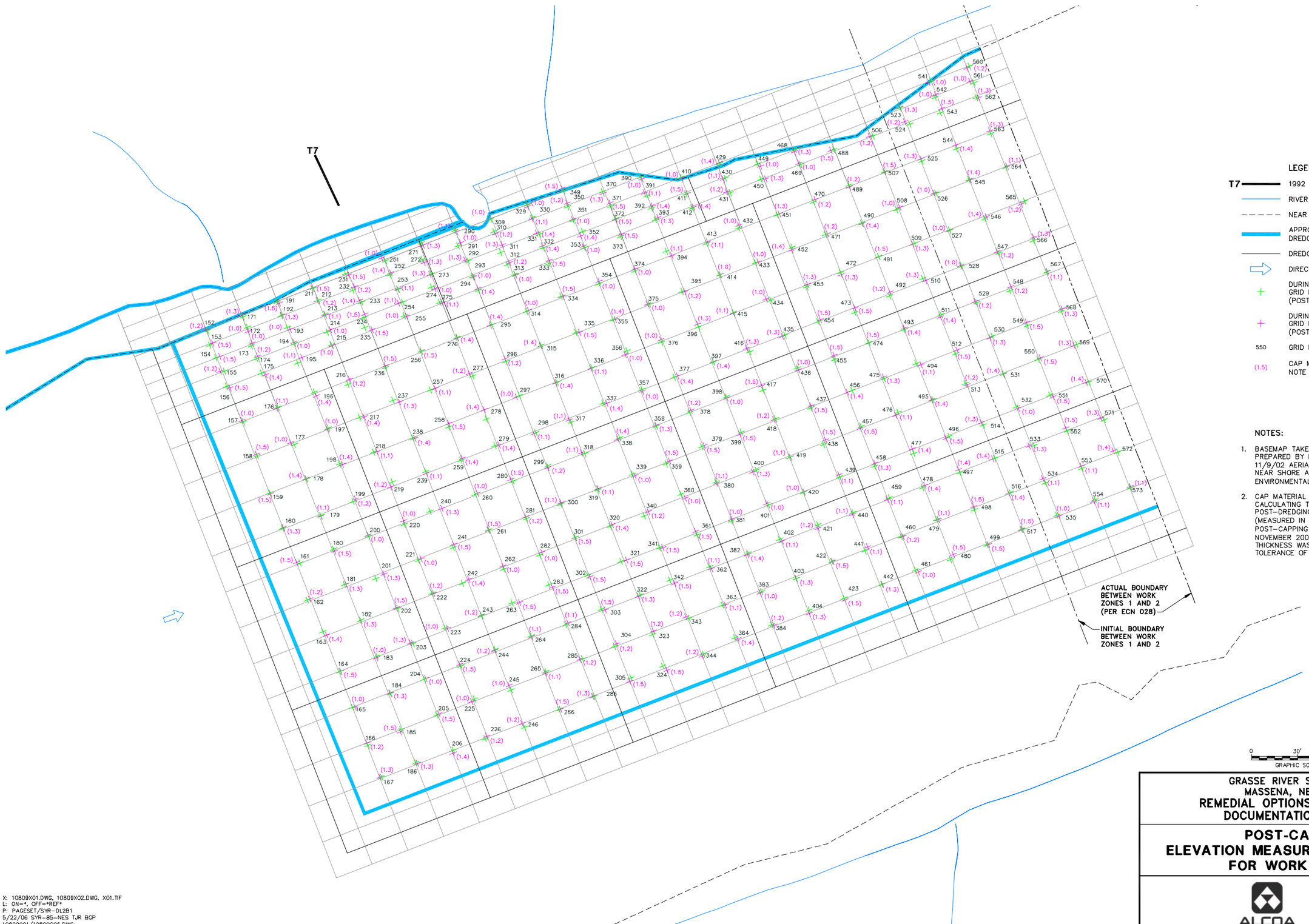
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR THE NORTHERN NEAR SHORE AREA

ALCOA

FIGURE
2-19

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G14.DWG



LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION (POST–DREDGING; OCTOBER 2005)
- DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION (POST–CAPPING; NOVEMBER 2005)
- 550 — GRID NODE ID
- (1.5) — CAP MATERIAL THICKNESS (FT; SEE NOTE 2)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE POST–DREDGING SURFACE ELEVATION (MEASURED IN OCTOBER 2005) AND THE POST–CAPPING ELEVATION (MEASURED IN NOVEMBER 2005). THE TARGET CAP MATERIAL THICKNESS WAS 1.0 FT WITH AN ALLOWABLE TOLERANCE OF +0.5 FT PER ECN 033.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 1

ALCOA

FIGURE
2-20

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES TJR BGP
10809001/10809G06.DWG

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-DREDGING; OCTOBER 2005)
- DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-CAPPING; NOVEMBER 2005)
- 819 — GRID NODE ID
- (1.5) — CAP MATERIAL THICKNESS (FT; SEE NOTE 2)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE POST-DREDGING SURFACE ELEVATION (MEASURED IN OCTOBER 2005) AND THE POST-CAPPING ELEVATION (MEASURED IN NOVEMBER 2005). THE TARGET CAP MATERIAL THICKNESS WAS 1.0 FT WITH AN ALLOWABLE TOLERANCE OF +0.5 FT PER ECN 033.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 2

ALCOA

FIGURE
2-21

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
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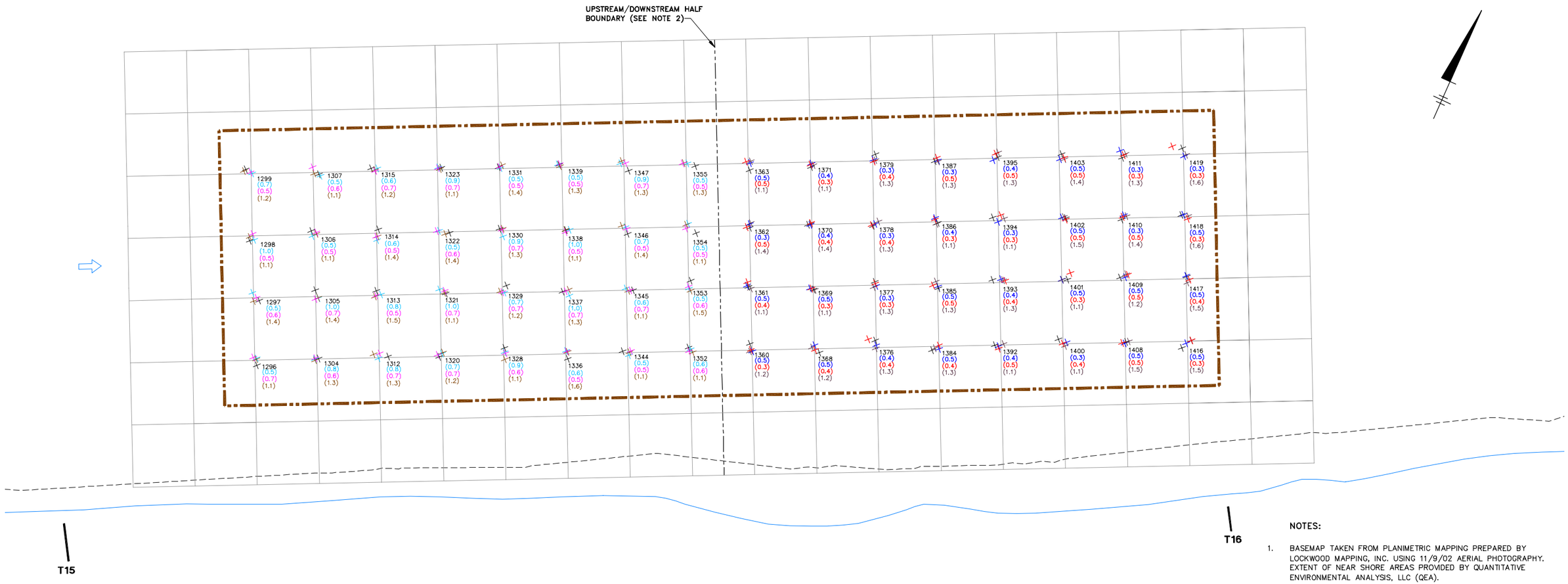
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G10.DWG



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. THE ARMORED CAP AREA WAS DIVIDED INTO AN UPSTREAM AND DOWNSTREAM HALF AS DIFFERENT LAYERS WERE PLACED IN THESE AREAS. THREE LAYERS WERE PLACED IN THE UPSTREAM HALF INCLUDING A 6–INCH BASE LAYER, 6–INCH FILTER LAYER, AND 13–INCH ARMOR LAYER. THREE LAYERS WERE ALSO PLACED IN THE DOWNSTREAM HALF INCLUDING TWO 3–INCH FILTER LAYERS AND A 13–INCH ARMOR LAYER. THE THICKNESSES PROVIDED HERE ARE ACTUAL; THICKNESS TOLERANCES ARE DESCRIBED IN ECN 027 REVISION 1.
3. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE 2005 BASELINE OR PREVIOUS CAPPING LAYER SURFACE ELEVATION AND THE NEXT POST–CAPPING ELEVATION (i.e., ARMORED LAYER THICKNESS DETERMINED USING THE FILTER SURFACE ELEVATION AND THE POST–ARMOR LAYER ELEVATION).

LEGEND:

T16	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
	DIRECTION OF RIVER FLOW
×	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
1352	GRID NODE ID

UPSTREAM HALF OF ARMORED CAP AREA

×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – BASE LAYER (POST–CAPPING; SEPTEMBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – FILTER LAYER (POST–CAPPING; SEPTEMBER/OCTOBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – ARMOR LAYER (POST–CAPPING; OCTOBER 2005)
(0.6)	BASE LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(0.5)	FILTER LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(1.2)	ARMOR LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)

DOWNSTREAM HALF OF ARMORED CAP AREA

×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – FILTER LAYER 2 (POST–CAPPING; SEPTEMBER/OCTOBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – FILTER LAYER 1 (POST–CAPPING; OCTOBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – ARMOR LAYER (POST–CAPPING; OCTOBER 2005)
(0.6)	FILTER LAYER 2 CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(0.5)	FILTER LAYER 1 CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(1.2)	ARMOR LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)

0 20' 40'
GRAPHIC SCALE

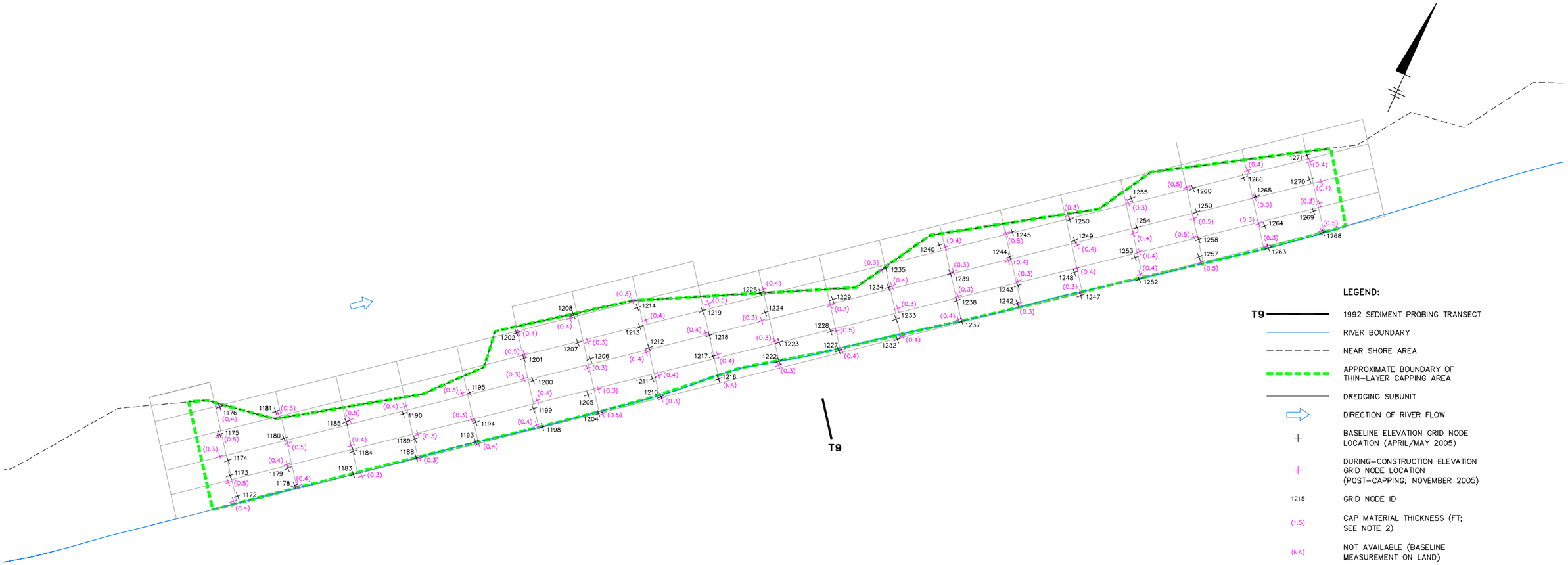
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR THE ARMORED CAPPING AREA

ALCOA

FIGURE
2-22

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G11.DWG



LEGEND:

T9	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
	DREDGING SUBUNIT
	DIRECTION OF RIVER FLOW
+	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
+	DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-CAPPING; NOVEMBER 2005)
1215	GRID NODE ID
(1.5)	CAP MATERIAL THICKNESS (FT; SEE NOTE 2)
(NA)	NOT AVAILABLE (BASELINE MEASUREMENT ON LAND)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE POST-DREDGING SURFACE ELEVATION (MEASURED IN OCTOBER 2005) AND THE POST-CAPPING ELEVATION (MEASURED IN NOVEMBER 2005). THE TARGET CAP MATERIAL THICKNESS WAS 0.3 FT TO 0.5 FT.

0 20' 40'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR THE SOUTHERN NEAR SHORE AREA

ALCOA

FIGURE
2-23

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G12.DWG

CORE 492 (AUGUST 30, 2005)

Visual Characterization	Total PCB Concentration
Dark brown silt, little fine sand, trace organics (twigs), odor	322 ppm
Brown very fine to fine sand, trace shells, odor	25.2 ppm
Dark brown to gray fine sand, little medium to coarse sand, trace fine to medium gravel	7.2 ppm
Brown fine sand, trace very fine sand, trace silt, trace medium sand	Non-detect
	Non-detect
Gray very fine sand and silt, trace clay, trace rock fragments	Non-detect
	Non-detect

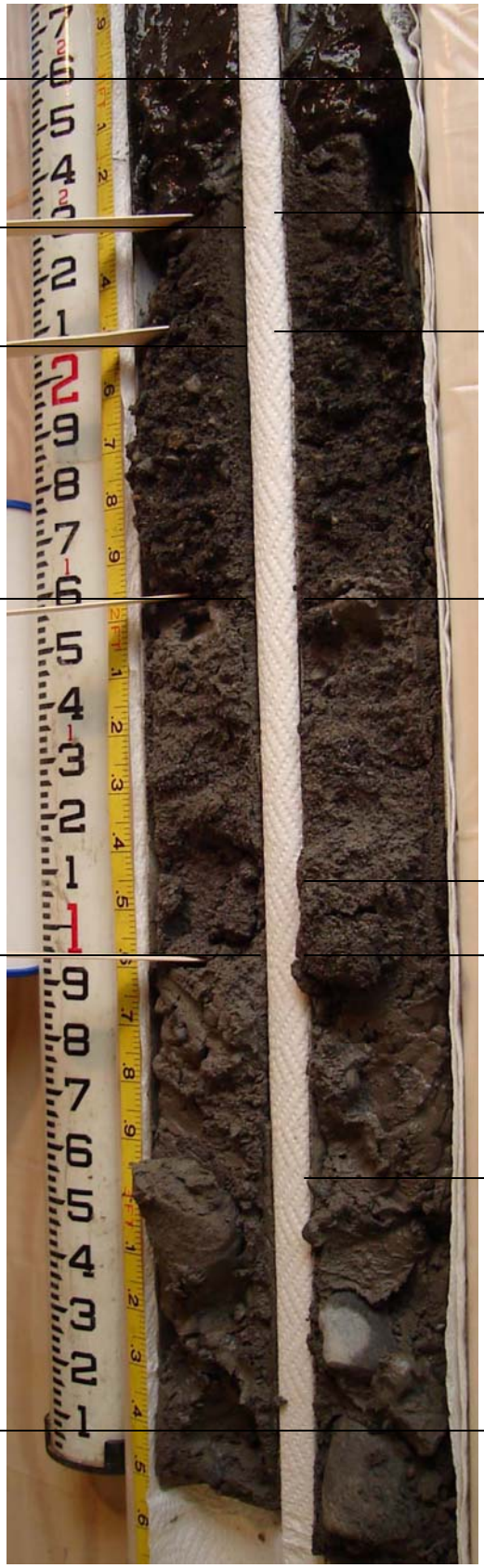


Figure 3-1. Example of Physical and Chemical Differences Between Contaminated Sediment Layer and Native Sediments.

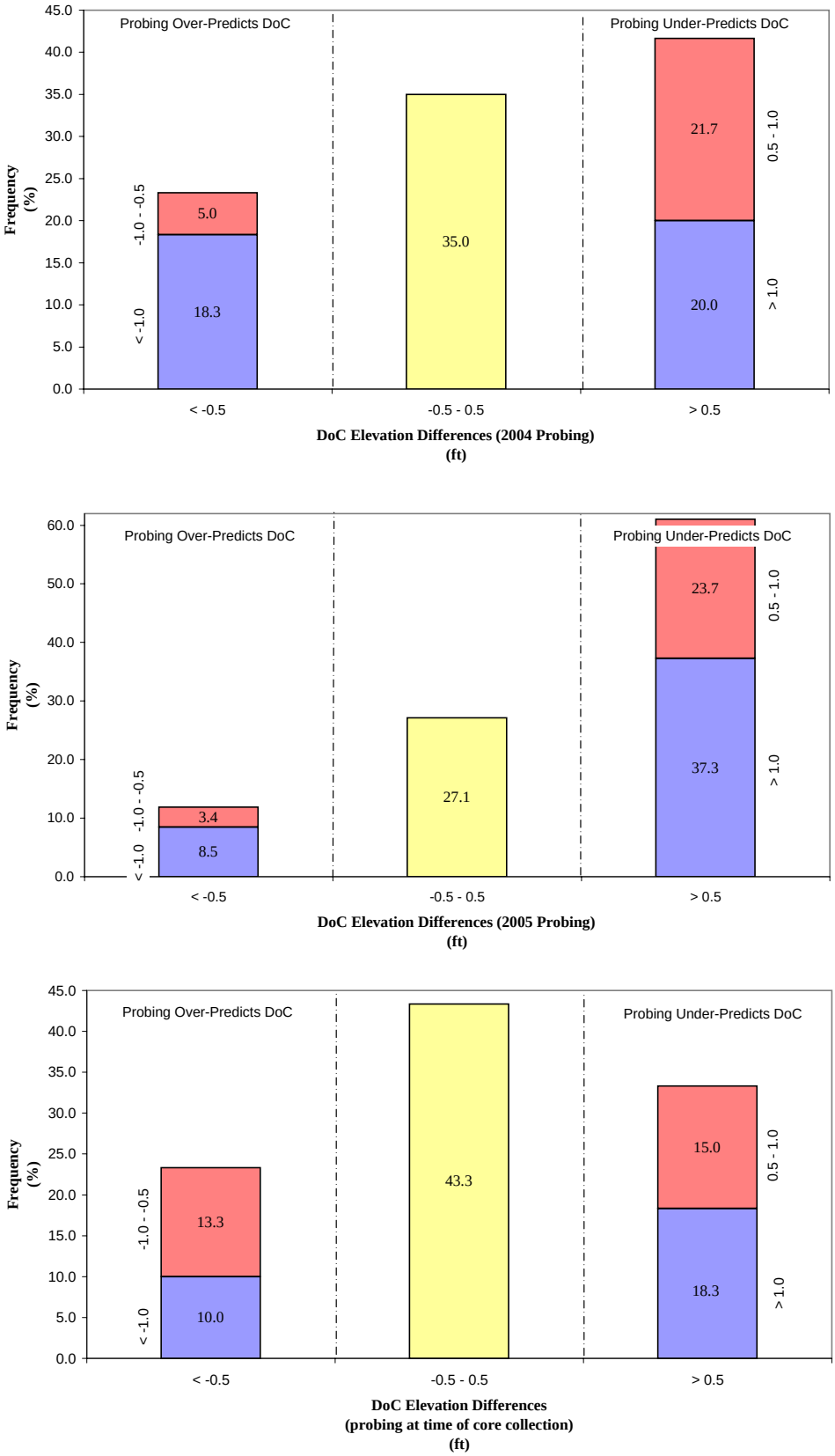


Figure 3-2. Comparison of Depth of Contamination (DoC) Estimates from Sediment Probing and Vibracoring Results for the Main Channel Area of Work Zone 1

Hard Bottom elevations based on 2004/05-baseline measurements, and probing conducted at the time of core collection. DoC elevations based on a 1 ppm limit for during-ROPS cores.

Data tables: sed_aro_ROPS, sed_probe_ROPS

ARC- D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\hard_bottom\0405baselineprobe_Vibracores.xls
5/15/2006 12:08 PM

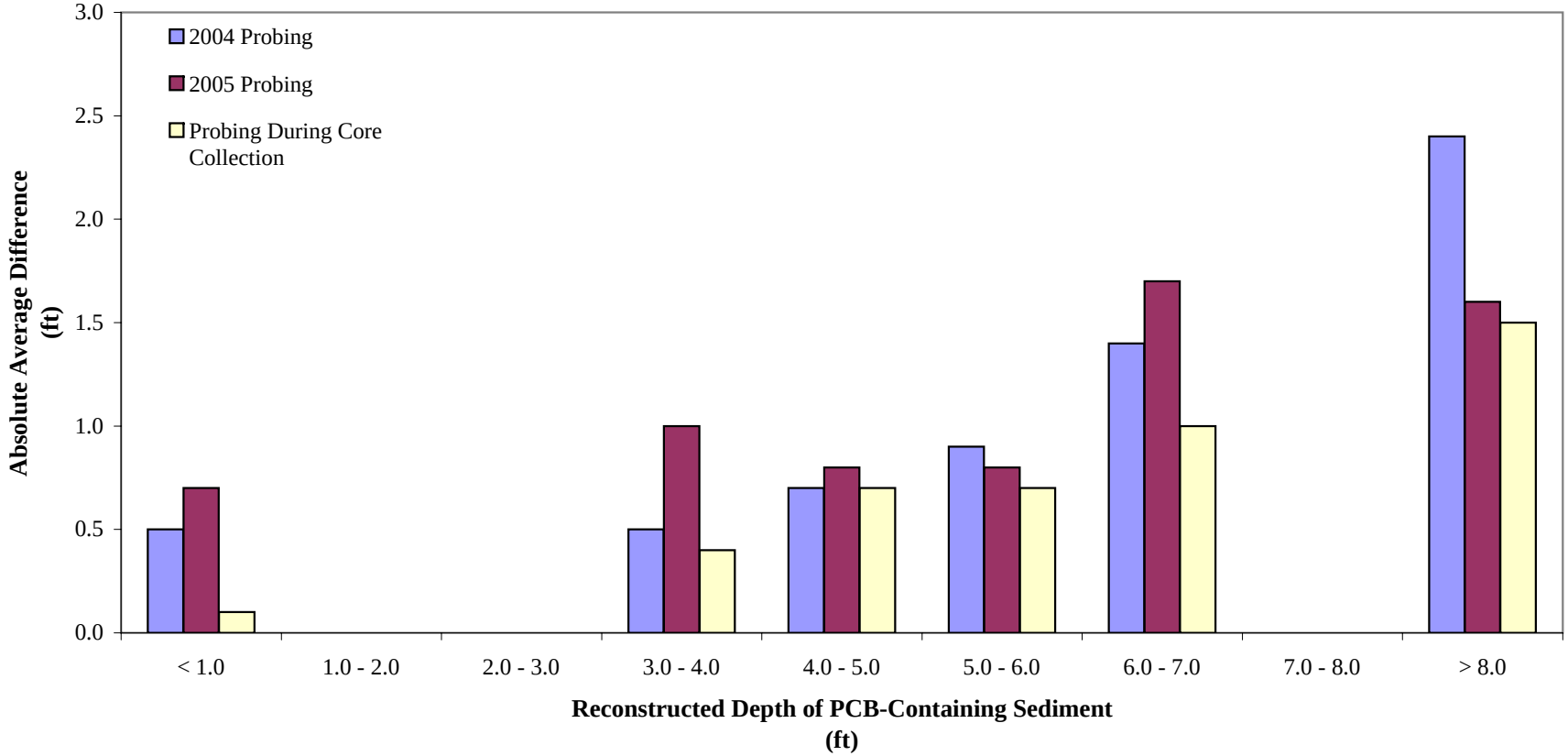
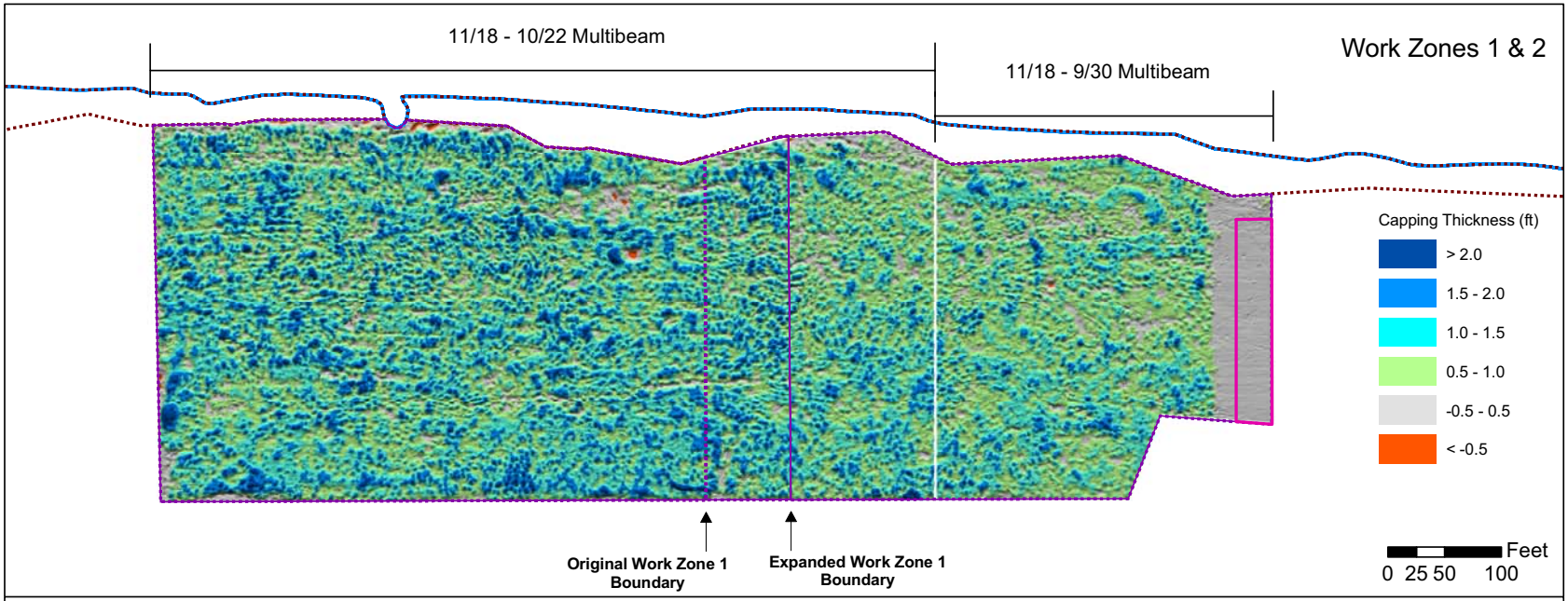


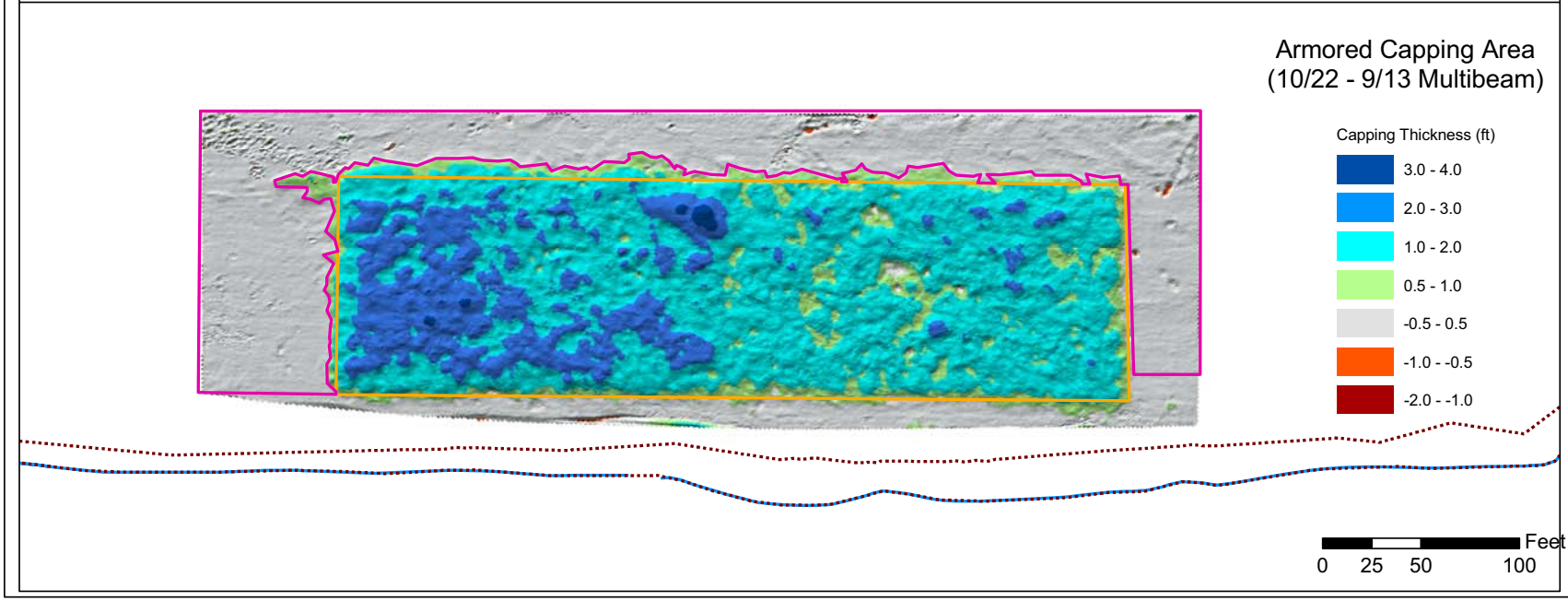
Figure 3-3. Absolute Differences (Reconstructed - Probing) in Estimated Depths of PCB-Containing Sediment for the Main Channel Area of Work Zone 1

Reconstructed depths based on elevations from 2003 Multibeam and depths of PCB-containing sediments for cores collected during ROPS.

Data tables: sed_aro_ROPS, sed_probe_ROPS

ARC- D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\hard_bottom\0405baselineprobe_Vibracores.xls
5/15/2006 12:30 PM





N

LEGEND

- No Activity Test Areas
- Workzone Outline
- Original Workzone Boundary
- Armored Capping Area
- Near Shore Area
- Grasse River Shoreline

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 3-4.
Areas Used to Assess Accuracy of Multibeam Bathymetry Measurements

ALCOA

Jan 2006

ARC:\\Adrianne\d_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\split_rops_probing_MC2005arc_051020.mxd

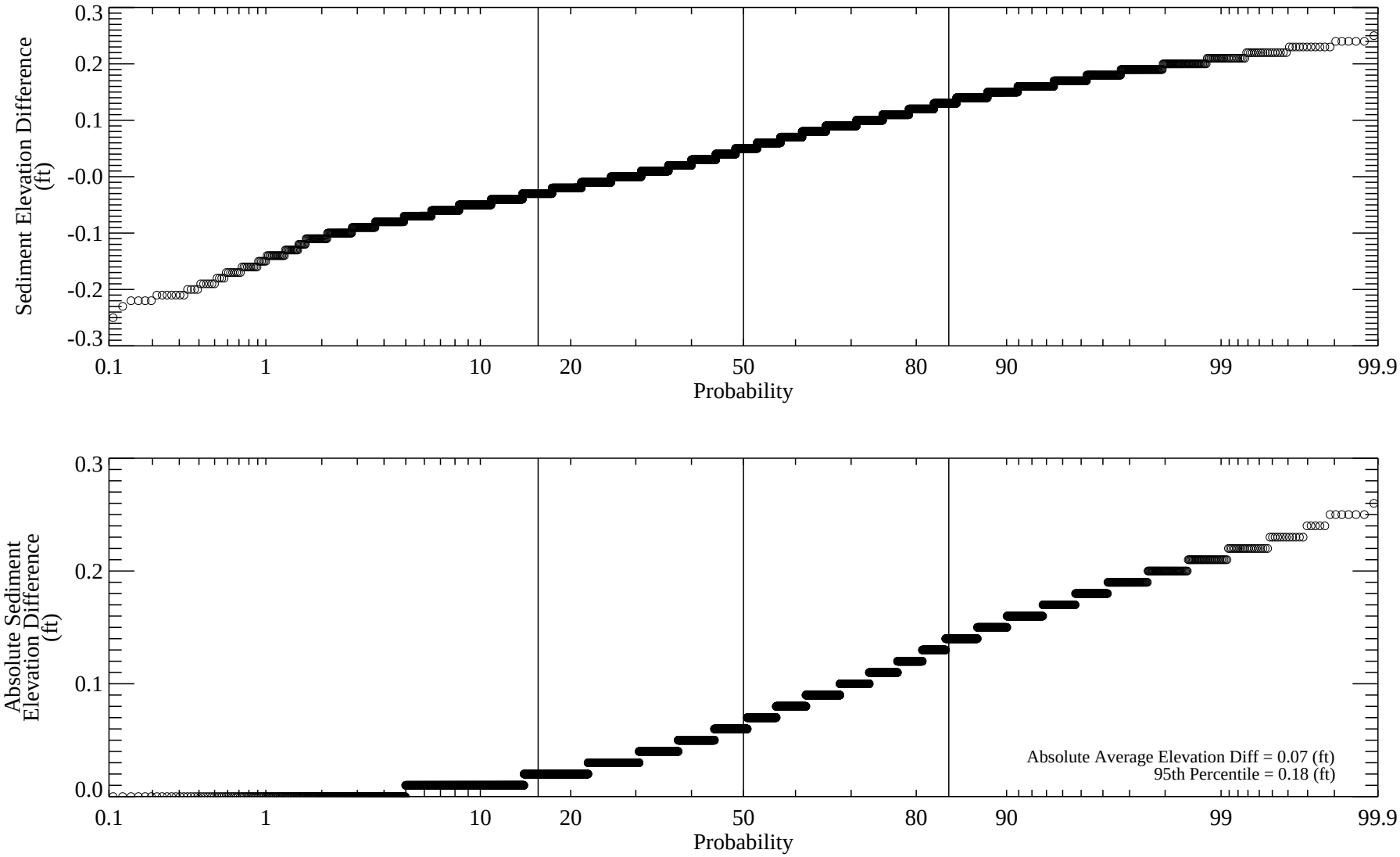


Figure 3-5. Cumulative Frequency Distribution of Sediment Elevation Differences in the Downstream Section of Work Zone 2
Based on multibeam surveys from September 30, 2005 and November 18, 2005
Top panel represents elevation differences (Nov 18 - Sept 30). Bottom panel represents absolute elevation differences (Nov 18 - Sept 30).

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\WZ2_MB_StdError_test.pro
Fri May 12 15:50:20 2006

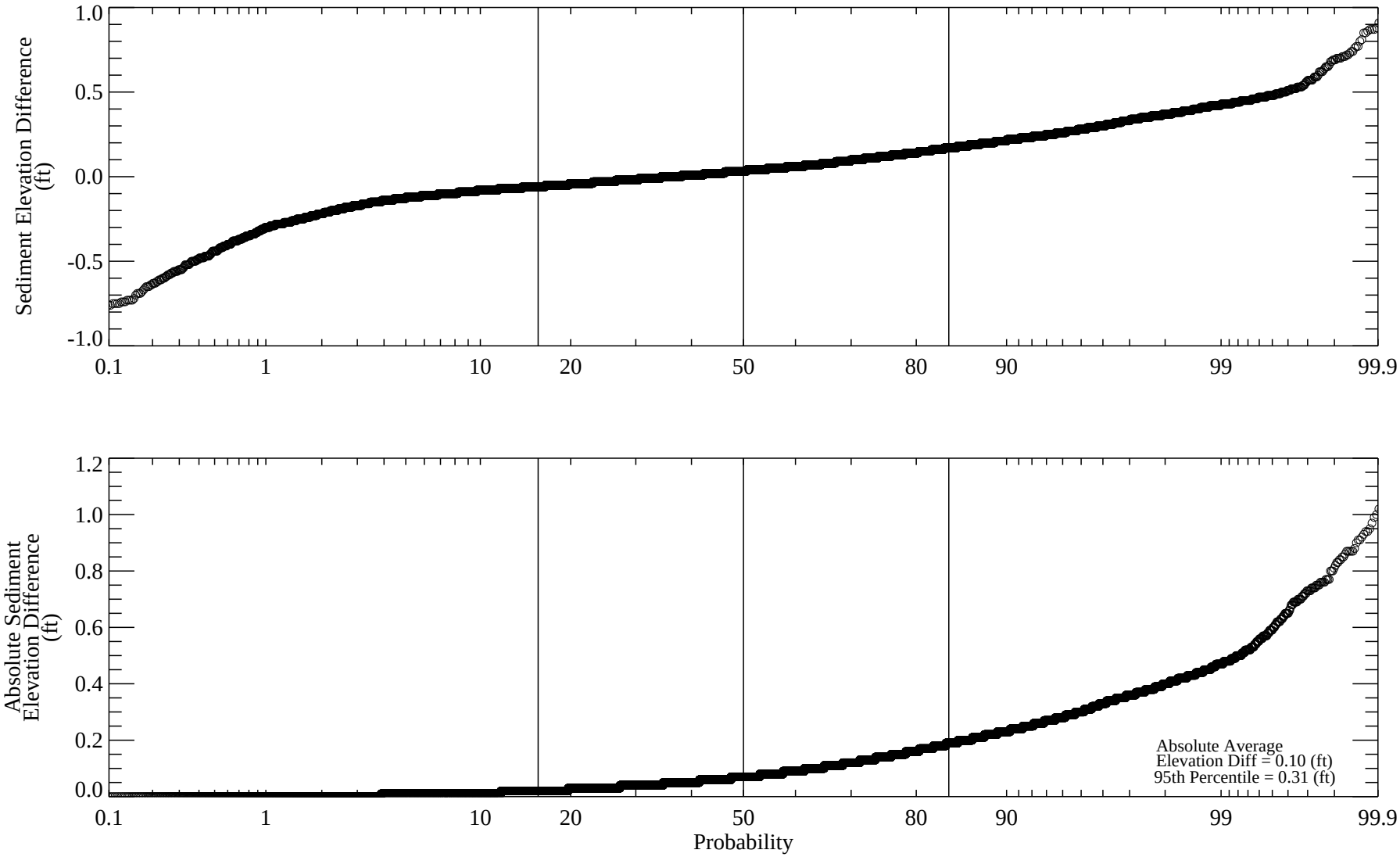
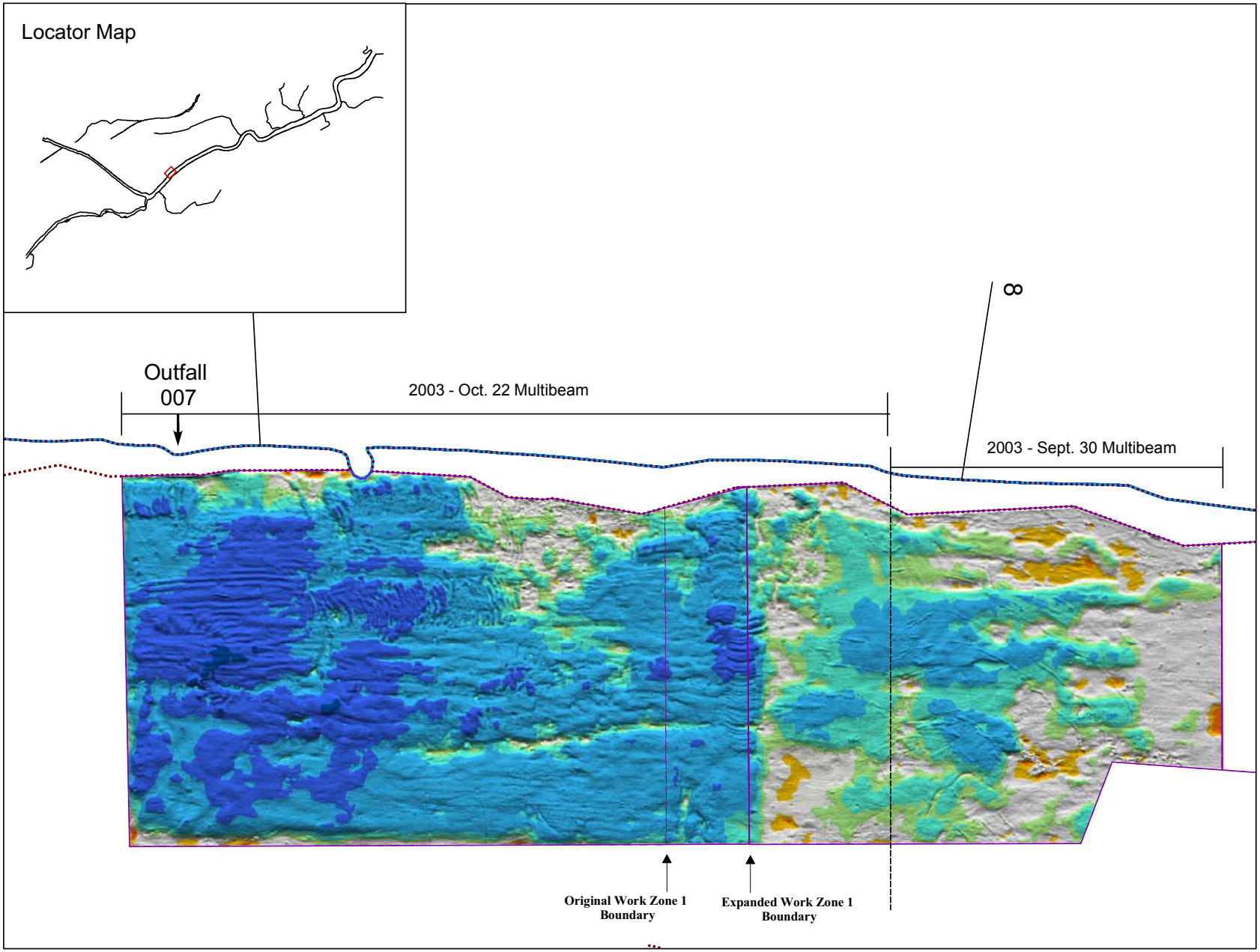


Figure 3-6. Cumulative Frequency Distribution of Sediment Elevation Differences Outside of the Armored Cap Area
Based on Multibeam surveys from September 13, 2005 and October 22, 2005. Near shore data has been excluded.
Top panel represents elevation differences (Oct 22 - Sept 13). Bottom panel represents absolute elevation differences (Oct 22 - Sept 13).

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\ACAP_MB_StdError_test.pro
Mon May 15 17:44:24 2006



GRAPHIC SCALE

Feet

0 25 50 100

LEGEND

Sediment Removed (ft)

- < -2
- -2 - -1
- -1 - -0.5
- -0.5 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- > 6

- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 3-7.
Sediment Elevation Differences
Between June/July 2003
and Sept. 30 & Oct. 22, 2005
Multibeam Bathymetry Surveys

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd

Figure 3-8. Example of Debris Removed from the ROPS Main Channel Work Area During Debris Removal Activities.

Photo MPP16 taken on June 17, 2005.

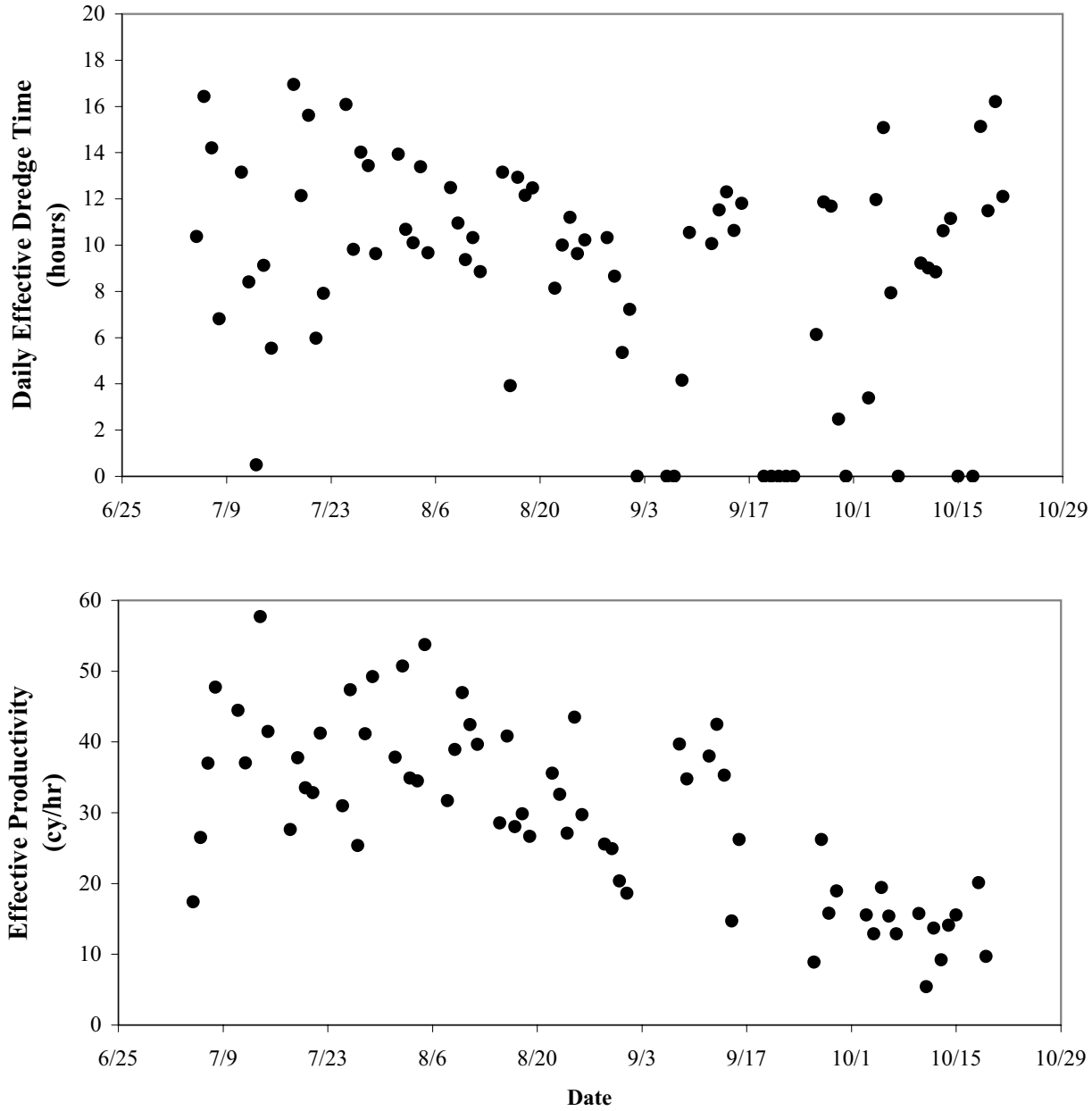
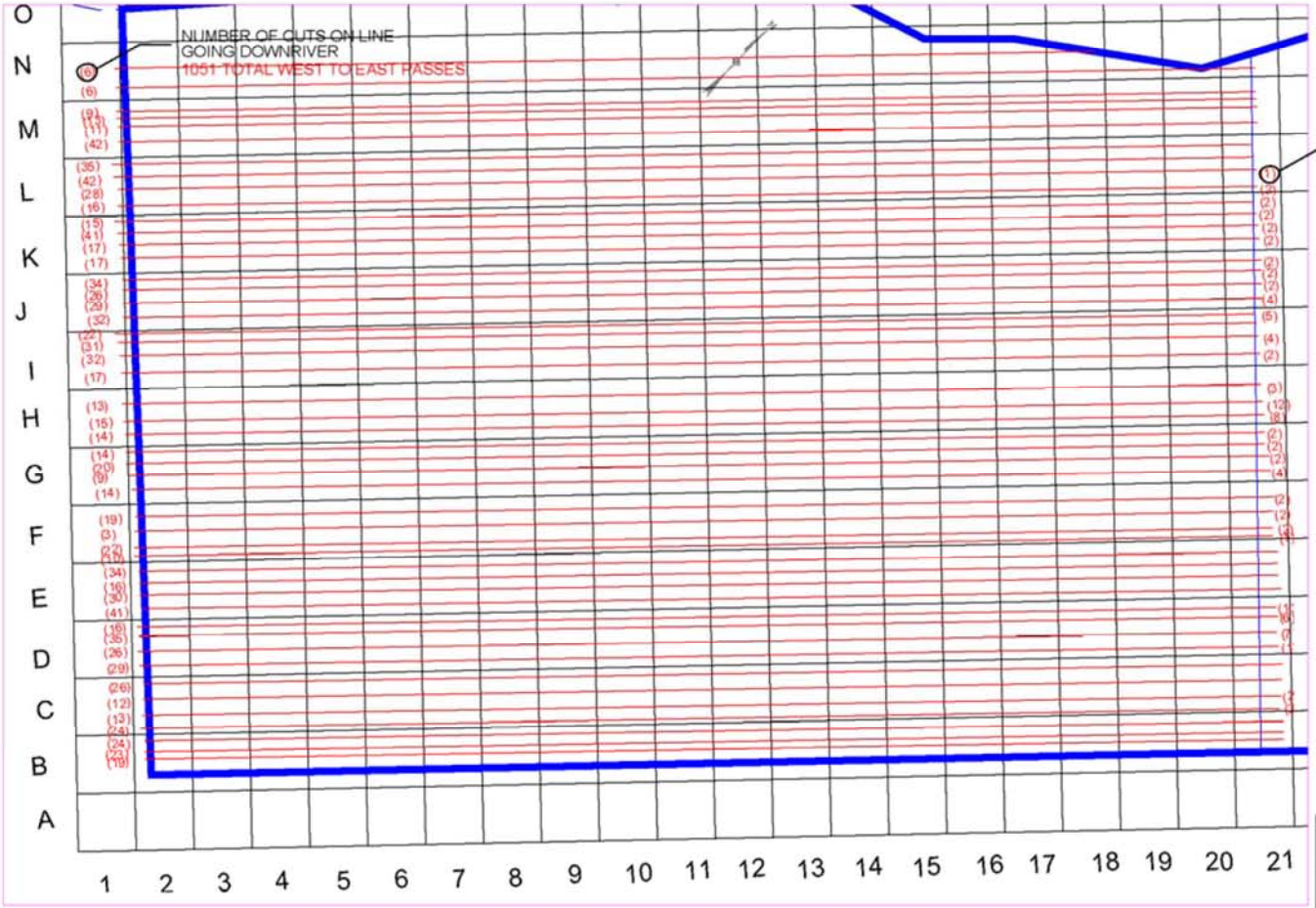


Figure 3-9. Daily Effective Dredge Time and Effective Productivity for Work Zone 1.
Effective dredge times reflect hours of dredge operation. The average effective dredge time includes days not worked due to weather or silt curtain repairs (11 days).
Effective productivity reflects the volume of sediment removed per hour on days when dredges were operational.



NOTE: INFORMATION OBTAINED FROM DREDGEPACK AND DREDGE REPORTS.

WORK ZONES
25FT GRID

50 0 50
SCALE IN FEET

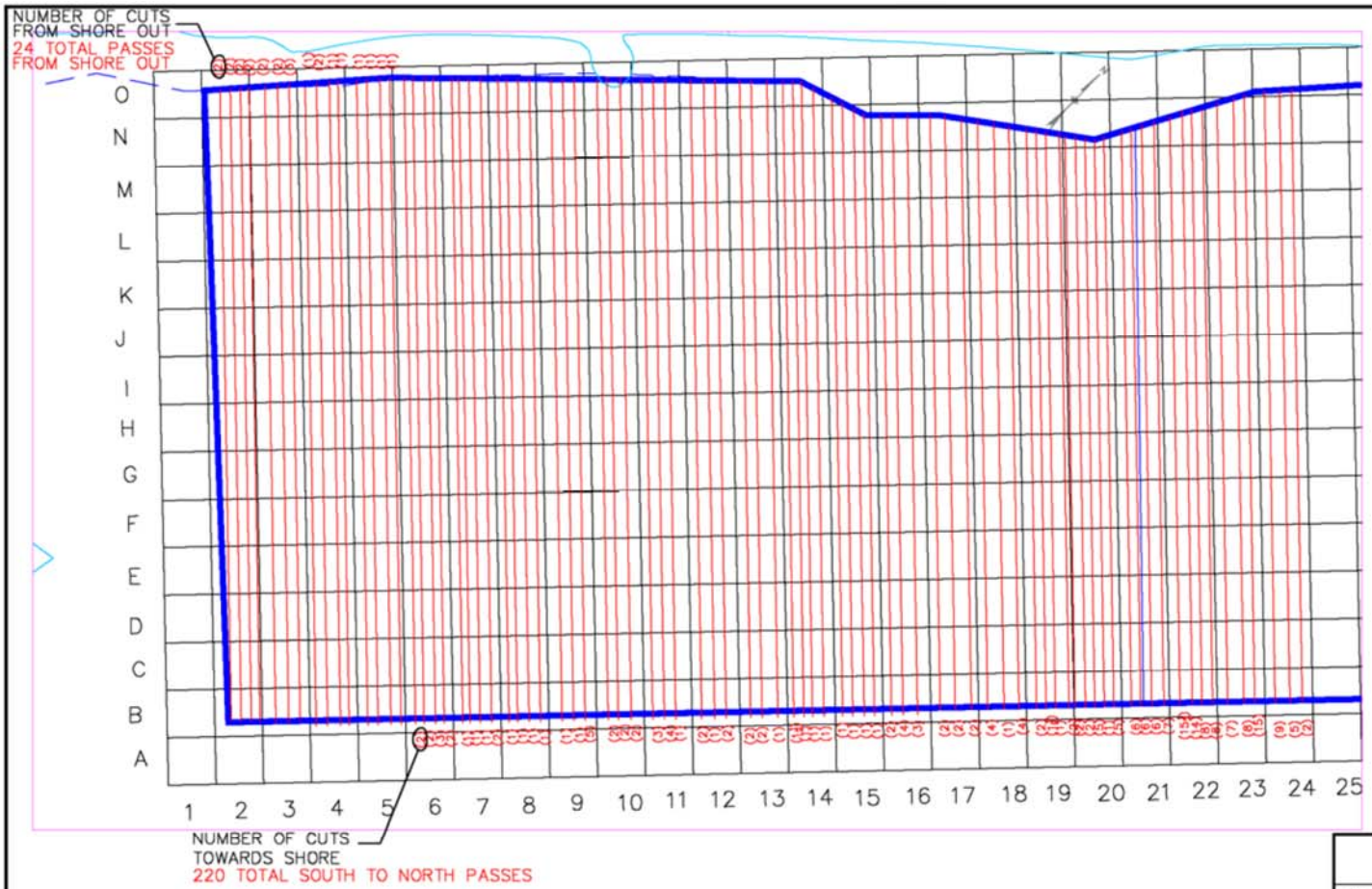
EAST TO WEST DREDGE CUTS AND DIRECTION

ALCOA
GRASSE RIVER REMEDIAL
OPTIONS PILOT STUDY
Massena, NY

ALCOA

Figure 3-10.

DATE:	
DRAWN BY:	K.Dorn
CHECKED BY:	K.Thibodeaux
CAD FILE:	hypack 030 wz1 volume left
SCALE:	1"=60'



NORTH AND SOUTH DREDGE CUTS AND DIRECTION

ALCOA
GRASSE RIVER REMEDIAL
OPERATIONS PILOT STUDY
Massena, NY

ALCOA

WORK ZONES
25FT GRID

60 0 60
SCALE IN FEET

NOTE: INFORMATION OBTAINED FROM DREDGEPACK AND DREDGE REPORTS

Figure 3-11.

DATE:	
DRAWN BY:	K.Dorn
CHECKED BY:	K.Thibodeaux
CAD FILE:	vert wz1
SCALE:	1"=60'

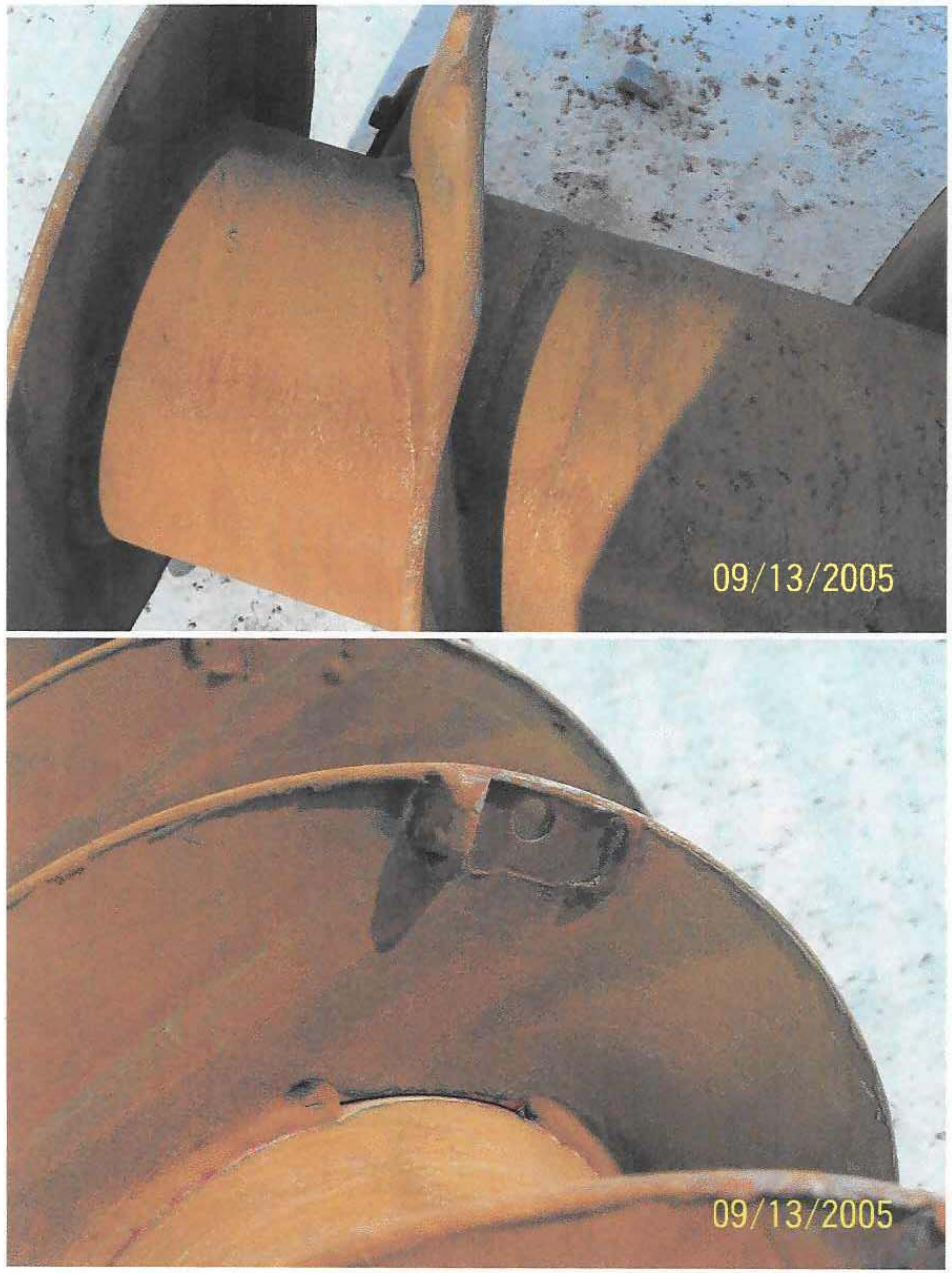


Figure 3-12. Photos of Damage to Horizontal Auger During Repeated Dredging Attempts in Work Zone 1.

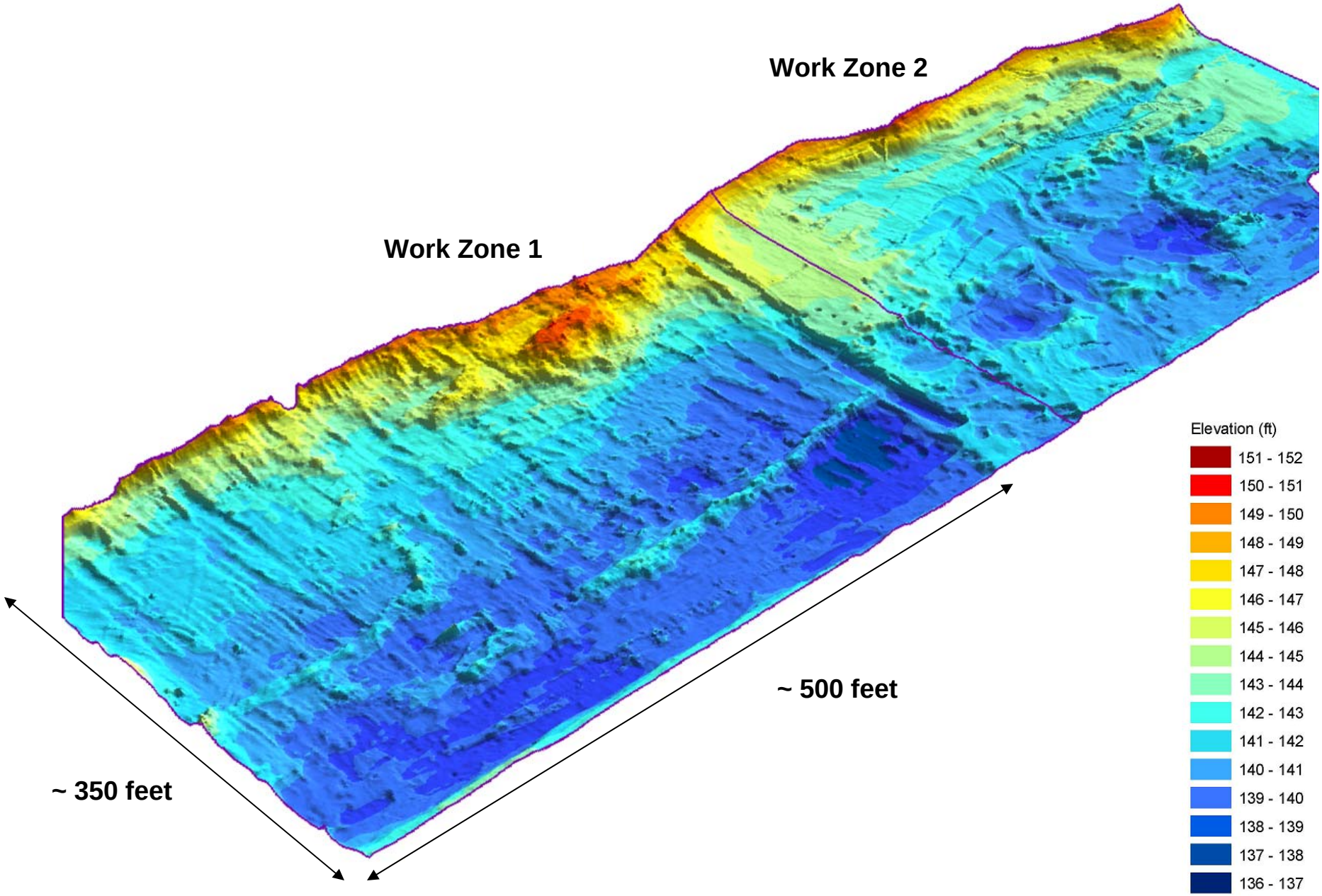


Figure 3-13. River Bottom Topography in Work Zones 1 and 2 (Sept. 12, 2005).

Based on September 12, 2005 multibeam bathymetry data.

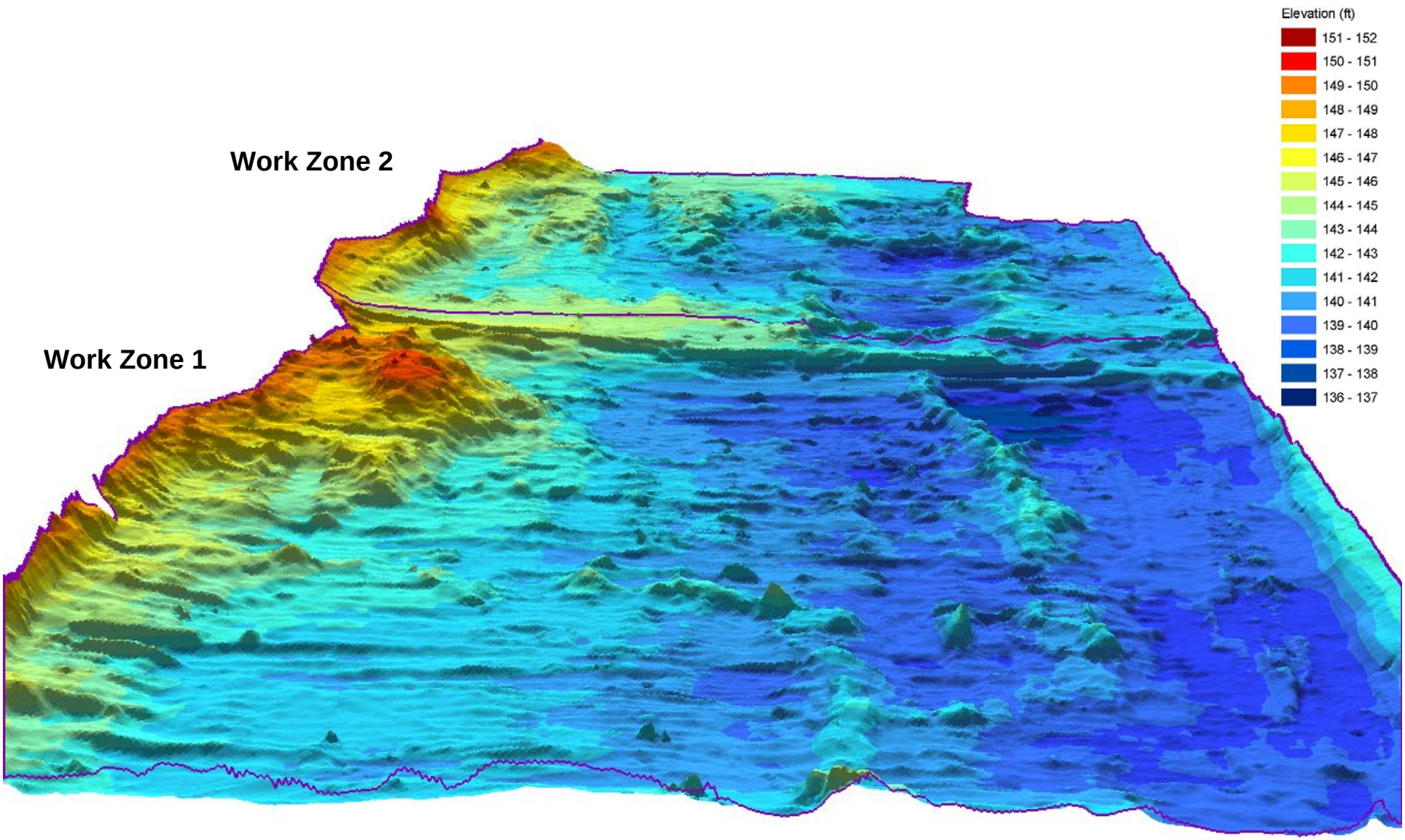
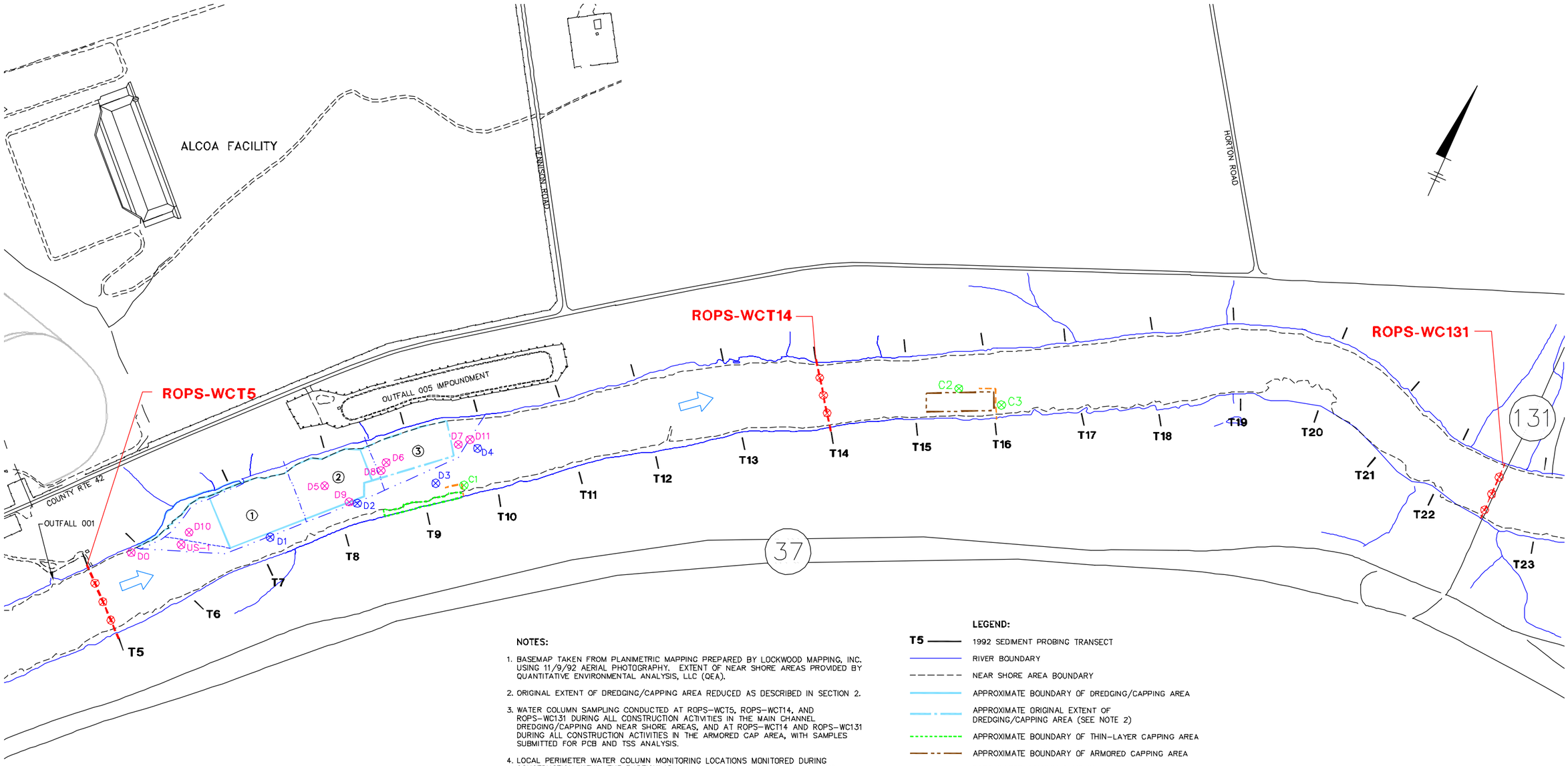


Figure 3-14. River Bottom Topography (Looking Downstream) in Work Zones 1 and 2 (Sept. 12, 2005).

Based on September 12, 2005 multibeam bathymetry data.



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

2. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.

3. WATER COLUMN SAMPLING CONDUCTED AT ROPS–WCT5, ROPS–WCT14, AND ROPS–WC131 DURING ALL CONSTRUCTION ACTIVITIES IN THE MAIN CHANNEL DREDGING/CAPPING AND NEAR SHORE AREAS, AND AT ROPS–WCT14 AND ROPS–WC131 DURING ALL CONSTRUCTION ACTIVITIES IN THE ARMORED CAP AREA, WITH SAMPLES SUBMITTED FOR PCB AND TSS ANALYSIS.

4. LOCAL PERIMETER WATER COLUMN MONITORING LOCATIONS MONITORED DURING CONSTRUCTION WITHIN THE PARTICULAR AREAS THEY SURROUND, WITH SAMPLES SUBMITTED FOR PCB AND TSS ANALYSIS DAILY. NOTE THAT LOCATIONS C2 AND C3 ARE APPROXIMATE.

5. LOCAL INTERIOR WATER COLUMN MONITORING STATIONS MONITORED AS PART OF SUPPLEMENTAL MONITORING ACTIVITIES TO ASSESS WATER QUALITY WITHIN SILT CURTAIN SETUP DURING DREDGING AND CAPPING.

6. DETAILS REGARDING ACTUAL SILT CURTAIN SETUP AND CONFIGURATION ARE PRESENTED IN SECTION 2 ALONG WITH THE CORRESPONDING FIGURES.

7. DURING CONSTRUCTION, THE LOCATION OF THE SILT CURTAINS SHIFTED FROM THAT SHOWN ON THIS FIGURE DUE TO RIVER FLOWS. THE ACTUAL WATER COLUMN MONITORING LOCATIONS ARE SHOWN ON THIS FIGURE AND WERE LOCATED IN THE FIELD AT THE TIME OF SAMPLING BASED ON THE SILT CURTAIN POSITION. THE LOCAL WATER COLUMN LOCATIONS WERE PLACED AS FOLLOWS: D0 LOCATED WITHIN OPENING OF UPSTREAM SILT CURTAIN DURING SCOW TRANSPORT; D1–D4 LOCATED IMMEDIATELY ADJACENT TO THE OUTSIDE PERIMETER OF THE SILT CURTAIN; D5–D6 LOCATED ALONG THE UPSTREAM SIDE OF THE INTERMEDIATE SILT CURTAINS BETWEEN THE WORK ZONES; D7 AND D11 LOCATED UPSTREAM OF THE DOWNSTREAM PORTION OF THE PERIMETER SILT CURTAIN; D8 LOCATED UPSTREAM OF THE INTERMEDIATE CURTAIN BETWEEN WORK ZONES 2 AND 3; D9 LOCATED INSIDE THE SILT CURTAIN ADJACENT TO D2; D10 LOCATED DOWNSTREAM OF THE AIR CURTAIN; US–1 LOCATED UPSTREAM OF THE AIR CURTAIN; C1 LOCATED DOWNSTREAM OF THE SILT CURTAIN RUNNING PERPENDICULAR TO SHORE DOWNSTREAM OF THE SOUTHERN NEAR SHORE AREA; C2 LOCATED NEAR THE CENTER OF THE RIVER AT THE MID POINT OF THE ARMORED CAP AREA; AND C3 LOCATION DOWNSTREAM OF THE SILT CURTAIN RUNNING PERPENDICULAR TO SHORE DOWNSTREAM OF THE ARMORED CAP AREA.

LEGEND:

- T5 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
- APPROXIMATE BOUNDARY OF THIN–LAYER CAPPING AREA
- APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
- ROPS WATER COLUMN SAMPLING TRANSECT WITH WATER COLUMN MONITORING STATION (SEE NOTE 3)
- LOCAL PERIMETER WATER COLUMN MONITORING LOCATION FOR DREDGING/CAPPING (SEE NOTES 4 AND 7)
- LOCAL PERIMETER WATER COLUMN MONITORING LOCATION FOR CAPPING (SEE NOTES 4 AND 7)
- LOCAL INTERIOR WATER COLUMN MONITORING LOCATION FOR DREDGING/CAPPING (SEE NOTES 5 AND 7)
- ① MAIN CHANNEL DREDGE WORK AREA
- APPROXIMATE PERIMETER SILT CURTAIN LOCATION (SEE NOTES 6 AND 7)
- APPROXIMATE INTERMEDIATE SILT CURTAIN LOCATION (SEE NOTES 6 AND 7)
- APPROXIMATE SHALLOW SILT CURTAIN LOCATION (SEE NOTES 6 AND 7)
- APPROXIMATE AIR CURTAIN LOCATION (SEE NOTES 6 AND 7)
- DIRECTION OF RIVER FLOW

0 300' 600'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

WATER COLUMN MONITORING LOCATIONS

ALCOA

FIGURE
3-15

X: 10809X01.DWG, X02.DWG, X01.TIF
L: ON=*, OFF=REF*
P: PAGESET/PLT–DL2B1
1/11/06 SYR–BS–KMD BGP DJP
10809001/10809B04.DWG

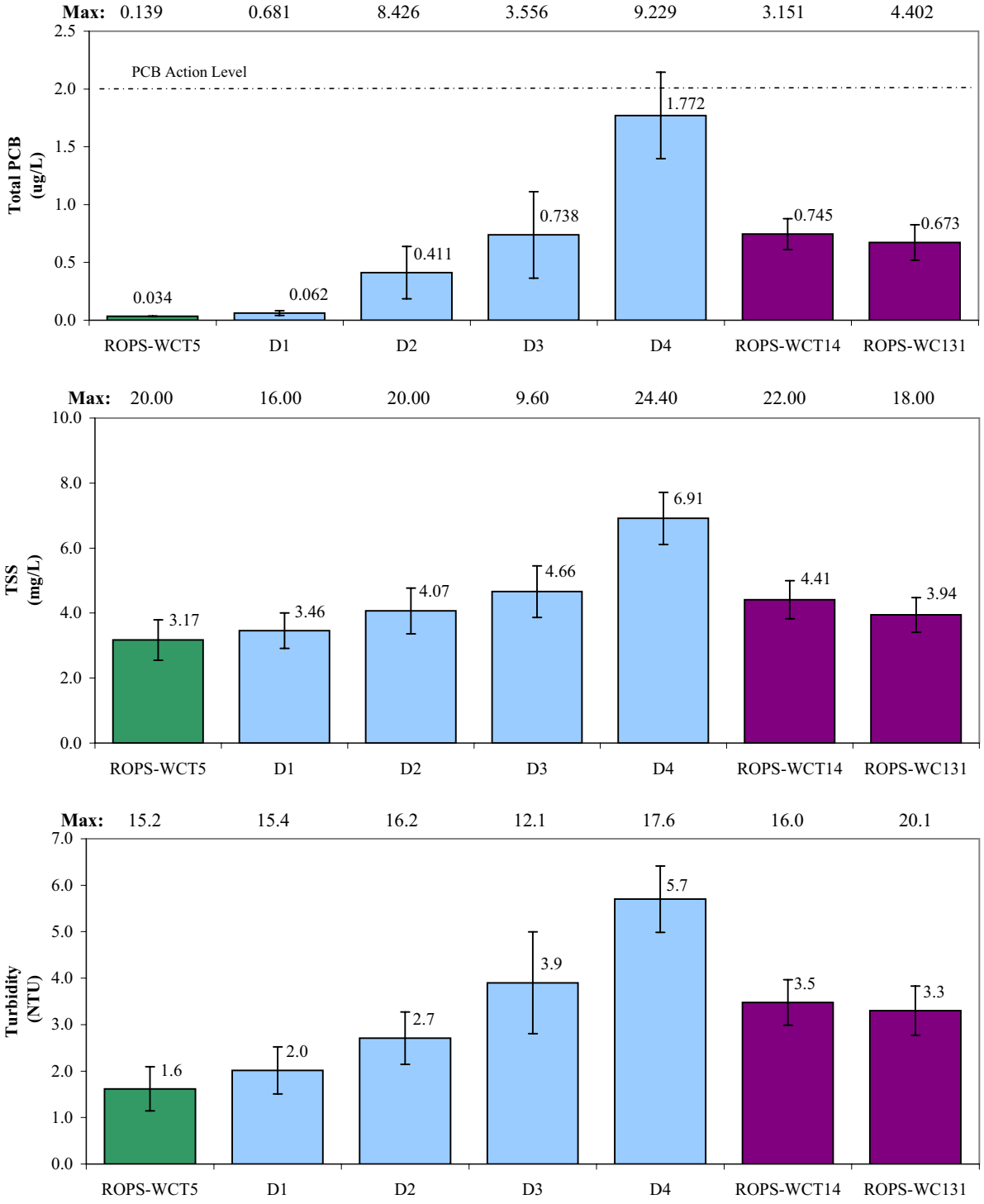


Figure 3-16. Average Water Column Levels During Main Channel and Northern Near Shore Debris and Sediment Removal Activities

Values below the detection were set to half the detection limit prior to calculations.
On days were stratification occurred, samples below the stratification level were excluded.
Error bars represent 95% confidence intervals.
Maximum levels displayed along the top of each panel for each location.
PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

Date tables: water_aro_ROPS, water_field_ROPS

- Upstream
- Local
- Downstream

ARC - D:\ALCgra\Analysis\ROPS\IDL\water\watercolumn_spatialavg_barplots.xls
5/22/2006 11:32 AM

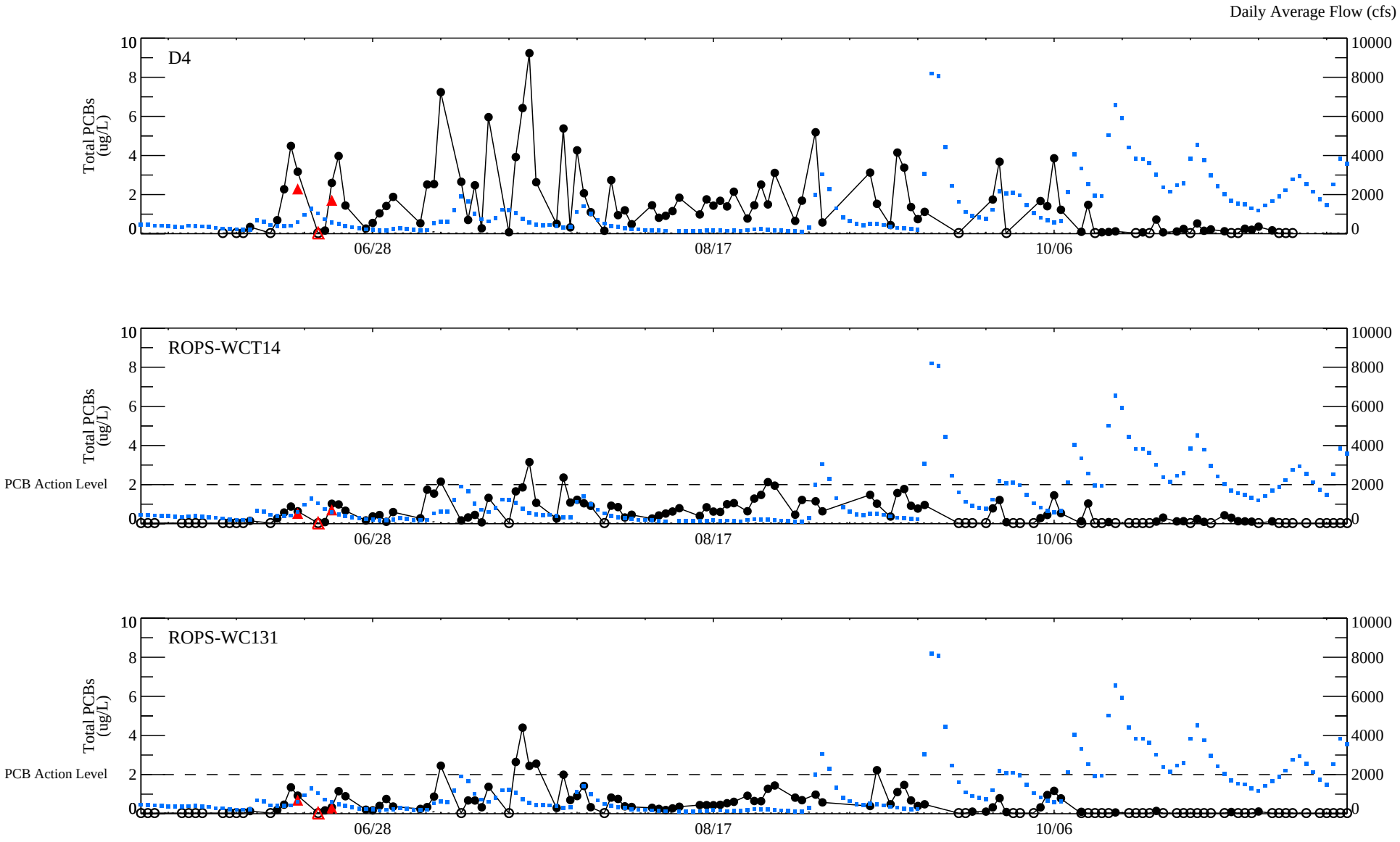


Figure 3-17. Total PCB Levels Measured Downstream of the Containment System

Non-detects plotted at half the detection limit as open symbols. Duplicates averaged.
If stratification is present, results for upper water mass are shown. Total PCBs are analyzed for Aroclors.
Results from baseline sampling on 5/2 and 5/16 not shown.

Data table: water_aro_ROPS, ChaseMills_ROPS

- ● Unfiltered water samples
- ▲ Filtered water samples
- ■ Daily average flow

ARC - D:\ALCgra\Analysis\ROPS\IDL\during_ROPS\water_aro\PCB_only\pcb_d4_t14_wc131_conc_temporals.pro
Mon May 15 15:12:09 2006

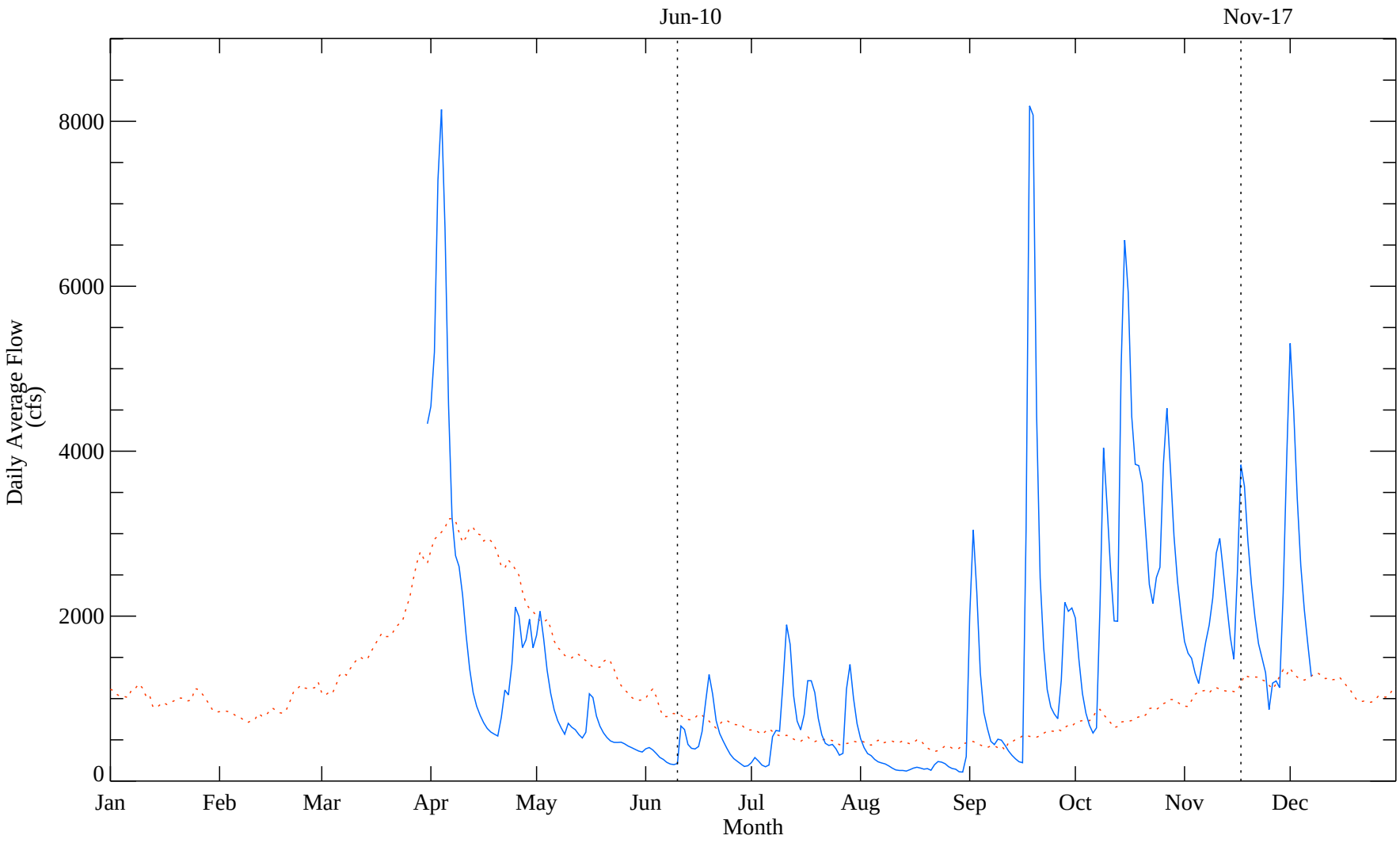


Figure 3-18. Comparison of 2005 and Historic Long Term Average River Flows

The historic flows are average of estimated Grasse river flow from Oswegatchie flows measured between the period 1916 and 2002, and flows measured at Chase Mills in 2003 and 2004.

Dashed vertical lines represent beginning and ending dates of in-river ROPS construction activities.

Data table: ChaseMills_ROPS

Long-term Average Flow
2005 Flow

PM - D:\ALCgra\Analysis\Historical_and_ROPS_flow_Comparisons\flow_comparisons.pro
Mon May 15 11:13:41 2006

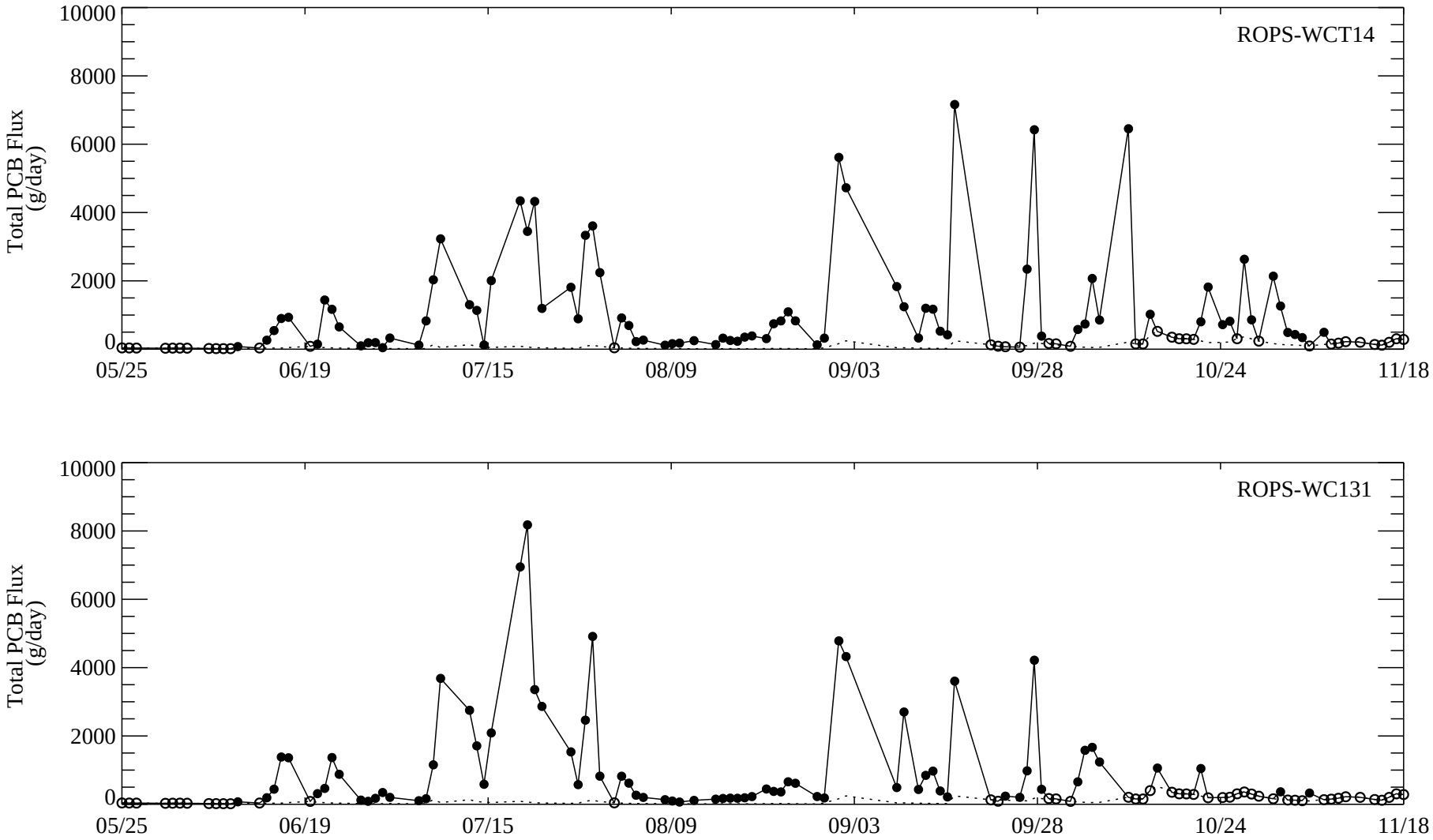


Figure 3-19. Total PCB Fluxes Downstream of the Containment System

Total PCBs are analyzed for Aroclors. Duplicates averaged.
If stratification is present, results for upper water mass are shown.
Data table: water_aro_ROPS, ChaseMills_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\during_ROPS\water_aro\PCBflux_only\pcb_T14_WC131_flux_temporals.pro
Wed May 17 14:00:00 2006

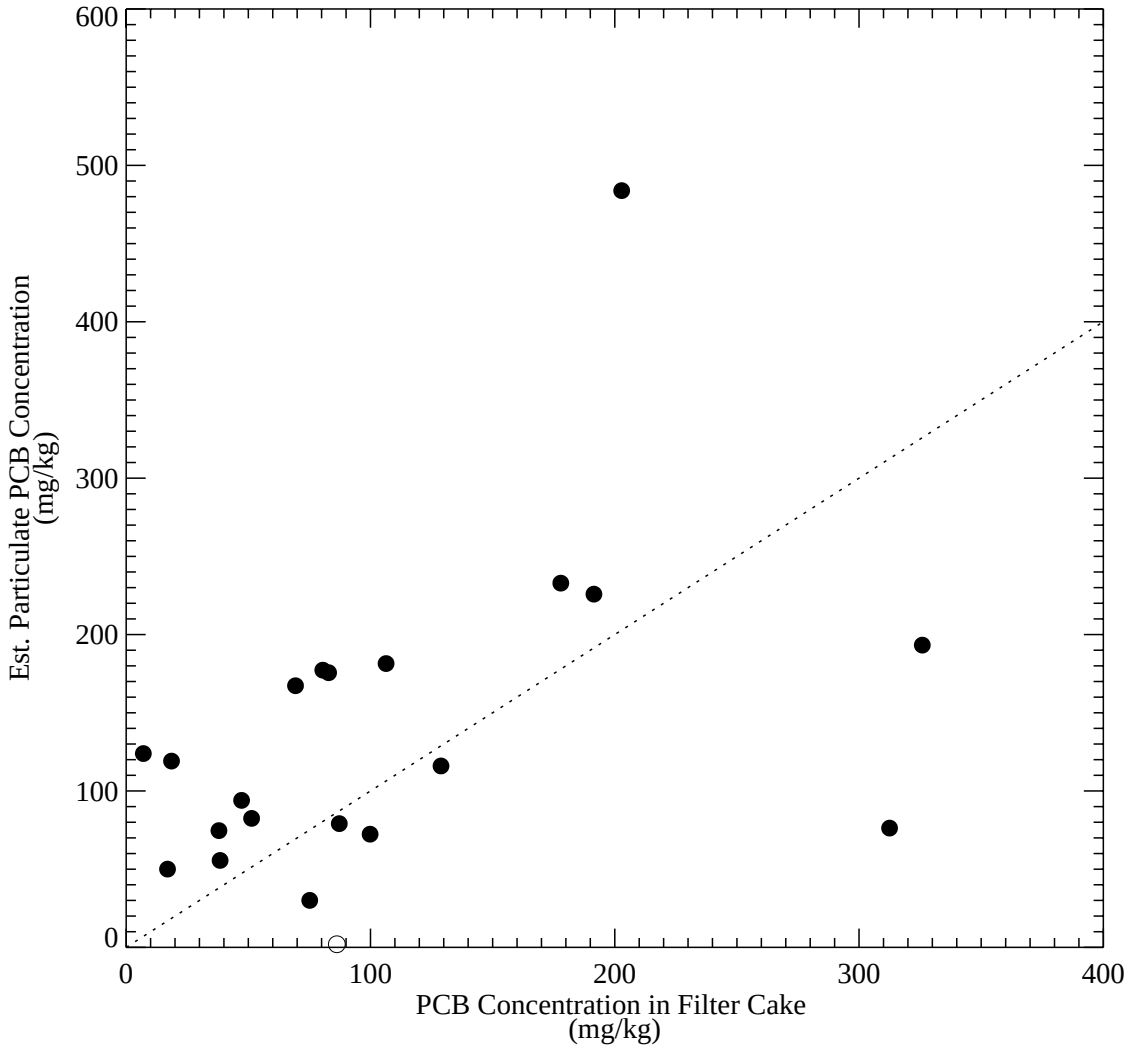


Figure 3-20. Estimated Particulate PCB Concentration at D4 Versus Filter Cake PCB Concentration.

Duplicates averaged. Particulate concentrations were estimated from TSS by using a partitioning coefficient of 90300 L/kg. Measured TSS values below 5 mg/L were not used in the calculations.
When PCB concentration was reported as non-detect in the water column, particulate concentrations were estimated at half the detection limit and are plotted as open circles.
Data tables: water_aro_ROPS, dredge_material_ROPS

PM - D:\ALCgra\Analysis\PCB_Release\Corr_Dredging_w_ds_PCB.pro
Mon May 15 11:03:39 2006

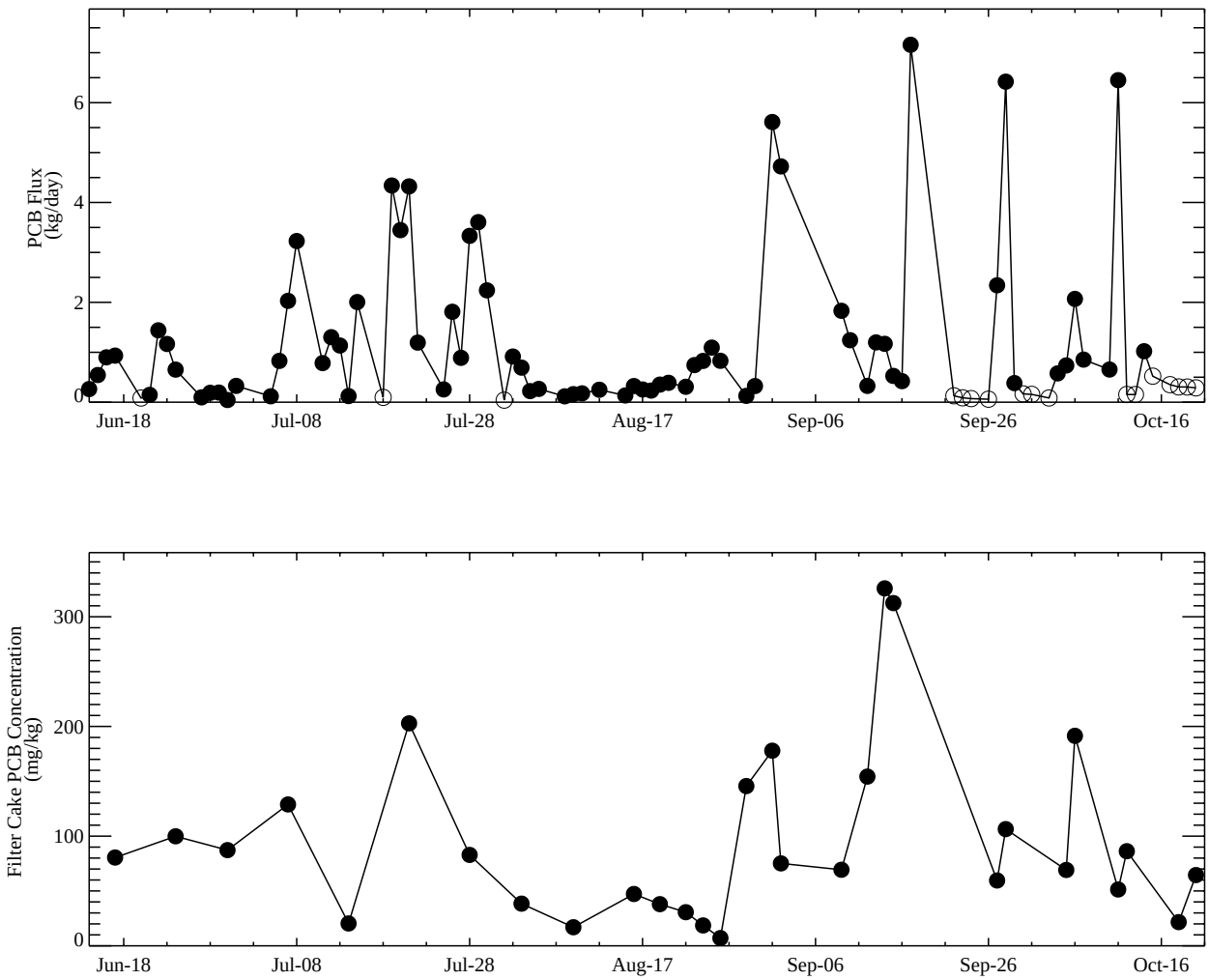


Figure 3-21. Time Series of PCB Flux at ROPS - WCT14 and Filter Cake PCB Concentration.

Duplicates averaged. When tot. PCB was reported as non-detect, the fluxes were estimated by setting the concentrations to half the detection limit. These estimated fluxes are plotted as open circles.

Data tables: water_aro_ROPS, dredge_material_ROPS, ChaseMills_ROPS

PM - D:\ALCgra\Analysis\PCB_Release\Corr_Dredging_w_ds_PCB.pro
Mon May 15 11:08:27 2006

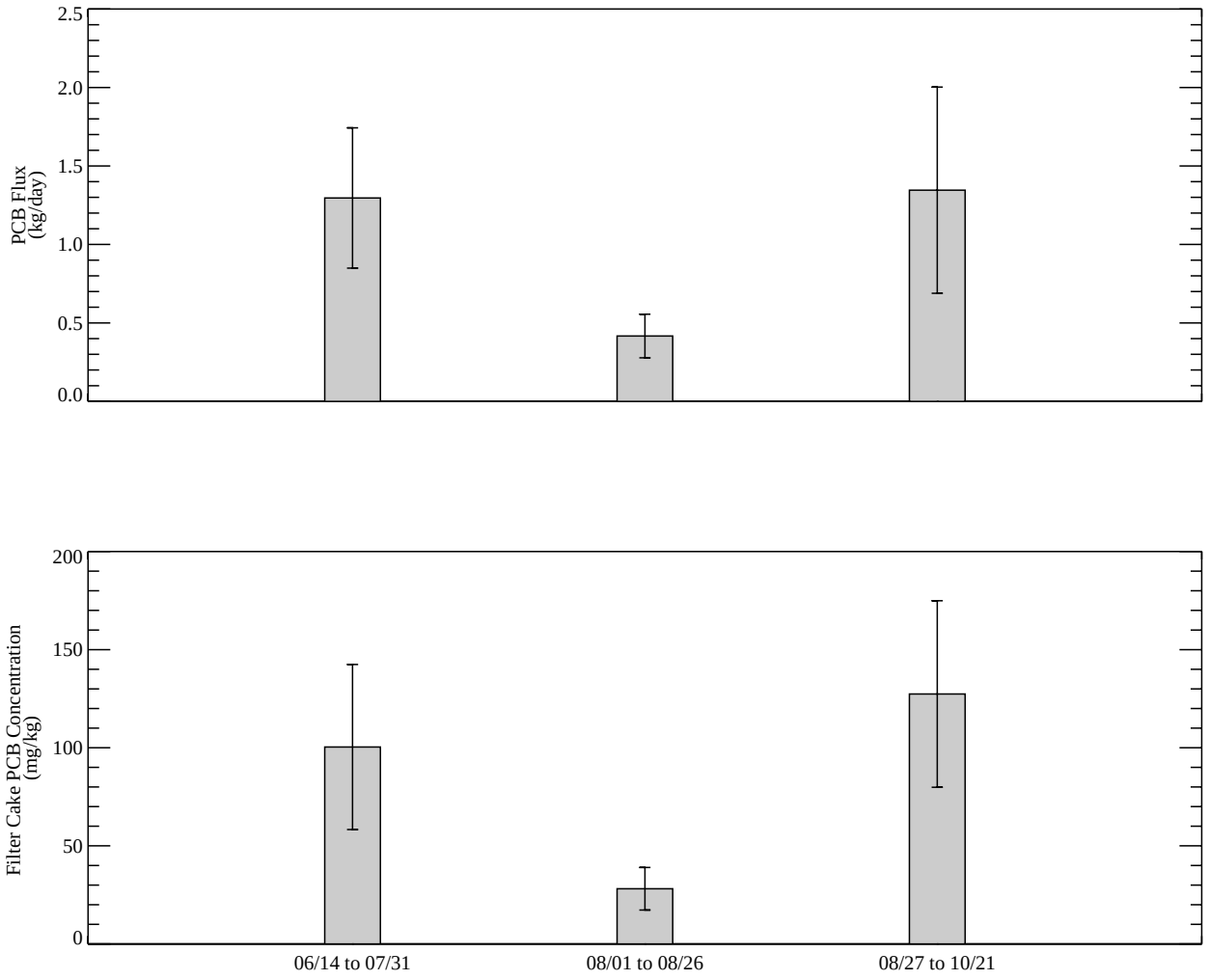


Figure 3-22. Average PCB Flux at ROPS - WCT14 and Filter Cake PCB Concentration.

Error bars shown represent two standard errors from the mean.

Data tables: water_aro_ROPS, dredge_material_ROPS, ChaseMills_ROPS

PM - D:\ALCgra\Analysis\PCB_Release\Corr_Dredging_w_ds_PCB.pro
Mon May 15 11:08:27 2006

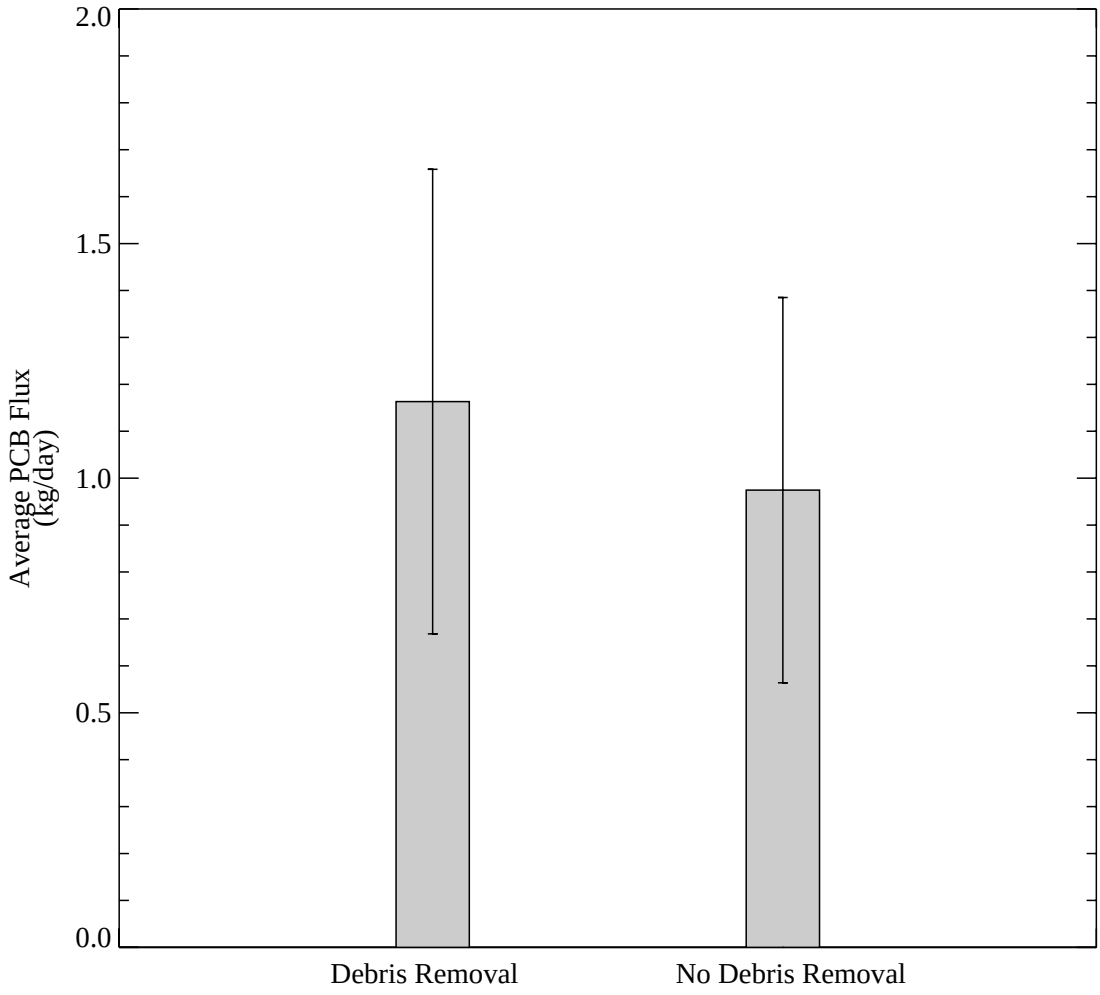


Figure 3-23. Comparison of Average PCB Flux at ROPS - WCT14 on Days With and Without Debris Removal.

Error bars shown represent two standard errors from the mean.

Data tables: water_aro_ROPS, ChaseMills_ROPS

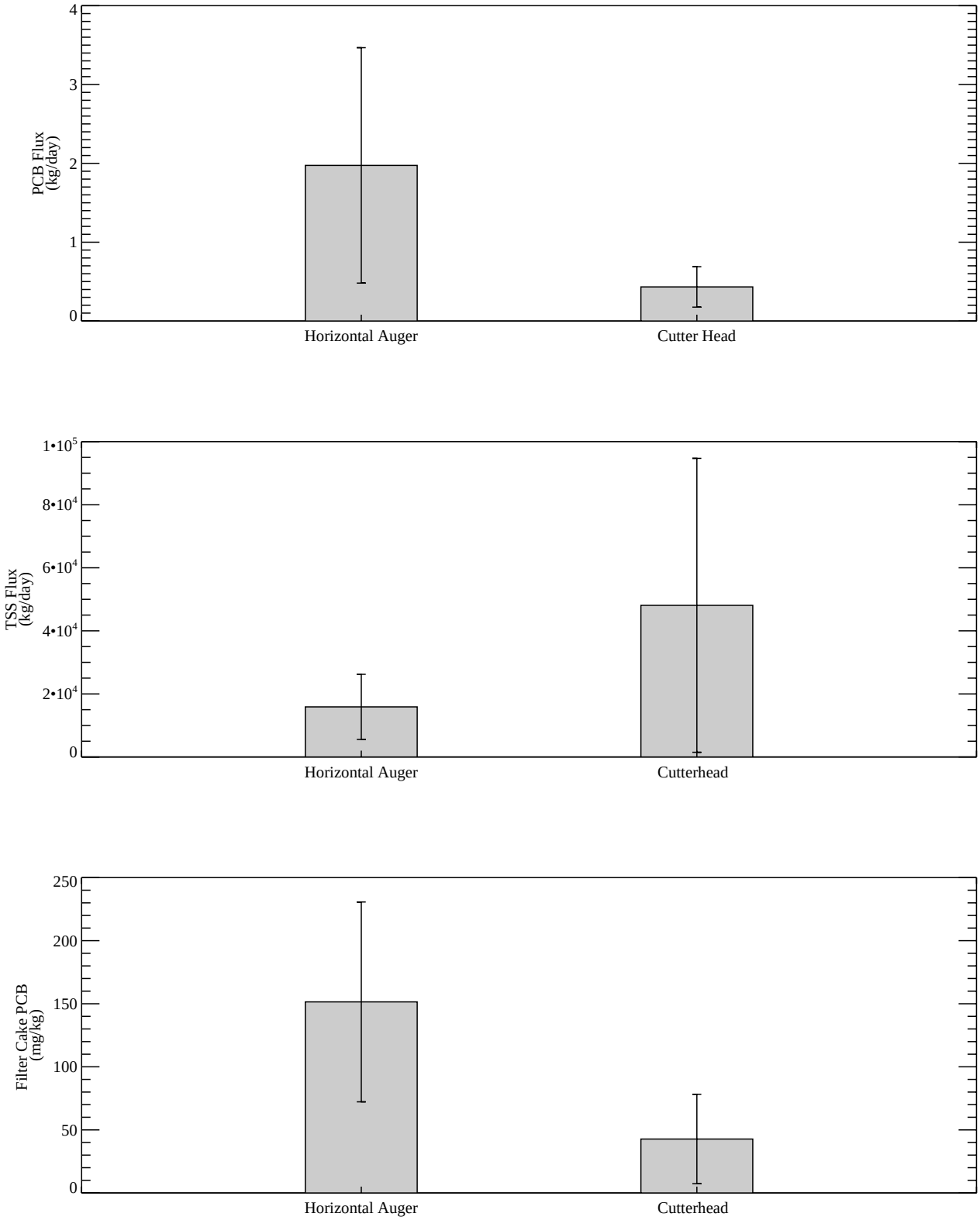


Figure 3-24. Comparison of Average PCB and TSS Fluxes at ROPS - WCT14 and Filter Cake PCB Concentrations for Days of Comparable Operating Conditions (Horizontal Auger Vs. Cutterhead Dredge).

Error bars shown represent two standard errors from the mean when more than 3 data points are available, and the range otherwise.

Data tables: water_aro_ROPS, dredge_material_ROPS, ChaseMills_ROPS

PM - D:\ALCgra\Analysis\PCB_Release\compare_ch_and_ha_release.pro
Mon May 15 11:10:46 2006

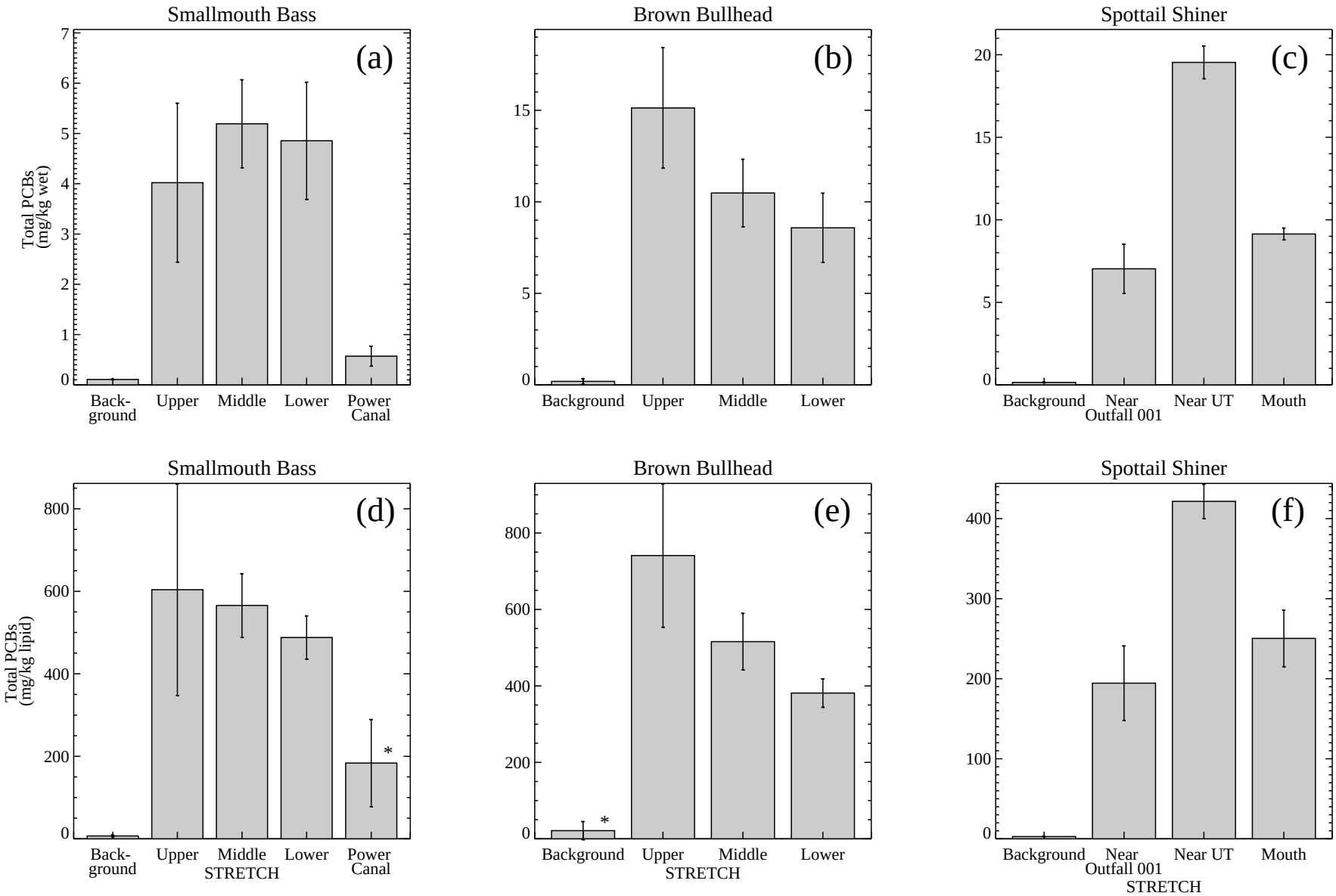


Figure 3-25. Average Aroclor-Based PCB Concentrations in Fish Collected in Fall 2005

Values represent arithmetic averages (+/- 2 standard errors). Non-detect values set to half the detection limit prior to averaging.

** One smallmouth bass and one brown bullhead sample were excluded due to unreasonably low lipid content (<0.1%).*

Data table: resfish_aro

ARC - D:\ALCgra\Analysis\ResFish\fall05\IDL\summary_plots\resfish_barplot_by_survey.pro
Tue Feb 14 13:38:18 2006

Routine Monitoring Stretches

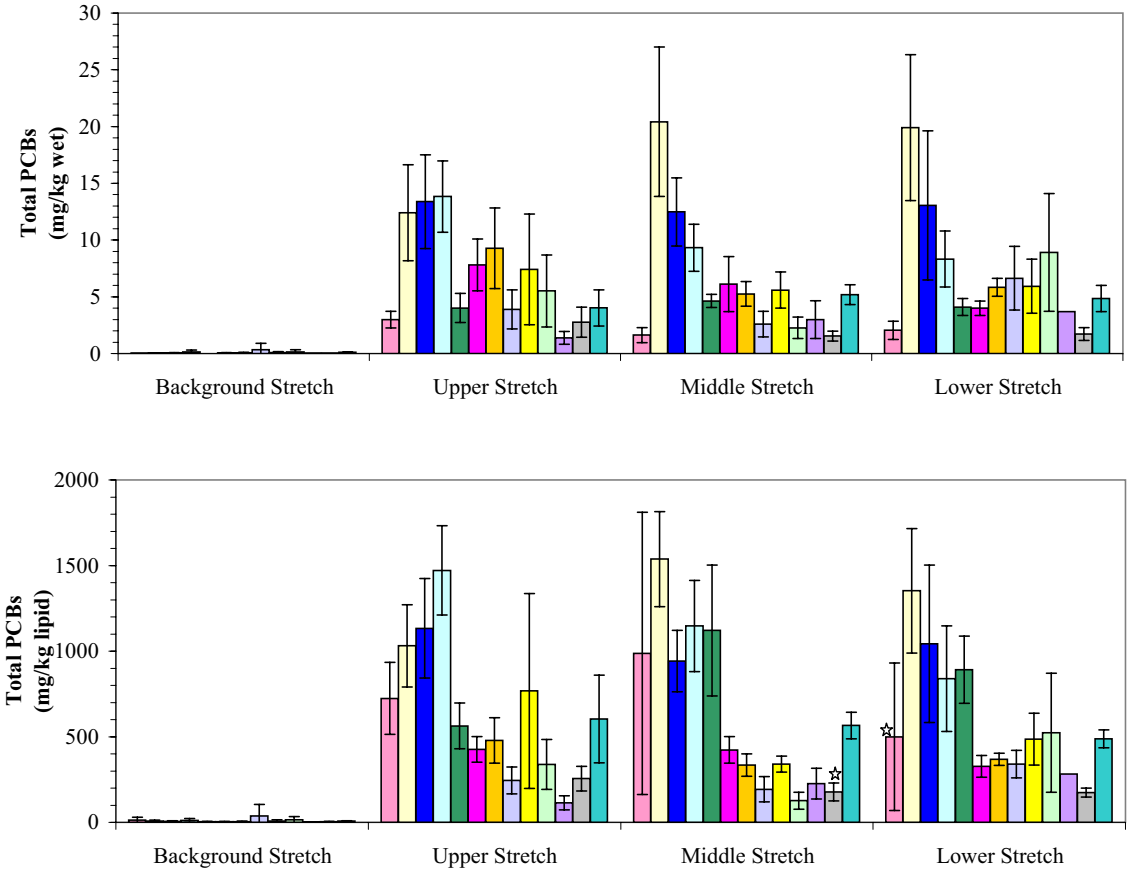


Figure 3-26. Average Aroclor-based PCB Levels in Smallmouth Bass (1991-2005)

Data are arithmetic means +/- two standards errors of the mean.

Samples analyzed as individual fillets.

Values below detection set to half the detection limit. If no detection limit reported, 0.05 ppm wet weight assumed.

Error bar not plotted if sample count fewer than three.

Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.

☆*One 1991 and one 2004 sample were excluded due to unreasonably low lipid content (<0.1%).*

Data table: resfish_aro

1991 1993 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

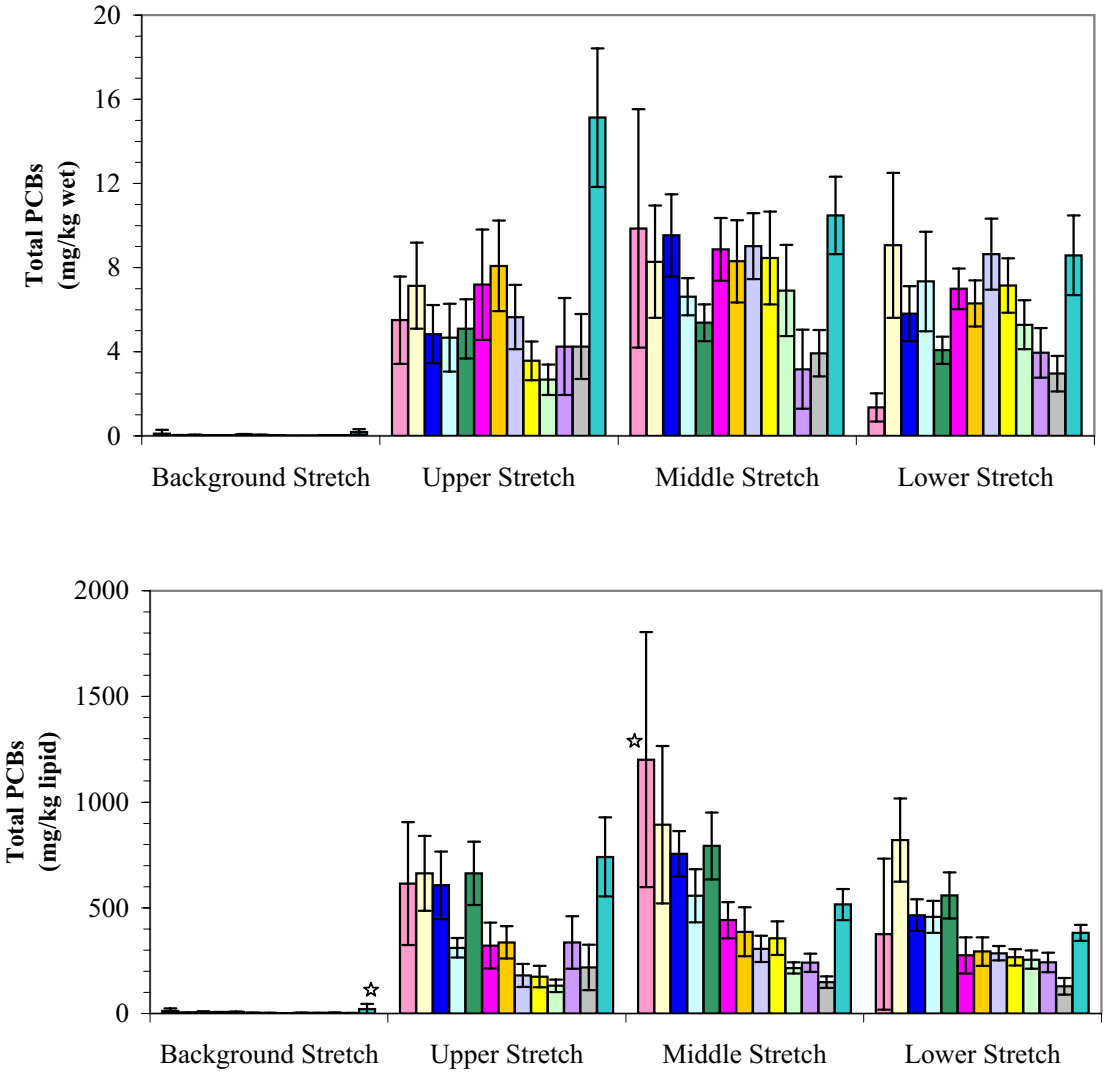


Figure 3-27. Average Aroclor-based PCB Levels in Brown Bullhead (1991-2005)

Data are arithmetic means +/- two standards errors of the mean.

Samples analyzed as individual fillets.

Values below detection set to half the detection limit. If no detection limit reported, 0.05 ppm wet weight assumed.

Error bar not plotted if sample count fewer than three.

Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.

☆*One 1991 and one 2005 sample were excluded due to unreasonably low lipid content (<0.1%).*

Data table: resfish_aro

1991 1993 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

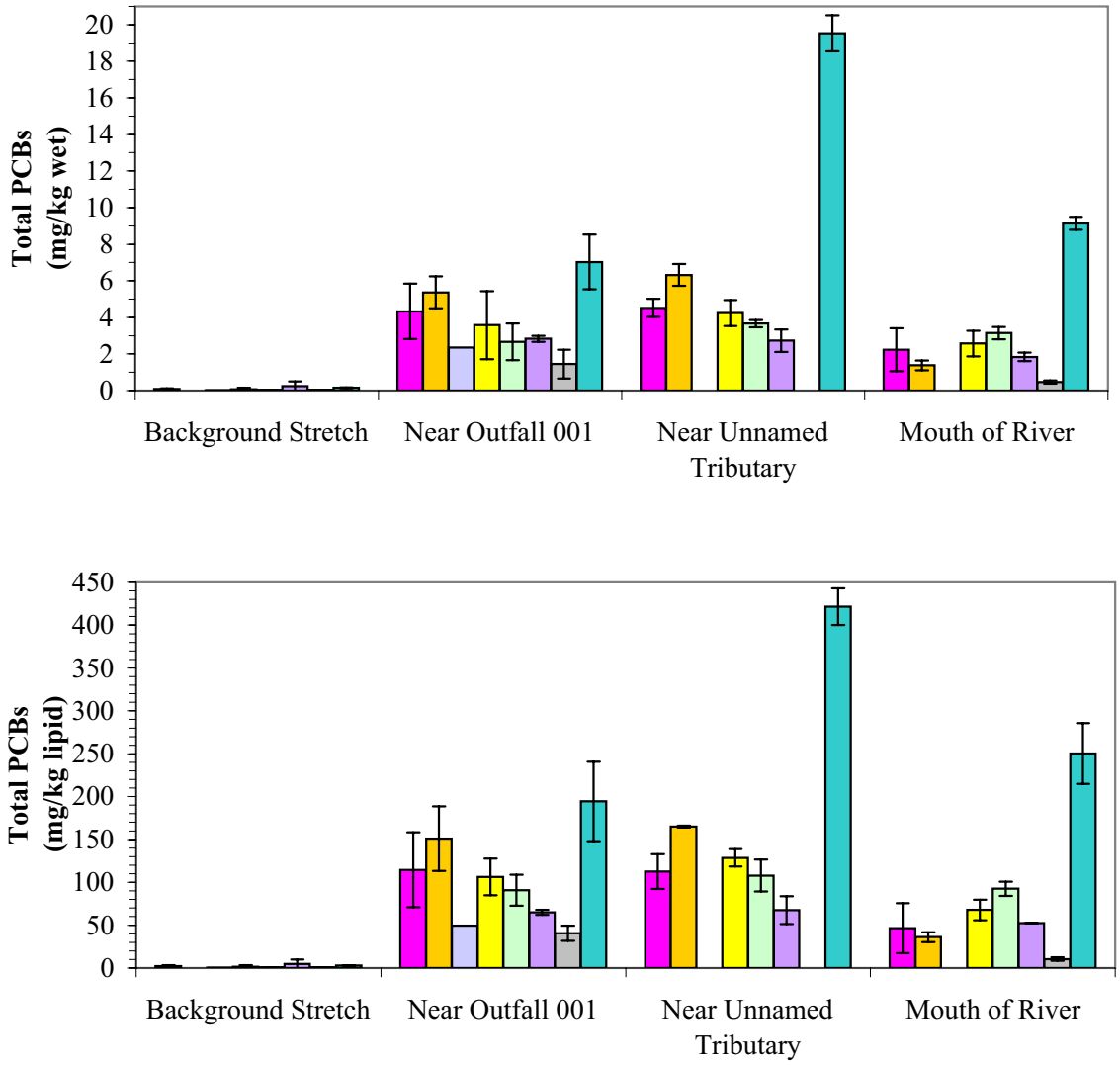


Figure 3-28. Average Aroclor-based PCB Levels in Young-of-Year Spottail Shiner (1998-2005)

Data are arithmetic means +/- two standards errors of the mean; error bar not plotted if sample count fewer than three. Samples analyzed as whole body composites. Composite was considered as YOY if all length were less than 6.5 cm. Values below detection set to half the detection limit. If no detection limit reported, 0.05 ppm wet weight assumed. Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.

Data table: resfish_aro

1998 1999 2000 2001 2002 2003 2004 2005

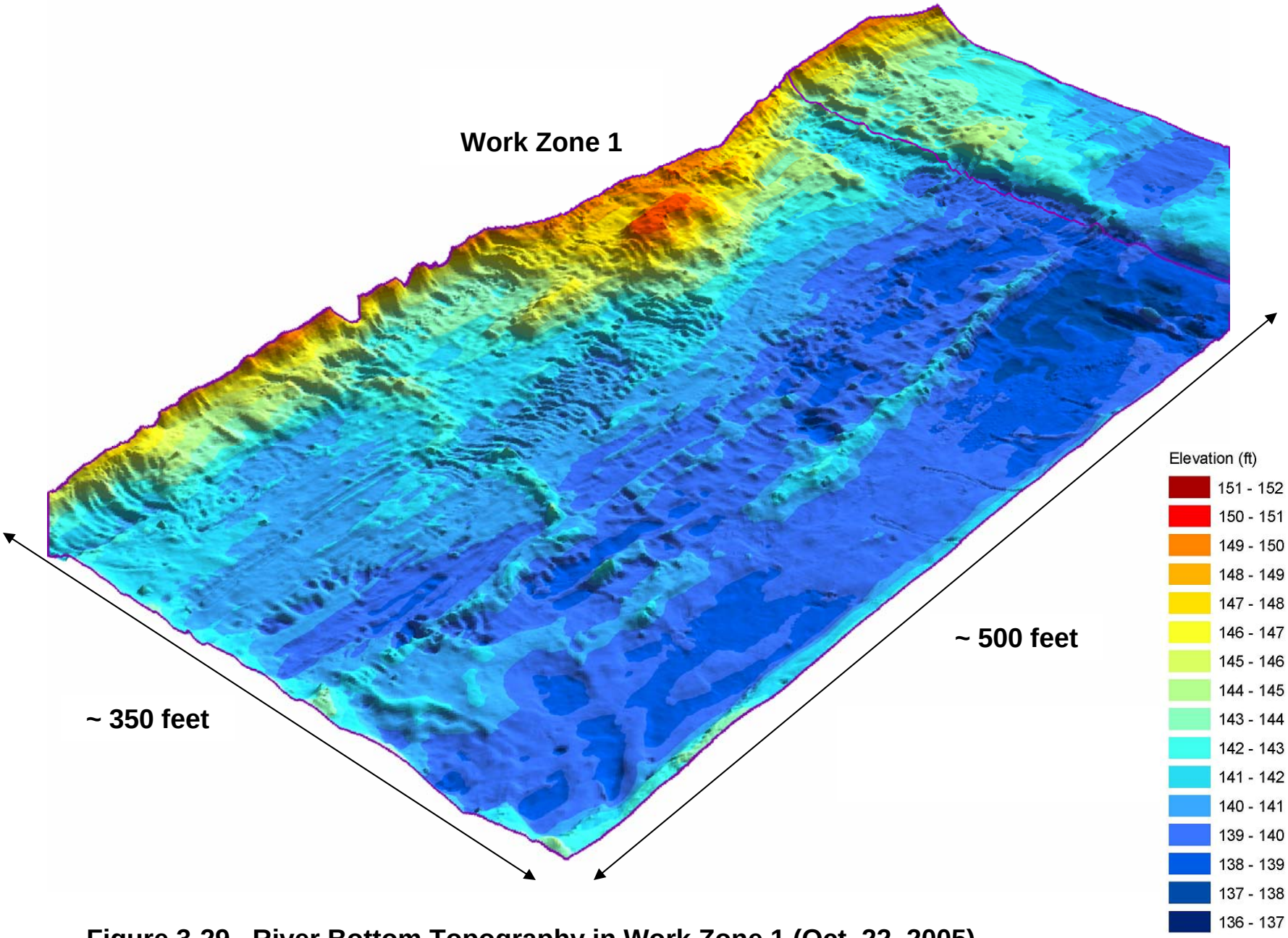


Figure 3-29. River Bottom Topography in Work Zone 1 (Oct. 22, 2005).

Based on October 22, 2005 multibeam bathymetry data.

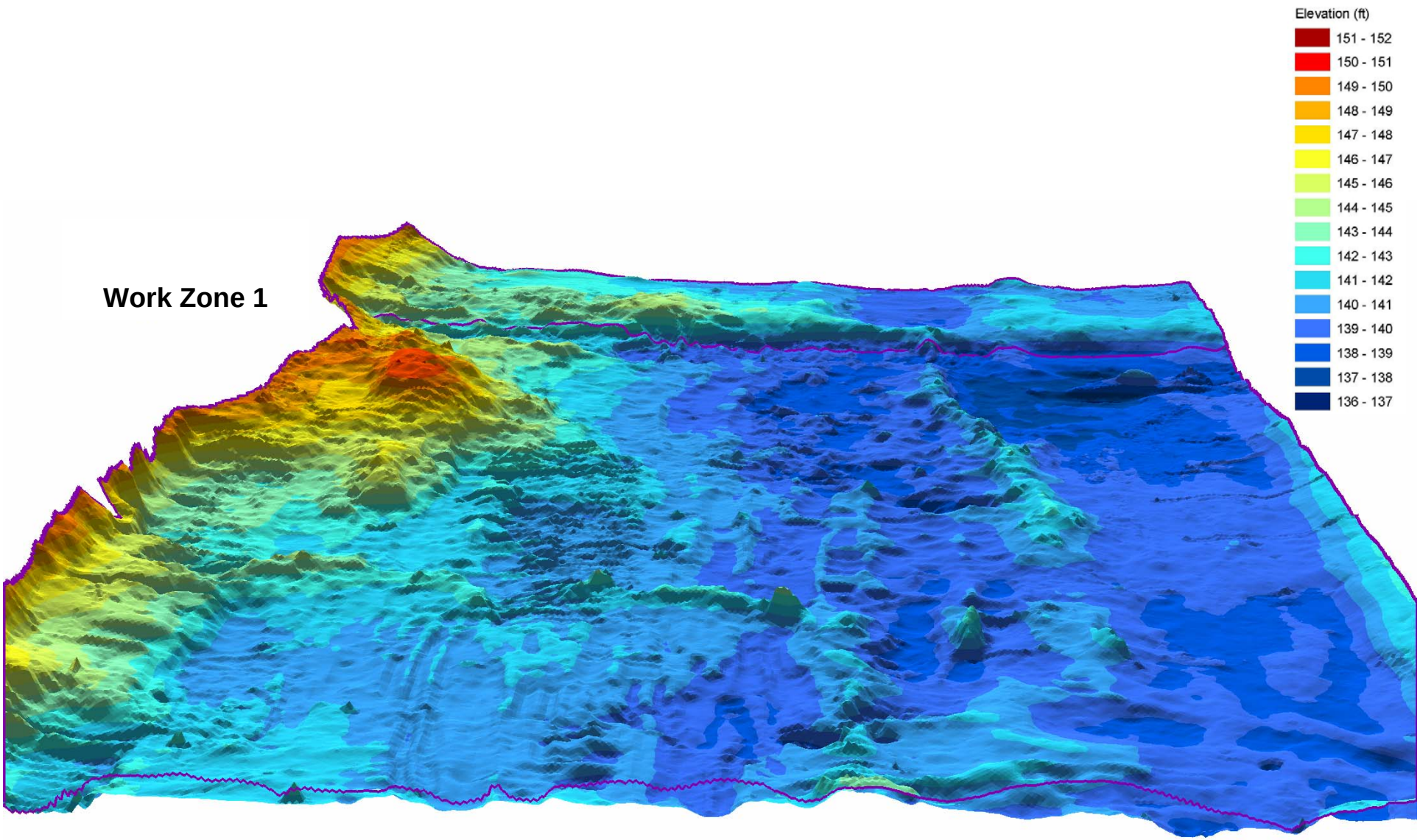


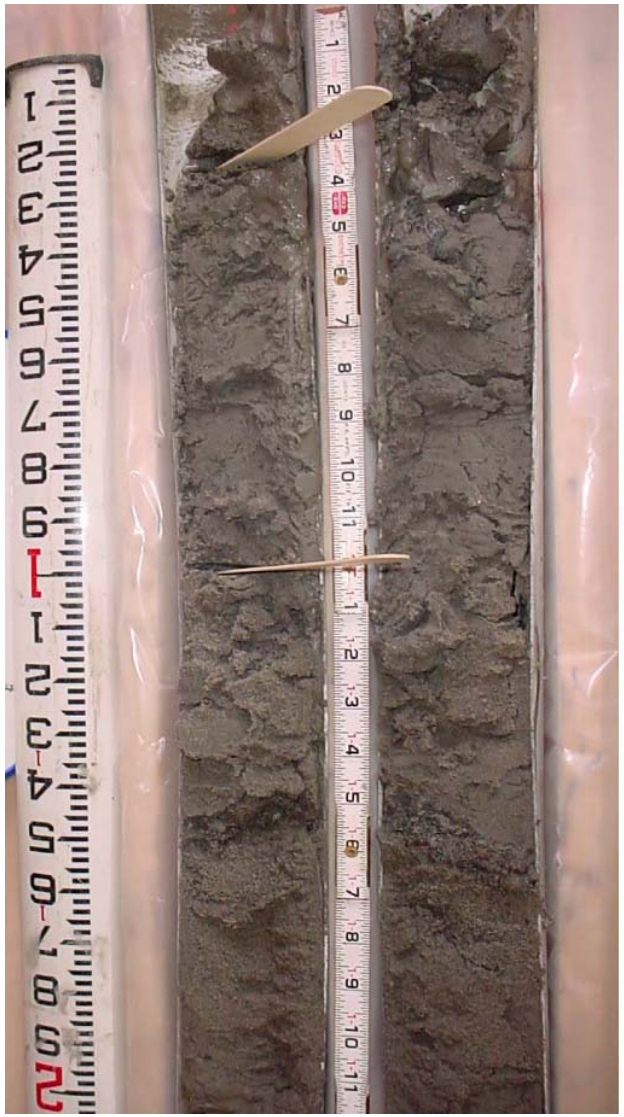
Figure 3-30. River Bottom Topography (Looking Downstream) in Work Zone 1 (Oct. 22, 2005).

Based on October 22, 2005 multibeam bathymetry data.

2005 Post-Dredging Cores

2004 Baseline Core
(MC-08; 2-4 ft)

Untouched Inventory
(Core 414; 0-2 ft)

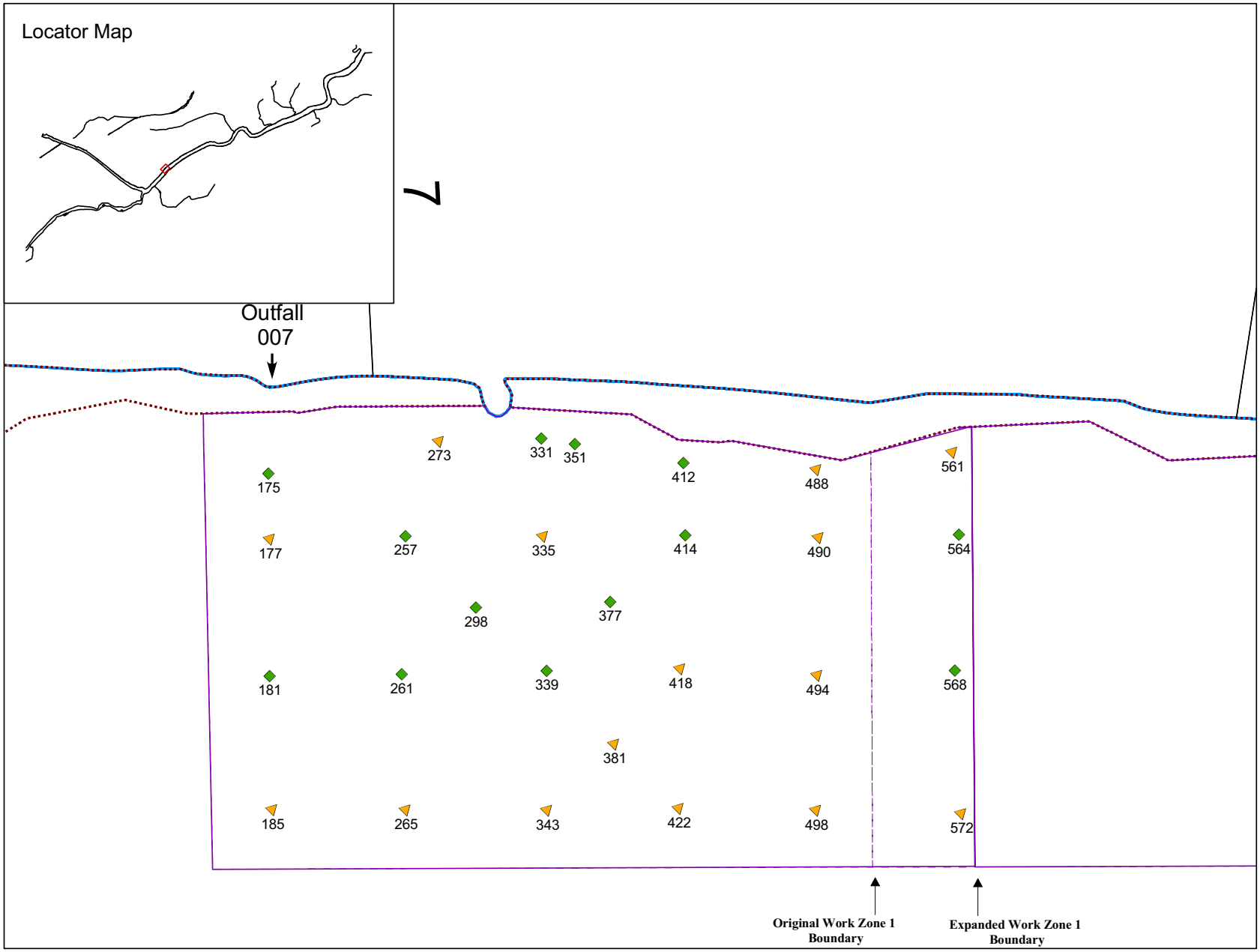


Residual Disturbed Sediment
(Core 422; 0-1.7 ft)

Residual

Figure 3-31. Example Photos of 2004 Baseline Core and 2005 Post-Dredging Cores With Untouched Inventory and Residual Disturbed Sediment.

2005 cores collected during October 22-24, 2005 vibracoring survey.



GRAPHIC SCALE

0 25 50 100 Feet

LEGEND

- Residual Disturbed Sediments
- Untouched Inventory
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 3-32.
Residual Disturbed Sediment and Untouched Inventory in Work Zones 1 based on 10/22/05 Vibracores

ALCOA

May 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060329.mxd

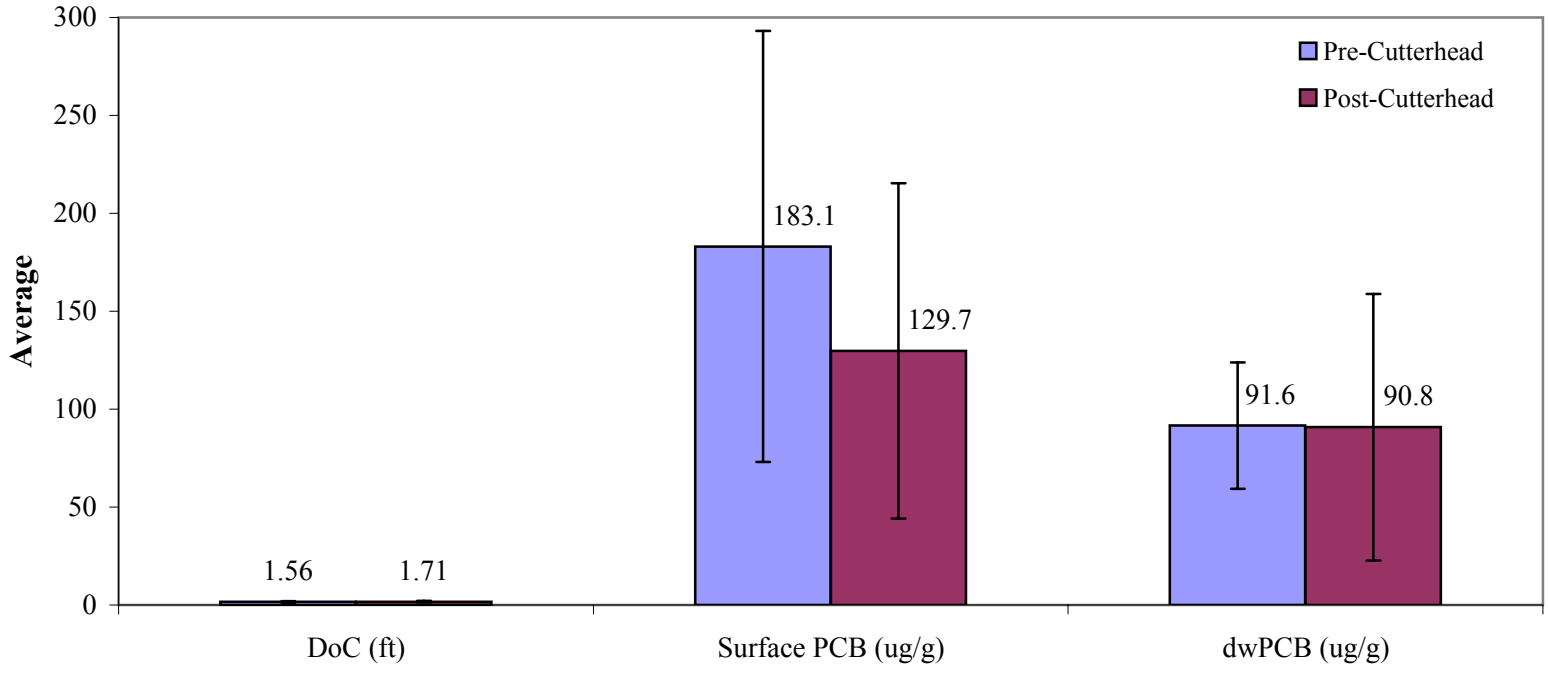
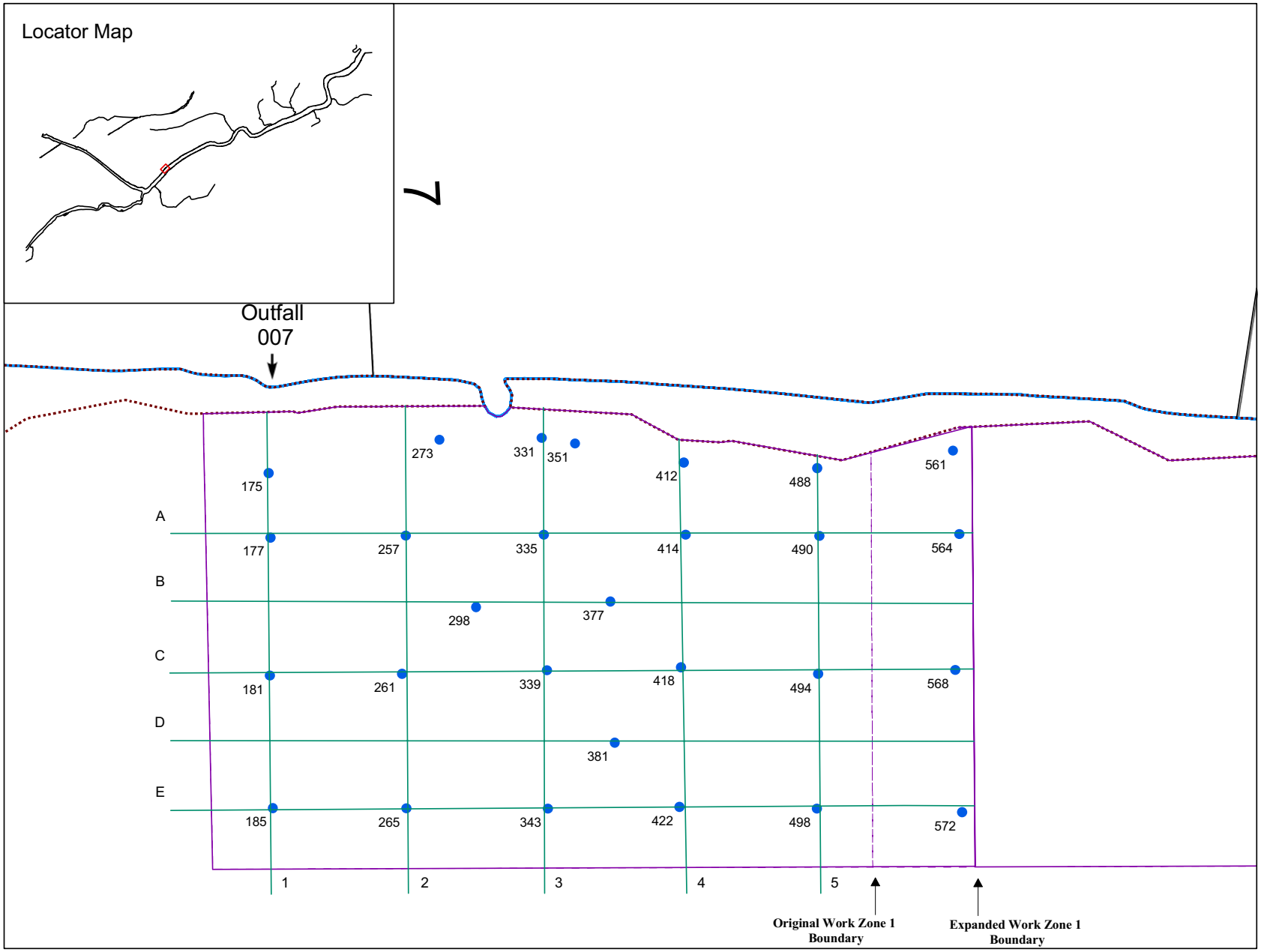


Figure 3-33. PCB Parameter Averages for Vibracores Collected Pre- and Post-Cutterhead Dredging

Pre-cutterhead cores collected 10/10-10/12/05. Post-cutterhead cores collected 10/22/05.
Depth-weighted PCB calculations exclude sediments below the depth of contamination (DoC).
Averages based on the 9 core locations dredged using the cutterhead dredge; core 418 is excluded as this location was also targeted by mechanical clamshell dredging.
Error bars represent +/- 2 standard errors.

Data table: sed_aro_ROPS



GRAPHIC SCALE

0 25 50 100 Feet

LEGEND

- X-sectional Transects
- Vibracore Locs (10/22)
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 3-34.
Vibracore Sampling Locations
from 10/22/05 and
Cross Sectional Transects
in Work Zone 1

ALCOA

May 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060329.mxd

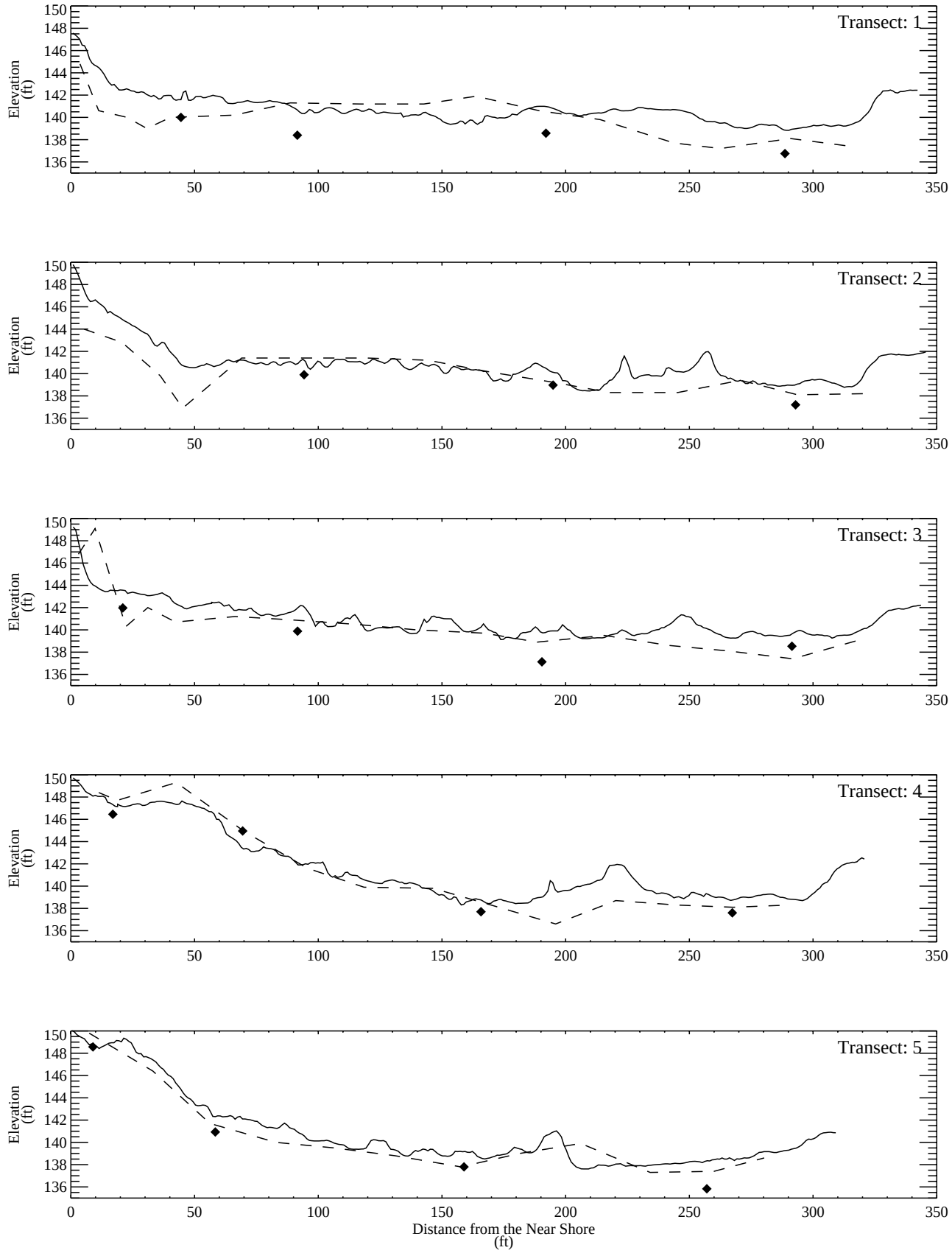


Figure 3-35. 2005 Baseline DoC Elevation Cross Sections Along Cross-Channel Transects in Work Zone 1

Based on Spring 2005 baseline probing measurements and a 1 ppm limit for the 10/22 Vibracores. Elevations based on USLS 1935 Datum. Multibeam data represents the sediment surface elevation.

Data tables: sed_probe_ROPS

– – Spring 05 Probing DoC
——— 10/22/05 Multibeam
◆ 10/22/05 Vibracores

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\baseline\Xsections\ROPS_05baseline_DoCelev_Xsections.pro
Fri May 12 14:15:19 2006

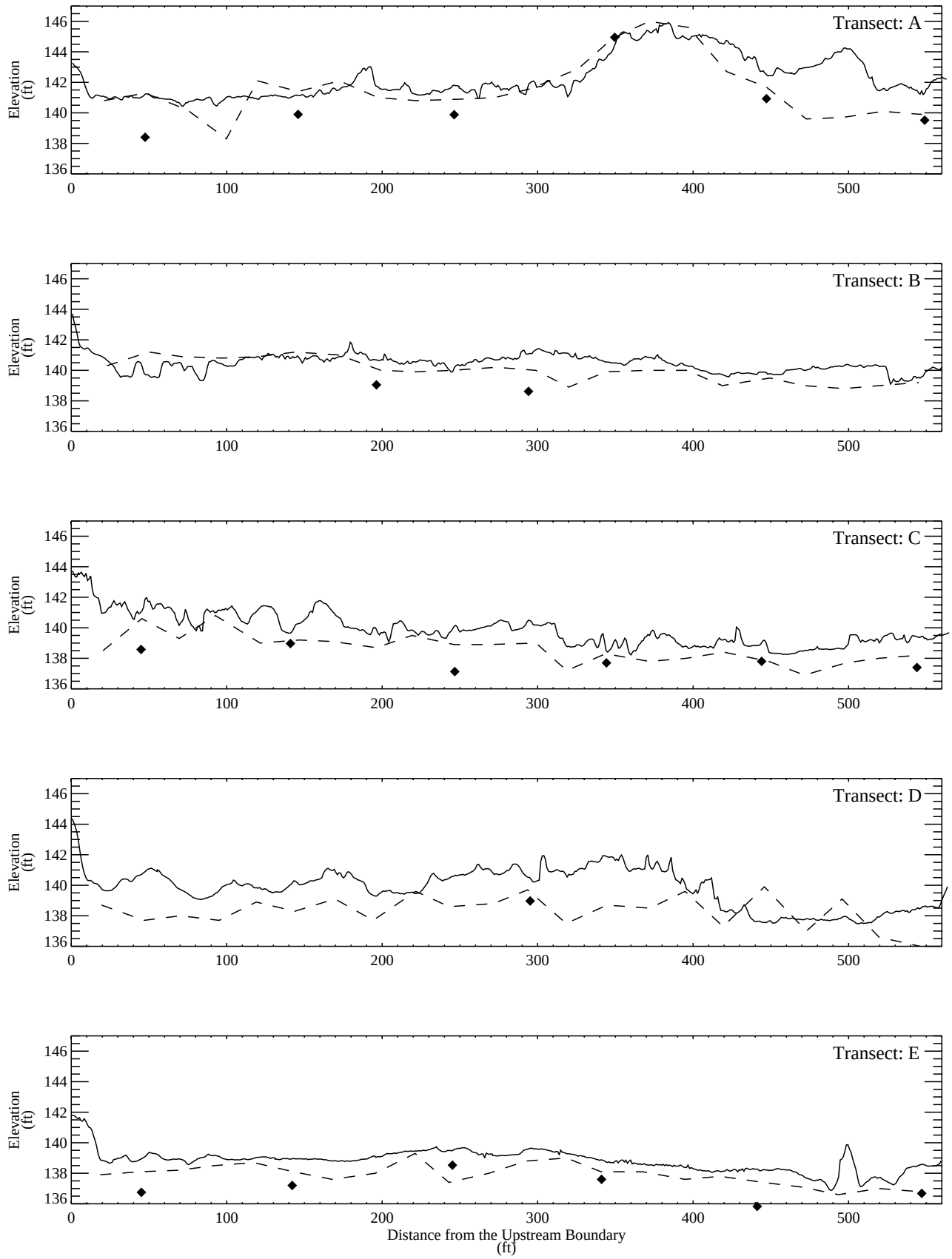


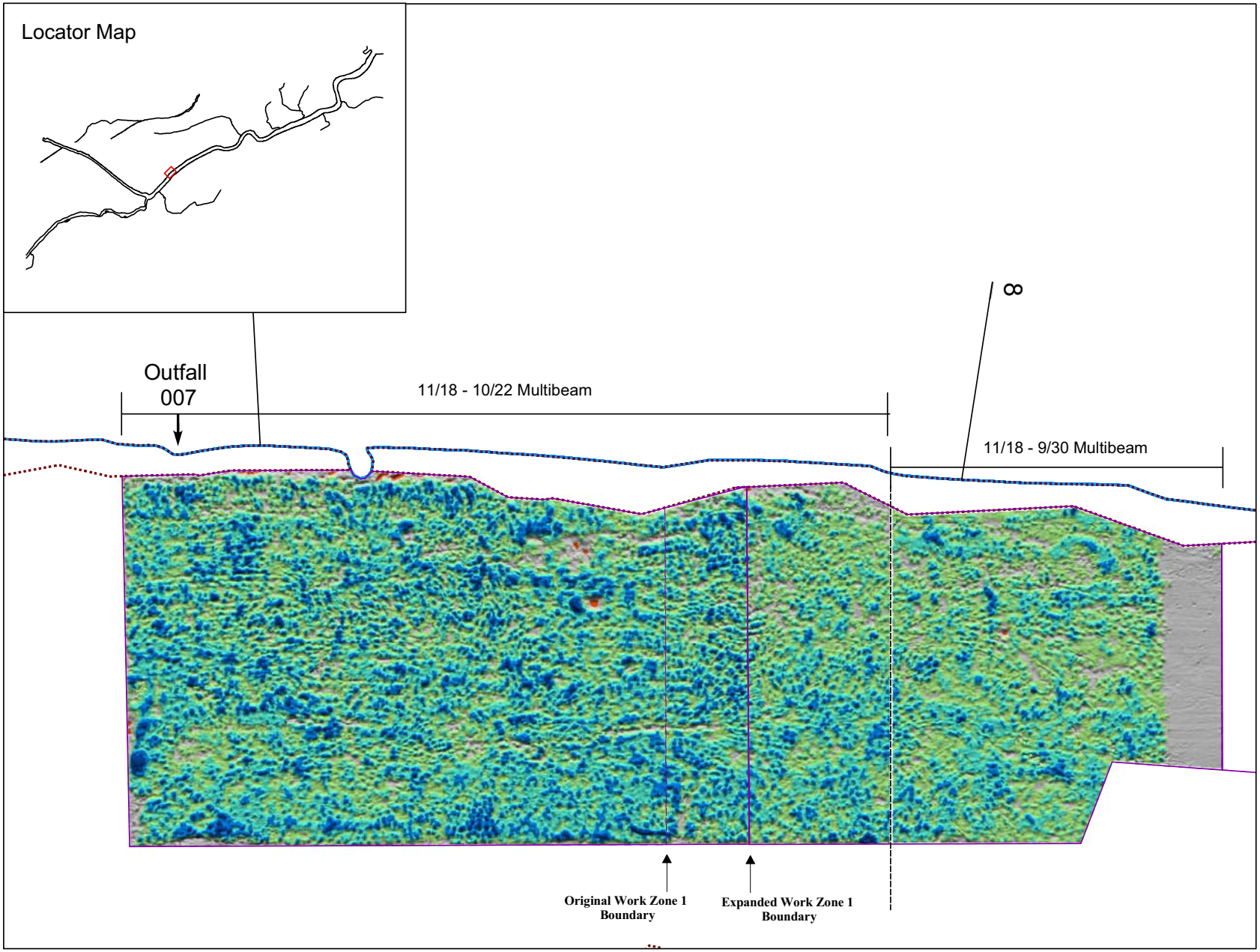
Figure 3-36. 2005 Baseline DoC Elevation Cross Sections Along Upstream to Downstream Transects in Work Zone 1

Based on Spring 2005 baseline probing measurements and a 1 ppm limit for the 10/22 Vibracores. Elevations based on USLS 1935 Datum. Multibeam data represents the sediment surface elevation.

Data tables: sed_probe_ROPS

– – Spring 05 Probing DoC
——— 10/22/05 Multibeam
◆ 10/22/05 Vibracores

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\baseline\Xsections\ROPS_05baseline_DoCelev_Xsections.pro
Fri May 12 14:15:19 2006



GRAPHIC SCALE
Feet
0 25 50 100

LEGEND

Capping Thickness (ft)
- > 2.0
- 1.5 - 2.0
- 1.0 - 1.5
- 0.5 - 1.0
- -0.5 - 0.5
- < -0.5

- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 3-37.
Sediment Elevation Differences
Between Sept. 30/October 22
and November 18
Multibeam Bathymetry Surveys

ALCOA

Feb 2006

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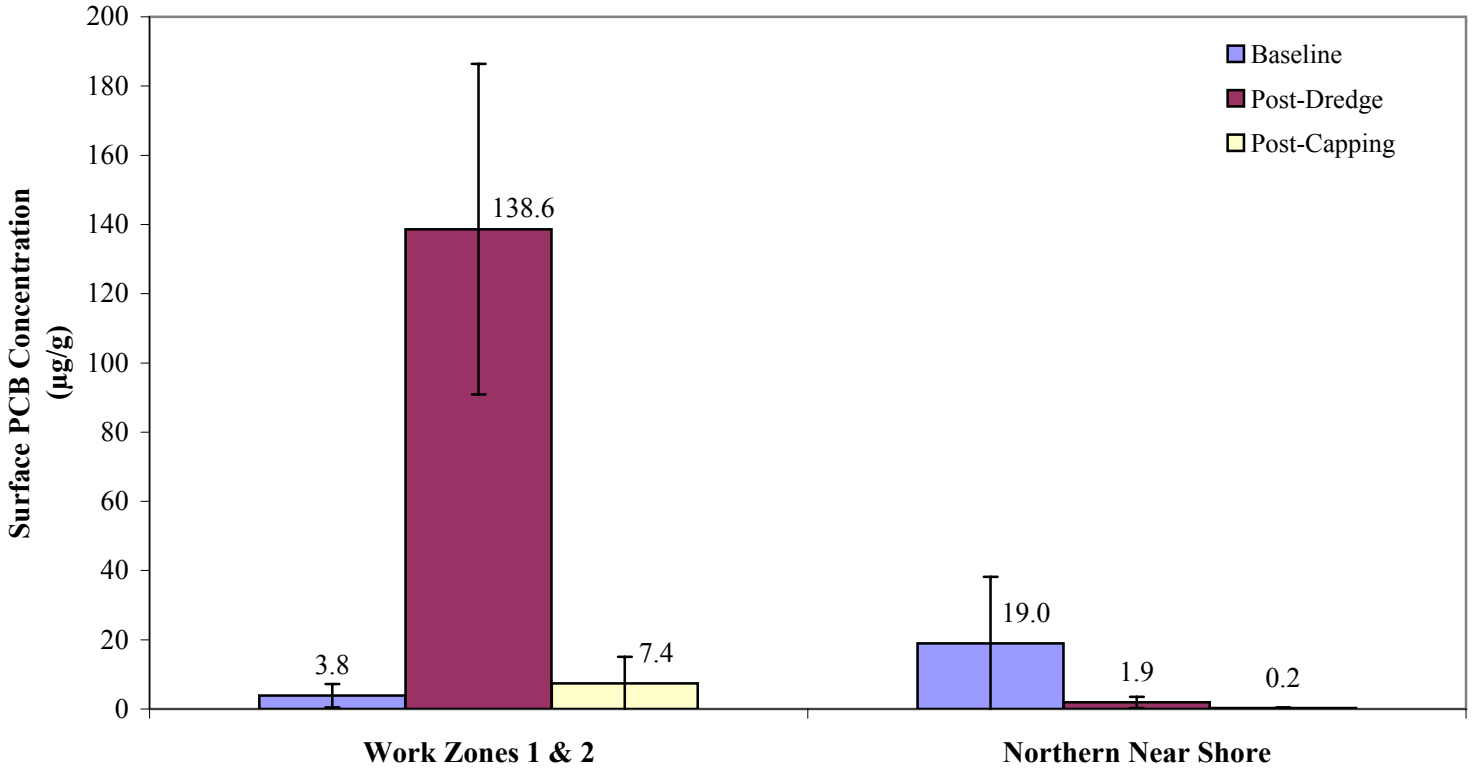

Figure 3-38. Comparison of Pre-Dredge, Post-Dredge, and Post-Capping Surface Sediment PCB Concentrations

Non-detects are set to half the detection limit prior to averaging. Duplicates are averaged.
Baseline grabs/cores collected in Fall 2003 and August - September, 2004.
Post-dredge cores collected on 10/22 for work zone 1, 9/30 for work zone 2, and 8/19/05 for the northern near shore.
Post-cap cores collected 11/28-12/1/05 for work zones 1 and 2 and the northern near shore.
Error bars represent +/- 2 standard errors.

Data table: sed_aro_ROPS

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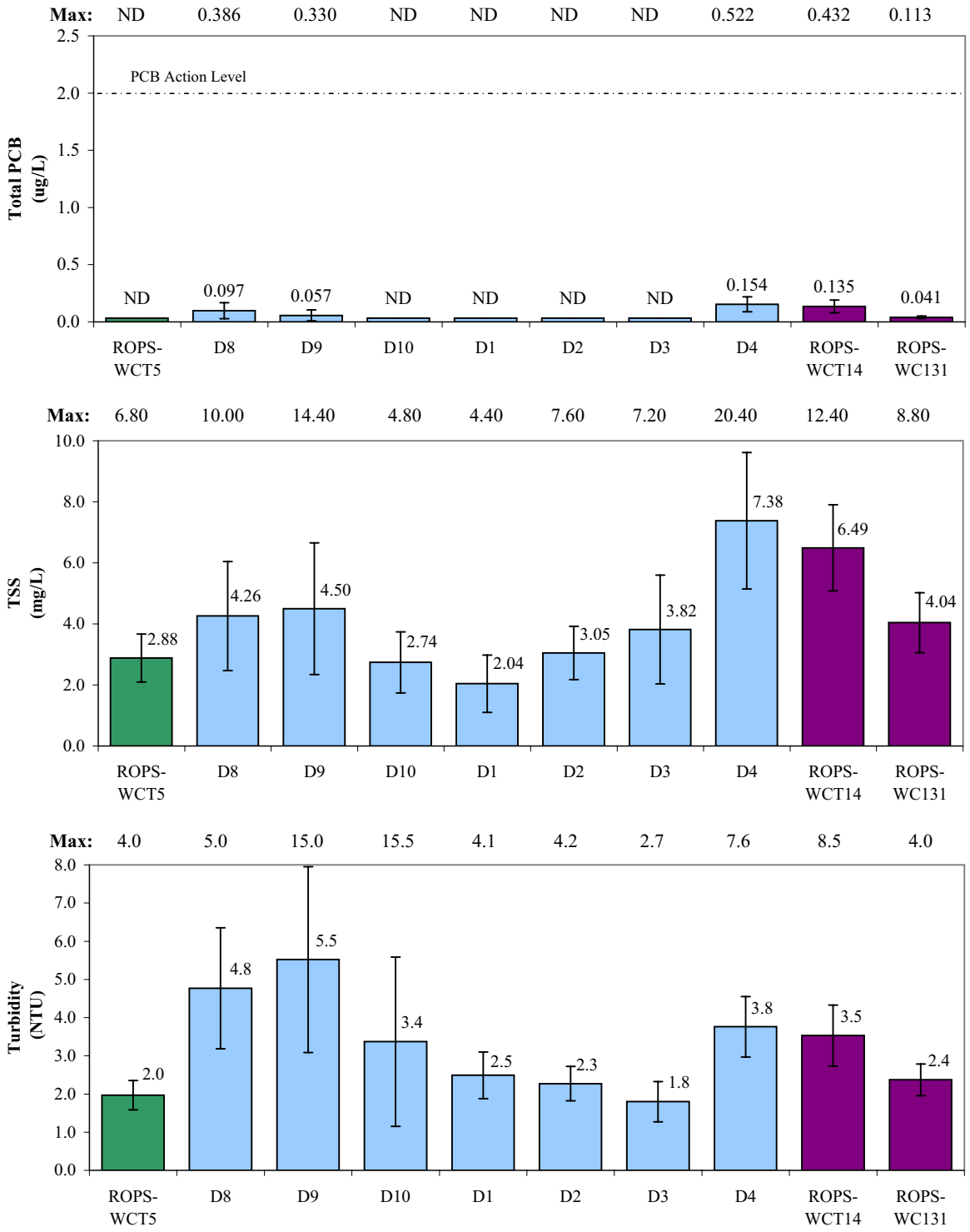

Figure 3-39. Average Water Column Levels During Post-Dredge Capping in Work Zones 1 and 2

Values below the detection were set to half the detection limit prior to calculations.

Locations where all PCB levels were below the detection limit (0.065 ug/L) are labled as 'ND'.

Error bars represent 95% confidence intervals.

Maximum levels displayed along the top of each panel for each location.

PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

Upstream
Local
Downstream

Date tables: water_aro_ROPS, water_field_ROPS

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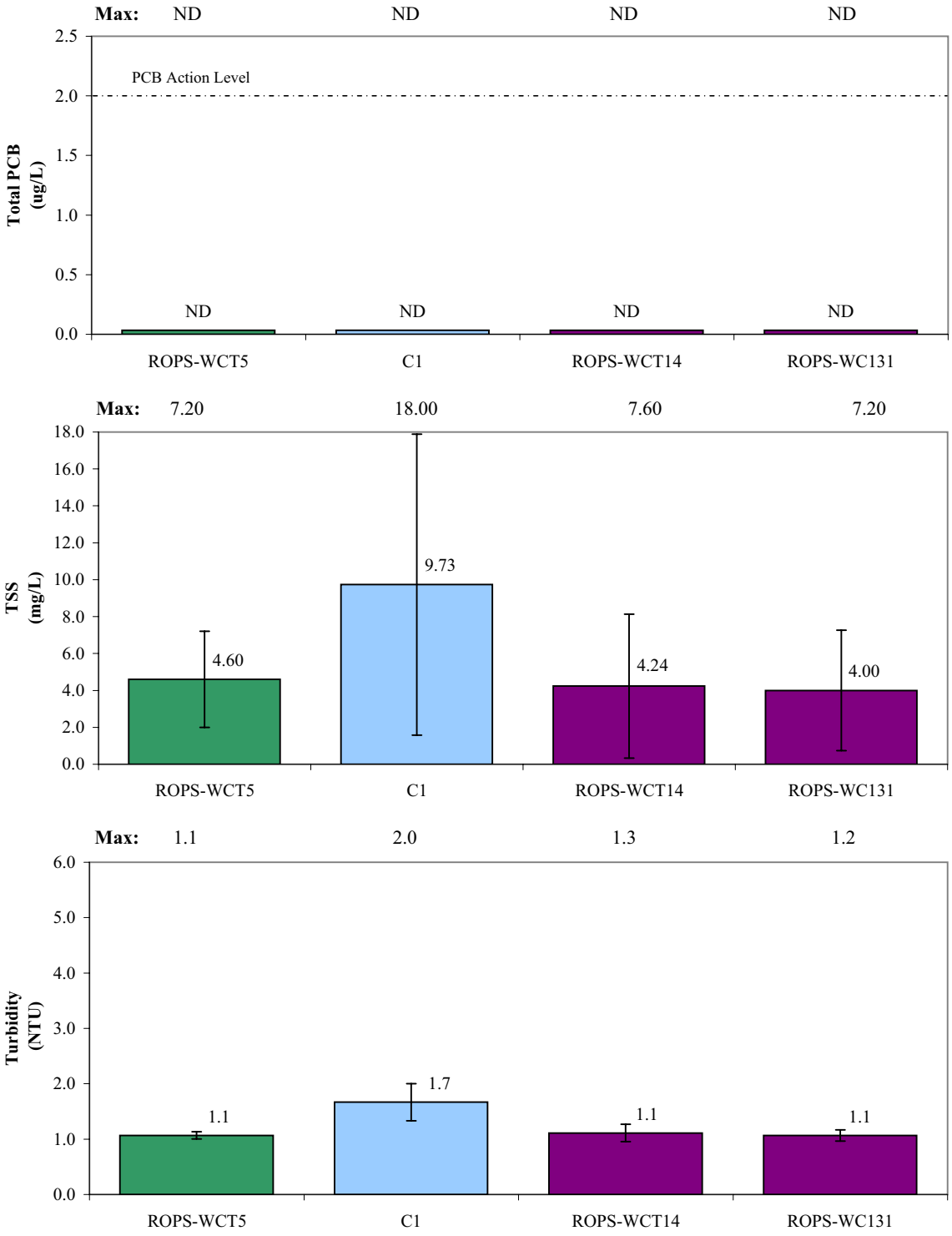

Figure 3-40. Average Water Column Levels During Thin-Layer Capping in the Southern Near Shore

Values below the detection were set to half the detection limit prior to calculations.
Locations where all PCB levels were below the detection limit (0.065 ug/L) are labled as 'ND'.
Error bars represent 95% confidence intervals.
Maximum levels displayed along the top of each panel for each location.
PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

- Upstream
- Local
- Downstream

Date tables: water_aro_ROPS, water_field_ROPS

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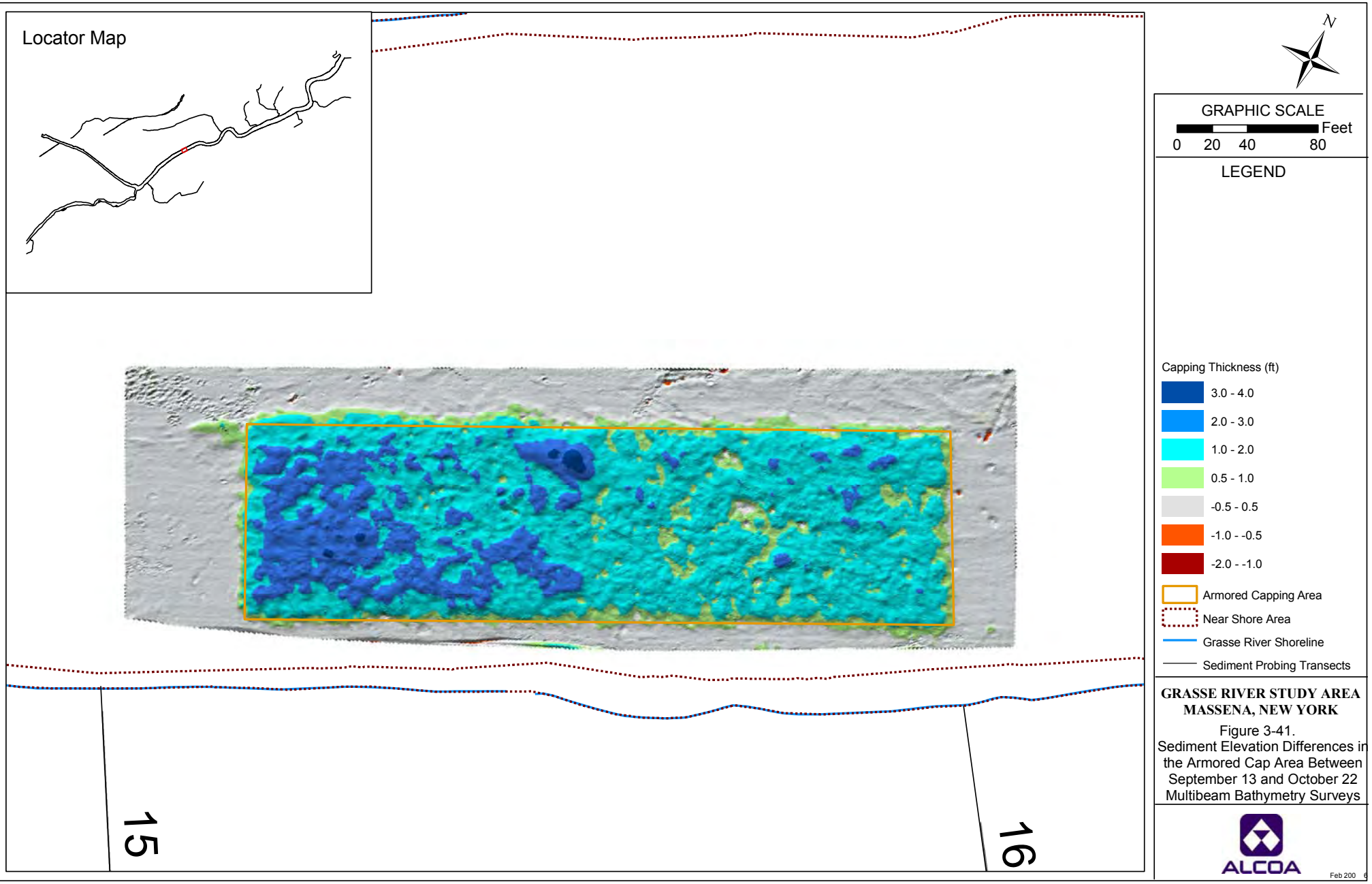

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure 3-41.
Sediment Elevation Differences in the Armored Cap Area Between September 13 and October 22 Multibeam Bathymetry Surveys

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd

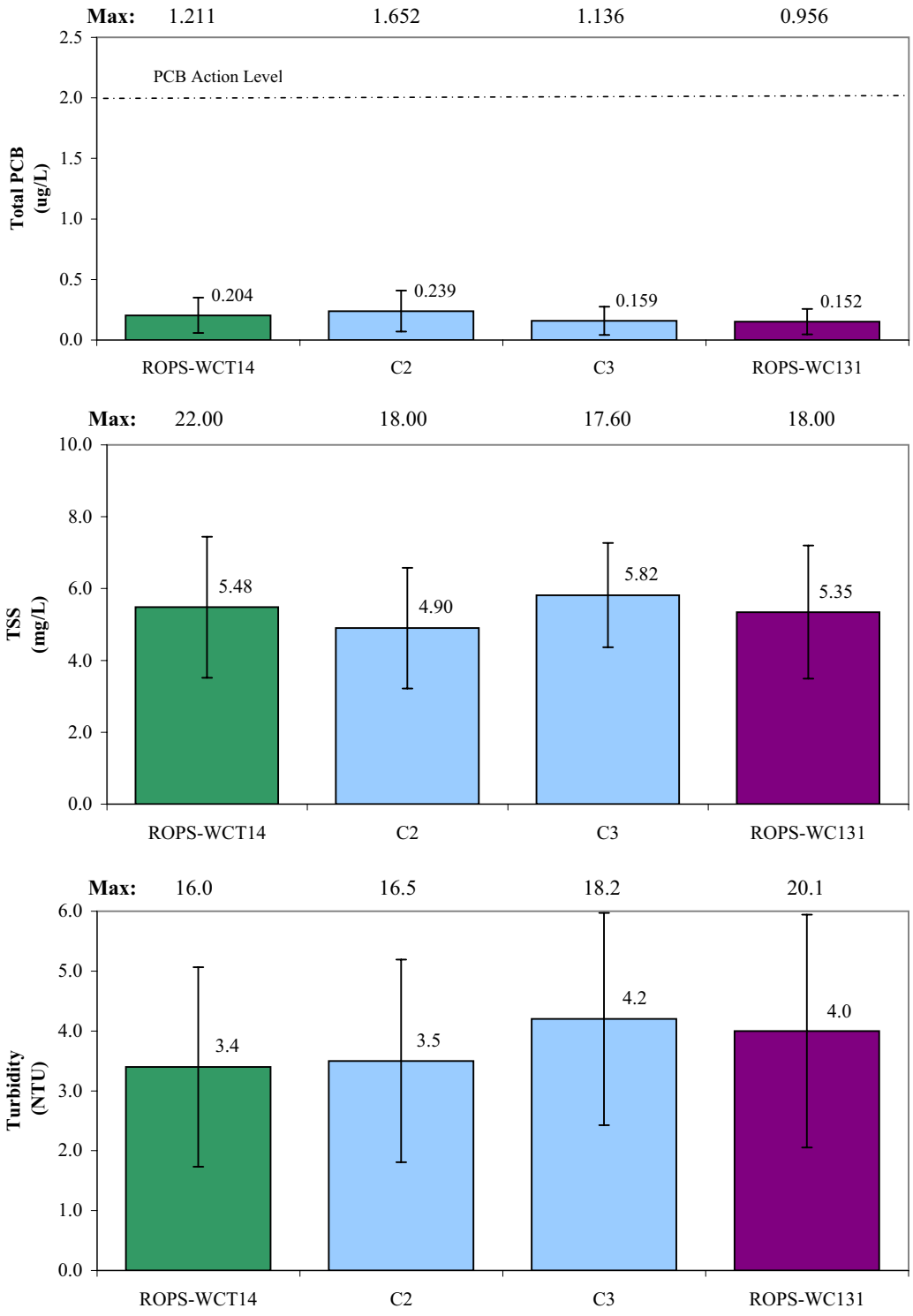

Figure 3-42. Average Water Column Levels During Armored Capping

Values below the detection were set to half the detection limit prior to calculations.
Error bars represent 95% confidence intervals.
Maximum levels displayed along the top of each panel for each location.
PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

Date tables: water_aro_ROPS, water_field_ROPS

- Upstream
- Local
- Downstream

ARC- D:\ALCgra\Analysis\ROPS\IDL\water\watercolumn_spatialavg_barplots.xls
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Attachments

Attachment A-1 Baseline Sediment PCB Characteristics
Attachment A-2 Additional Sediment Sampling Events Scope of Work

1. General Overview of the Environmental Monitoring Program

An intensive environmental monitoring program was developed for the Remedial Options Pilot Study (ROPS) consisting of baseline, during-construction, and post-construction monitoring. The monitoring program was designed to assess the overall and component-specific objectives outlined in Section 1.1, and generate data necessary to evaluate the Environmental Data Quality Objectives (DQOs) presented in Section 1.2. Baseline monitoring was conducted in 2004 and spring 2005, during-construction monitoring was performed from April to November 2005, and post-construction monitoring was conducted in November and December 2005. Longer-term monitoring will be conducted in 2006, and this program is currently under development in coordination with the Agencies (i.e., the United States Environmental Protection Agency [USEPA], New York State Department of Environmental Conservation [NYSDEC], and the St. Regis Mohawk Tribe [SRMT]).

Each monitoring period (i.e., baseline, during-construction, and post-construction) consisted of a number of activities based on the ROPS construction activities. In general, environmental monitoring included the following activities: sediment surface elevation and probing measurements; water column, air, and ecological monitoring; bathymetric measurements/remote sensing surveys; sediment chemistry and grain size analysis; ex-situ dredge material, water treatment effluent and cap material sampling. Monitoring activities were performed in accordance with Attachment VI of the *Remedial Options Pilot Study Operations Plan* (Operations Plan; Sevenson Environmental Services, Inc. [Sevenson], May 2005), various Engineering Change Notices (ECNs; Appendix G), and the protocols established therein.

Details regarding the environmental monitoring conducted during each portion of the program are presented in Sections 2.1 through 2.3. Additional construction-related operational monitoring activities conducted during the ROPS, such as noise and light monitoring and wipe sampling, are described in Section 2 of the main body of this ROPS Documentation Report. Also, monitoring and results associated with the hydrocyclone operational and Geotube pilot studies are included in Appendix K. Table A-1 identifies where all data presented in this appendix are provided. Appendix M presents a discussion of the quality assurance/quality control (QA/QC) sample results and evaluation.

1.1 ROPS Objectives

ROPS construction activities were developed based on consideration of the following overall objectives:

- Evaluate remedial options to reduce potential risks associated with exposure to buried polychlorinated biphenyls (PCBs) that could be mobilized by a future ice jam-related sediment scour event in the lower Grasse River;
- Develop information to address outstanding issues regarding remedy effectiveness, remedy implementation, and the conceptual site model (CSM) that impact the analysis of remedial alternatives; and
- Make progress in the lower Grasse River to support final remedy development, evaluation, selection and implementation.

To further guide development, design, and the implementation of each ROPS construction component and the monitoring activities, additional component-specific objectives were developed that took into account the updated CSM, overall ROPS objectives, and general construction components.

Dredging/capping in the main channel and adjacent northern side slope area was conducted to:

- Evaluate dredging as a remedial option to reduce the potential risk that may be posed by future ice jam-related sediment scour events by removing a targeted area of sediments with elevated PCB concentrations in an area of the river that is known to be subject to ice jam-related scour;
- Develop site-specific information related to dredging effectiveness, dredging residuals, dredging production rate, and sediment resuspension that can be used in the development of the revised Analysis of Alternatives (AA) Report;
- Evaluate construction issues pertaining to placement of a cap over the dredged area; and
- Evaluate the potential for incoming clean sediments from upstream of the lower river to provide containment for any residuals that may remain after dredging.

Dredging/capping in the northern near shore area and thin-layer capping in the southern near shore area were implemented to:

- Develop site-specific information on the effectiveness and implementability of removal in near shore areas for use in the development of the revised AA Report;
- Develop information on the effectiveness and implementability of thin-layer capping in the near shore areas for use in the development of the revised AA Report; and
- Evaluate habitat impacts and recovery in near shore areas which have been dredged and/or capped.

Placement of an armored cap in the main channel was conducted to:

- Evaluate constructability issues related to placing an armored cap in the river channel; and
- Evaluate the ability of an armored cap to withstand estimated forces from potential future ice jam events (through a laboratory physical model).

1.2 Data Quality Objectives

DQOs were developed for the ROPS to clarify the overall and component-specific objectives of the project and ensure that the data collected as part of the monitoring program would be appropriate for their intended use. The ROPS monitoring program was originally designed to provide the data needed to evaluate the following DQOs as presented in Section 4 of the *Remedial Options Pilot Study Work Plan* (ROPS Work Plan; Alcoa Inc. [Alcoa], February 2005):

- Develop a refined understanding of the pre-construction physical and chemical conditions within the river areas targeted for possible dredging and/or capping (i.e., main channel, side slopes, and near shore areas);
- Determine system-wide impacts of construction activities, if any, on PCB levels in the water column and fish;
- Quantify the downstream transport of PCBs that occurs as a result of dredging activities;
- Determine PCB levels and sediment volumes that remain after production dredging;
- Assess the relationship between local conditions and post-dredging PCB residual concentrations to the extent possible;
- Determine the effectiveness of post-dredging capping as a means to isolate PCB-containing residual sediment;
- Determine impacts of dredging activities, if any, on PCB concentrations in the air;
- Determine the ability of the native sediments to support an armored cap designed to withstand the forces imposed by increased velocities and turbulence under an ice jam (as observed during the 2003 event);

- Assess impacts of capping activities, if any, on the downstream transport of PCBs in the water column;
- Determine the ability of thin-layer capping to isolate PCB-containing sediments in near shore areas;
- Document the changes in habitat caused by dredging or thin-layer capping in near shore areas;
- Evaluate sedimentation rates in near shore areas of the river;
- Document the changes in habitat caused by construction of an ice control structure (ICS);
- Quantify loadings of clean sediments from upstream into the lower river and quantify the impact of an ICS on sediment transport to the lower Grasse River;
- Document the efficacy of an ICS as a means to mitigate ice runs into the lower Grasse River; and
- Assess stability of sediments downstream of region exhibiting effects from ice-related scour.

Table A-2 presents the DQOs and the related monitoring element conducted to meet the specified objectives. As discussed in Section 1.2 of the main body of this ROPS Documentation Report, the ROPS Work Plan (Alcoa, February 2005) also included provisions for installation of an ICS. Based on community concerns, the ICS component was not implemented as part of the ROPS activities, and therefore DQOs related to the ICS were not evaluated as part of the ROPS.

2. Environmental Monitoring Activities and Results

2.1 Baseline Monitoring

Baseline monitoring was conducted in summer/fall 2004 and spring 2005 to obtain additional information necessary to refine the scope of the ROPS activities, and fill data gaps regarding baseline conditions as a point of comparison with future monitoring results to assess achievement of objectives, and consider seasonal variation in biological characteristics of the targeted areas. A summary of the activities performed and information generated during each of the baseline monitoring events is presented in Sections 2.2.1 and 2.2.2.

2.1.1 2004 Baseline Monitoring

Baseline monitoring activities conducted in summer/fall 2004 included the following:

- Sediment sampling in the main channel and near shore areas in August/September 2004;
- Sediment surface elevation and probing measurements in all areas targeted as part of the ROPS from July to September 2004;
- Geotechnical investigation in the main channel armored cap area in September 2004;
- Ecological monitoring, including benthic community sampling and habitat characterization, in the northern and southern near shore areas in September 2004; and
- Ecological monitoring, including benthic community sampling, habitat characterization, fish community survey, and vegetative survey in the proposed ICS area in September 2004.

Initiation of these monitoring activities was approved by USEPA in 2004 based on their review of the draft ROPS Work Plan submitted June 11, 2004. The description and sampling protocol for the 2004 baseline monitoring activities were the same in the draft and final ROPS Work Plans. As such, the monitoring activities were conducted consistent with Appendix A of the ROPS Work Plan (Alcoa, February 2005). Details regarding each of these monitoring elements, including a summary of field collection activities and discussion of results were presented in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b). The number of samples collected as part of the 2004 baseline monitoring events is presented on Table A-3 for purposes of completeness.

In addition, monitoring was conducted during the 2004/2005 winter season to document ice formation and breakup over this time period. The specific monitoring activities and an analysis of data obtained during these activities are presented in the *Technical Memorandum Grasse River Project 2004/2005 River Ice Monitoring Documentation Summary* (Alcoa, April 2006).

2.1.1.1 Baseline Sediment Characteristics

The *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b) included a description of the characteristics of each ROPS component area prior to implementation of construction activities. The sediment characteristics in each area are briefly summarized below; figures illustrating the PCB sediment concentrations in each of the ROPS areas are contained within Attachment A-1.

Results of the 2004 baseline ecological monitoring (i.e., benthic community assessment and habitat characterization) are briefly discussed in Sections 2.1.2.4.1 and 2.1.2.4.2.

Main Channel

Based on data collected through January 2004 (12 locations), measured PCB concentrations in the targeted area ranged from non-detect to 3,668 parts per million (ppm) (maximum PCB concentration observed at a depth of approximately 3.5 feet (ft) below the sediment surface).

Additional sediment sampling was conducted in August/September 2004 to further characterize the area. A total of 30 sediment cores were collected in 2004 from the main channel and northern side slope (19 and 11 cores, respectively). Approximately 3 to 5 ft of sediment was recovered in each of the cores collected from the main channel. The top 18 inches (in) of sediment within the cores was coarser than the deeper sediments. PCB levels were relatively low at the surface (i.e., 0 to 3 in) with levels ranging from 0.1 to 9.0 ppm in most cores; one core had a concentration of 29.9 ppm. At-depth PCB concentrations ranged from 238 to 3,859 ppm and were generally found 3 to 4 ft below the surface.

Approximately 2 to 6 ft of sediment were recovered from the 11 cores collected along the northern side slope. Cores contained 62% sand, 34% fines, and 4% gravel. PCB levels in the three most upstream side slope cores were relatively low ranging from non-detect to 17.4 ppm. The eight downstream cores exhibited profiles similar to the main channel cores with generally low surface PCB concentrations (less than 7 ppm) and peak PCB levels of 153 to 1,578 ppm observed approximately 1 to 5 ft below the sediment surface.

Considering all data collected post-2003 ice jam-related scour event, the average surface PCB concentration in the main channel dredge area prior to the ROPS was 4.5 ppm (see ECN 012; Appendix G). Sample locations and results are shown on Figure 1 in Attachment A-1.

Northern Near Shore

A total of eight sediment cores were collected in 2004 from the northern near shore area. Approximately 1 to 3.5 ft of sediment was recovered in each of these cores, with average compositions of 56% fines, 36% sand, and 3% gravel. Surface PCB concentrations averaged 19.0 ppm; six of the eight cores contained less than 15 ppm and the other two cores (located in the middle of the area) contained 48.8 ppm and 73.1 ppm. Peak PCB levels were generally observed in the top 6 to 18 in (range of 0.2 to 234 ppm), and concentrations at the bottom of the cores were low. One surface (0-3 in) sediment sample was collected from this area in 2003; its resulting concentration was 31.3 ppm. These sample locations and associated PCB results are shown on Figure 2 in Attachment A-1.

Southern Near Shore

A total of 6 sediment cores were collected in 2004 from the targeted southern near shore area, and approximately 8 to 16 in of sediment was recovered in each core. On average, the cores contained 75% fines, 24% sand, and 1% gravel. Cores generally contained low levels of PCBs. Four of the 6 cores contained surface PCBs less than 2 ppm, and the other two cores contained 36.5 ppm and 9.1 ppm at the surface. The average surface PCB concentration was 8.3 ppm, and deeper portions of the cores contained PCB levels below the detection limit. One surface (0-3 in) sediment sample was collected from this area in 2003; its resulting concentration was 18.4 ppm. These sample locations and associated PCB results are shown on Figure 2 in Attachment A-1.

Armored Cap Area

Sediment samples were collected in 2003 after the ice jam-related scour event. The area targeted for armored cap placement contained surface sediment (i.e., 0 to 3 in) PCB concentrations that ranged from non-detect to 7.9 ppm and averaged 2.8 ppm (10 sample locations), and at-depth PCB concentrations (i.e., from 3 in to bottom of the sediment column) that average 40.0 ppm (one core location). The upstream half of the armored cap area has a surface sediment PCB concentration of 3.4 ppm (six sample locations; no at depth data). The downstream half has a surface sediment concentration of 2.0 ppm (four sample locations including one core) and at-depth PCB concentrations that average 40.0 ppm (one core location). These sample locations and associated PCB results are shown on Figure 3 in Attachment A-1.

Details regarding field collection activities and a discussion of results can be found in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b).

2.1.2 2005 Baseline Monitoring

The 2005 baseline monitoring events, which were conducted in April and May 2005 prior to initiation of ROPS construction activities, included: sediment surface elevation and probing measurements; water column, air, and ecological monitoring, including invertebrate community sampling and habitat characterization. A summary of each monitoring activity and associated results are described in Sections 2.2.2.1 through 2.2.2.4. Table A-3 presents an overview of each sampling event conducted, the total number of locations sampled, and the total number of sample/measurements obtained during each monitoring activity.

2.1.2.1 Sediment Surface Elevation and Probing Measurements

2.1.2.1.1 Monitoring Activities

Baseline sediment surface elevation and probing measurements were conducted in areas targeted as part of the ROPS between April 19 and May 16, 2005 to obtain additional data for future comparisons. Sediment surface elevation and probing measurements were collected within the main channel and northern near shore areas targeted for dredging/capping, and elevation measurements were collected in the main channel area targeted for armored capping and the proposed southern near shore capping area. Measurements were collected along the same grids used during the 2004 baseline event, which included a 25-ft by 25-ft grid throughout the main channel, and a more refined 25-ft by 10-ft grid in the side slope and near shore areas.

At each grid node, the total water depth was obtained using a surveyor's rod to measure the distance from the water to sediment surface, and water surface elevation was recorded using real-time kinematic (RTK) survey techniques. This information was used to calculate the sediment surface elevation at each node by taking the recorded water surface elevation and subtracting the water depth. For those grid node locations within the areas targeted for dredging, sediment probing was conducted by advancing a 5/8-in steel pipe into the sediment as far as possible using reasonable human force to measure total sediment depth and determine physical characteristics/other observations (e.g., presence of cobbles/boulders, debris, bedrock, etc.), to the extent possible. All grid node horizontal positions and water surface elevations were determined using RTK survey techniques.

Similar to the 2004 baseline event, sediment surface elevation and probing measurement results for two locations within the northern near shore area could not be obtained due to the presence of overhanging trees that created interference with the surveying unit. In total, the field team surveyed 1,163 grid node locations in the

northern near shore/main channel dredging/capping areas and 272 in the southern near shore/armored capping areas. Targeted grid node locations are presented on Figures A-1 and A-2.

Data were generated and distributed electronically for inclusion in the database (Appendix B). All sediment surface elevation and probing measurements were obtained in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005).

In addition to the manual elevation and probing measurements, Hypack and multibeam surveys were conducted to collect bathymetry data to further characterize the river bottom. A pre-dredge survey was conducted using Hypack to determine the topography of the areas in the main channel targeted for dredging on May 13, 2005. Hypack information was obtained using a survey boat equipped with digital global positioning system (DGPS), a depth sounder, and navigation software to position the boat. The survey was performed at transects spaced approximately 5 ft apart across the targeted dredge areas. In June/July 2003, Ocean Surveys, Inc. (OSI) conducted multibeam bathymetry from sediment probing transects (T) 1 to T38 using a Reson Seabat Multibeam echo sounder, which provided high resolution depth measurements at a density of one measurement every one square ft of river bottom. Survey vessel navigation, trackline control, and position fixing were accomplished using a Trimble 7400 "On-The-Fly" (OTF) RTK DGPS interfaced with OSI's personal computer (PC)-based hydrographic software package "MareTrack II". Data collected during these surveys are provided in Appendix O and discussed in Section 2.3.1.3. The 2003 event represents the most recent multibeam survey conducted in the targeted area prior to the ROPS.

2.1.2.1.2 Summary of Results

ROPS Target Dredge Areas (Main Channel, Side Slopes, and Northern Near Shore)

Two baseline sediment surface elevation surveys were conducted in 2005: 1) sediment probing and elevation measurements in the main channel, side slopes, and northern near shore in April/May 2005; and 2) Hypack survey measurements conducted in the main channel dredging area in May 2005 (Section 2.1.2.1). Sediment surface elevation measurements obtained during these two surveys were compared to elevation measurements from 2003 (multibeam) and 2004 (probing) to assess potential changes in the sediment bed elevation that may have occurred during the 2004/2005 winter and to determine starting sediment surface elevations necessary to calculate sediment removal or capping material volumes for the ROPS.

Point-by-point comparisons of paired[1] sediment surface elevation measurements from the June/July 2003 multibeam and 2004 and 2005 baseline surveys are presented in Figure A-3. The 2004 and 2005 elevation surveys were relatively similar, on average, to the 2003 multibeam elevation measurements, with mean elevation differences of 0.5 to 0.4 ft observed in the main channel area between the 2003 multibeam and the 2004 and 2005 surveys, respectively (Figure A-3). Greater variability was noted in the side slope and near shore areas (mean differences of 0.7 to 0.6 ft). This was expected given that positioning differences (i.e., spatial differences in locations where measurements were obtained) will introduce more variability in areas where sediment surface elevations change rapidly over small distances than in areas where the river bottom elevation is more uniform. No distinct bias was observed in any of these three datasets, as evidenced by the data scatter around the line of equality (i.e., 1:1 line).

The spatial distribution of elevation changes in the main channel between the 2004 and 2005 baseline surveys is presented in Figure A-4**;** comparisons were not performed for the near shore and side slope areas given the

[1] Since measurement locations differed among the various surveys, measurements collected within 10 ft of each other were considered paired; those separated by more than 10 ft were excluded from the analysis.

uncertainty introduced by positioning inaccuracies in these regions (as described above). This comparison indicates changes that may exceed what is expected from measurement error. Although increases and decreases in elevation are intermixed to some extent, there is a clear tendency toward decreases in elevation (suggesting erosion) between T7 and T9 and increases in elevation (suggesting deposition) downstream of T9.

In an effort to understand how much of these apparent changes may be due to measurement error derived from horizontal positioning differences between the paired 2004 and 2005 measurements and error in the measurement of elevation (i.e., vertical inaccuracy), the changes between 2004 and 2005 were compared to changes measured between replicate surveys conducted in July-September 2004 to estimate measurement error. These replicate surveys are described in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b). The distributions of differences between paired elevation measurements for the replicate 2004 surveys and the 2004 and 2005 survey comparison are presented in Figure A-5. The replicate 2004 data differences, which are shown by solid circles, appear to be normally distributed with a median of about zero with 95 percent (%) of the values between -0.5 ft (decrease) and +0.5 ft (increase). In contrast, the differences between the paired 2004 and 2005 measurements, which are shown by open triangles, have a distribution that deviates from normality at the tails, have a median value of about -0.2 ft (decrease) and 95% of the values between -1.5 ft (decrease) and +1.1 ft (increase). Thus, it appears that some erosion and deposition occurred between the 2004 and 2005 surveys. Overall, the replicate measurements that indicate that the decreases in elevation differ, on average, by about -0.3 ft while those that indicate an increase in elevation differ, on average, by +0.3 ft. Comparable statistics from the 2004 to 2005 elevation differences are 0.5 ft for both areas of apparent erosion and deposition. Thus, on average, the 2004 to 2005 changes are about 0.2 ft greater than might be expected due to measurement error. It is possible that the small ice jam that formed in the vicinity of the ROPS area in spring 2005 may have resulted in sufficient bottom shear stress to cause limited sediment disturbance in this area (Alcoa, April 2006).

The May 2005 Hypack survey data exhibited less variability in relation to the 2003 multibeam and 2004 and 2005 elevation surveys, with mean elevation differences in the main channel of 0.3 to 0.5 ft (Figure A-6). However, a bias is evident in these comparisons; the Hypack elevation measurements are consistently higher than most elevation measurements collected during the 2003 multibeam and the 2004 and 2005 elevation surveys. The reason for this bias is not known. Based on this observation, the accuracy of the Hypack information was brought into question.

Due to the resolution of the 2003 multibeam data set (i.e., one measurement every one square ft of river bottom), and the limited differences observed between this information and the 2004 and 2005 baseline surveys, the 2003 multibeam data set was used to define the ROPS pre-removal sediment surface elevations for the estimation of sediment removal volumes for the main channel and side slope areas (Figure A-7). Since the shallow nature of the northern near shore precluded the collection of multibeam bathymetry information from this portion of the river in 2003, data obtained during the 2005 elevation survey were used to define pre-removal surface sediment surface elevations in the northern near shore area (Figure A-8).

Probing measurements from the 2005 baseline monitoring were used to provide an estimate of the thickness of sediment targeted for removal during the ROPS. Evaluation of these data was facilitated by the development of a triangular irregular network (TIN) using ArcGIS software (Figure A-9). A TIN represents a surface as a set of contiguous, non-overlapping triangular facets of irregular shape and size; it provides a relatively precise analysis of source data compared to other interpolating methods. The TIN of the 2005 baseline probing data shows that sediments are generally thicker (i.e., 2 or more ft thick) in the main channel than in the near shore area and on the side slopes, and that several areas of thinner (i.e., less than 2 ft thick) sediments exist in the downstream half of the main channel target area. In addition, deposits of shallow sediment are found within the near shore areas; shallow surface sediment deposits in two of the larger areas are mid-way between T7 and T8 and between T8 and T9.

Qualitatively, these observations are similar to those made from the 2004 probing measurements (Alcoa, April 2005b). However, comparisons between the 2004 and 2005 ROPS probing measurements on a point-by-point (i.e., grid node by grid node basis) indicate considerable variability (Figure A-10), much greater than that exhibited by comparison of the sediment surface elevations from the 2004 and 2005 surveys (as described above; Figure A-3). On average, probing depth differences of 1.0, 1.3 and 1.8 ft were observed in the main channel, side slopes, and northern near shore areas, respectively, between the two surveys. The cause for the greater variability in the probing depth comparisons is not known with certainty, but is believed to be attributable to positioning inaccuracies coupled with variations in the bottom conditions at the site.

ROPS Target Cap Areas (Armored Cap and Southern Near Shore Areas)

Point-by-point comparisons of paired sediment surface elevation measurements from the 2003 multibeam and the 2004 and 2005 surveys are presented for the main channel armored cap area in Figure A-11. In the armored cap area, the 2005 elevation measurements are similar to those from the 2003 and 2004 surveys, with mean elevation differences of 0.6 and 0.7 ft observed among the respective surveys. Greater variability was noted in this area relative to that observed in the main channel target dredge area (0.6 ft versus 0.4 to 0.5 ft). This was expected given that a large portion of this area was affected by the 2003 ice jam, leaving a more variable river bottom in this region relative to the main channel target dredge area located further upstream (Alcoa, April 2004). Pre-capping sediment surface elevations in the armored cap area were also obtained during a multibeam bathymetry survey on September 12-13, 2005 as part of the ROPS during-construction monitoring activities (see Section 2.2.1.3 for details). The sediment surface elevations measured during this survey were similar to those from the 2003 multibeam survey (average mean difference of 0.3 ft). Therefore, since the September 12-13, 2005 survey represented the most recent depiction of the river bottom in the armored cap area prior to cap construction, the September 12-13, 2005 multibeam data were used to define the ROPS pre-capping sediment surface elevations in this area (Figure A-12).

Point-by-point comparisons of paired sediment surface elevation measurements from the 2004 and 2005 baseline surveys are presented for the southern near shore thin-layer cap area in Figure A-13. Surface sediment surface elevations measured in the thin-layer cap area in 2005 are similar to those measured in 2004, with a mean difference in elevation of about 0.7 ft between the surveys. Note some of the variability observed between the two surveys is the result of including measurements along the adjacent side slopes. A TIN of the 2005 sediment surface elevation data indicates similar patterns to those observed in 2004; elevations are highest near the shore and decline towards the center of the river channel (Figure A-12). Since multibeam bathymetry data could not be obtained in the southern near shore thin-layer cap area in 2003, the April 2005 elevation measurements were used to define pre-capping surface sediment surface elevations for the ROPS.

2.1.2.2 Water Column Monitoring

2.1.2.2.1 Monitoring Activities

Two baseline water column monitoring rounds were conducted, one each on May 2 and 16, 2005 – one and three weeks prior to in-river construction activities – to document baseline conditions in the river before implementation of construction. Monitoring during these events consisted of the collection of water column samples and water quality parameters at ROPS-WCT5, ROPS-WCT14, and ROPS-WC131. The location of these transects are presented on Figure A-14. At each transect, the total water column depth was measured using a depth finder, and grab samples were collected from three depths (0.2, 0.5, and 0.8 times the total water column depth) at each of three equally-spaced water column sampling stations across the transect, resulting in a total of nine grab samples. Samples were collected using a Kemmerer stainless steel sampler. The grab samples were composited by transect into glass carboys and divided into sample jars for laboratory analysis.

Prior to sample collection, stratification of the water column was evaluated via vertical profiling of water temperature and specific conductivity (i.e., collection of these parameters every 2 ft in the water column) at the center sampling station. Stratification occurs when cooler, higher conductivity water from the St. Lawrence River migrates along the bottom of the lower Grasse River. Stratification generally occurs during summertime low flow periods in the Grasse River, and creates vertical differences in water temperature, specific conductivity, and PCB concentrations within the water column (Alcoa, April 2005b). If stratification was observed, the sampling protocol would be altered to collect representative samples above and below the demarcation of stratification. However, the water column was not stratified during the baseline rounds, and the grab samples were collected as described above. Water temperature, dissolved oxygen (DO), specific conductivity, pH, and turbidity (water quality parameters) were also collected at the three sampling depths at each transect, but from the center channel location only. All water quality parameters were obtained using a real-time meter (YSI 650MSD with a 6820 Sonde probe). Data were generated and distributed electronically (as described in Section 2 of the main body of this ROPS Documentation Report) for inclusion in the water column monitoring forms (Form 8; Appendix H) and database (Appendix B).

Samples were submitted to the Alcoa Massena ChemLab (ChemLab) for PCB (Aroclor) and total suspended solids (TSS) analysis with results requested on a 24-hour turn-around-time (TAT). All baseline water column monitoring activities were conducted in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005).

2.1.2.2.2 Summary of Results

PCB, TSS, and turbidity measurements collected during the two baseline monitoring surveys were consistent with levels measured historically in May. PCB concentrations were below the 0.065 micrograms per liter (µg/L) detection limit (Aroclor) for all locations during both surveys. These levels are within the range of PCB (congener) levels generally observed in this stretch of the river during the past few years (0.002 to 0.290 µg/L).

TSS concentrations measured during the May 2, 2005 survey exhibit a general increase across the site, with levels ranging from 2.2 milligrams per liter (mg/L) at ROPS-WCT5 to 6.0 mg/L at ROPS-WC131. No distinct spatial trend was observed in TSS levels measured during the May 16, 2005 survey; TSS levels were below the detection limit (1.43 mg/L) at ROPS-WCT5 and ranged from 1.8 to 2.0 mg/L further downstream (at ROPS-WC131 and ROPS-WCT14). Overall, the TSS concentrations observed during these two 2005 surveys are consistent with levels measured historically from this stretch of the river (non-detect to 7.1 mg/L).

Turbidity readings collected at ROPS-WCT5 and ROPS-WCT14 were similar during both 2005 surveys, ranging from 3.8 to 5.3 nephelometric turbidity units (NTUs). Turbidity levels measured at ROPS-WC131 were slightly higher (6.1 to 6.4 NTU). These levels are consistent with those observed in this stretch of the river during past years (0.5 to 7.1 NTU).

2.1.2.3 Air Monitoring

2.1.2.3.1 Monitoring Activities

One baseline air monitoring event was conducted from May 24-27, 2005 prior to initiation of intrusive activities, as outlined in the *Remedial Options Pilot Study Community Health and Safety Plan* (CHASP; Alcoa, April 2005a) and summarized in Attachment VI of the Operations Plan (Sevenson, May 2005). During this baseline event, air monitoring was conducted at a total of six monitoring stations (Locations #1-#6), including three locations upwind and downwind of the targeted dredging area, two locations upwind and downwind of the

sediment handling/processing area and the Secure Landfill (SLF) within the Alcoa plant, and a background location established upstream of the Power Canal/Grasse River confluence. All air monitoring locations are presented on Figure A-15, and a typical air monitoring station setup is shown on Figure A-16. The baseline air monitoring event included collection of high volume air samples and monitoring via real-time monitoring methods (RTMM) as described below.

The baseline program included time-integrated sampling over a 24-hour period using USEPA methodologies for several parameters at each sampling location. Samples were collected over a 24-hour exposure duration, as this time period was equivalent to the duration of daily dredge operations in the river. These time-integrated air samples (i.e., high volume samples) and corresponding collection methodologies included the following:

- PCBs per USEPA Method TO-4A for area sampling (USEPA, January 1999a) using a Tisch PUF Sampler (model TE-5040A);
- Polycyclic aromatic hydrocarbons (PAHs) per USEPA Method TO-13A (USEPA, January 1999b) using a Tisch PUF Sampler (model TE-5040A);
- Particulate matter less than 10 microns (PM_{10}) per USEPA Method PM-10 using a Tisch PM-10 High Volume Sampler (model TE-5028); and
- Volatile organic compounds (VOCs) per USEPA Method TO-15 (USEPA, January 1999c) using laboratory-supplied summa canisters.

Although previous sampling efforts indicated very low levels of VOCs at the site, total VOCs were assessed as part of this air monitoring program for purposes of completeness.

At each air monitoring station, the high volume samplers were powered using propane generators, as no other available power source was available. Two 100-gallon propane tanks supplied the generators during all monitoring activities. Air monitoring stations not located on Alcoa property were enclosed by a chain link fence with signage for security purposes.

The high volume time-integrated air samples described above were collected over a single day sampling event, except for PCBs, which were sampled over three consecutive single day periods. High volume sampling for PCBs occurred daily from May 24-27, 2005, and high volume sampling for PAHs, PM_{10}, and VOCs occurred on May 26-27, 2005. All samples were submitted to Con-Test Analytical Laboratories (Con-Test) with results requested on a 48-hour TAT.

Concurrently with the high volume sampling, RTMM were used to monitor for PM_{10} and VOCs at all six locations for a 24-hour period on May 26-27, 2005. PM_{10} readings were collected using a TSI 8520 DustTrak meter (DustTrak) with an environmental enclosure set to log 15-minute running average concentrations. Total VOC levels were collected using a MiniRAE photoionization detector (PID) with an environmental enclosure set to log 5-minute running average concentrations. Meters were checked throughout the day and downloaded at the end of the 24-hour sampling period concurrently with high-volume sample retrieval. Data were generated and distributed electronically for inclusion in the air monitoring forms (Forms 8B and 8C; Appendix H) and database (Appendix B).

Upwind and downwind locations were also determined each day in consideration of the typical prevailing wind direction through observation of meteorological conditions/data (e.g., wind speed/direction, wind gust, temperature, humidity, etc.) obtained from the National Weather Service weather station at the Massena International Airport – Richards Field (Station ID: KMSS), located approximately 1 mile (as the crow flies) from the site. Weather data from this station are available at http://www.met.utah.edu/cgi-bin/droman/meso_base.cgi?stn=KMSS. Data were downloaded and used to calculate average wind speed and estimate the typical prevailing wind direction daily during each monitoring period. This information was also

distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report. In addition, data obtained from the weather station were supplemented with "on-the-ground" daily observations.

2.1.2.3.2 Summary of Results

Baseline air monitoring provided data for comparison to future during-construction air concentrations in order to assess potential air quality changes and the necessity of corrective actions, as appropriate. PCB concentrations at all six monitoring locations were below the detection limit (~0.003 micrograms per cubic meter [$\mu g/m^3$]) during all three monitoring events when high volume samples were collected. Average real-time PM_{10} concentrations at each location ranged from 0.014 to 0.017 milligrams per cubic meter (mg/m^3), with a minimum individual 15-minute running average reading of 0.008 mg/m^3 and maximum of 0.038 mg/m^3. The PM_{10} values from the real-time DustTrak meter were confirmed by the laboratory results from the PM_{10} samples exposed for 24 hours from May 26 to May 27 (differences of 0.001 to 0.003 mg/m^3 between the average 15-minute real-time readings and the analytical results).

The average total VOC concentrations for the intensive sampling event were generally low at each location (range of 0.1 to 1.2 ppm) with the exception of AIR4 (Location #4) which had an average total VOC concentration of 9.7 ppm. This value for total VOCs as measured in the field (average of 5-minute readings by a PID meter) was not confirmed by the summation of analytical results for individual VOCs from the 24-hour exposure sample and, therefore, was considered suspect. The manufacturer of the PID instrument does not document in the user's manual which individual VOCs are included in the total VOC measurement and therefore, it is impossible to ensure proper comparison between the field and laboratory data. However, the laboratory result is believed to be more accurate than that measured directly by the field instrument. Moreover, the accuracy of PID meters is affected by weather conditions (i.e., humidity; www.raesystems.com). Additional comparisons between field and laboratory measured total VOC concentrations were made during intensive surveys conducted on June 22-23, July 14-15, and July 26-27, 2005; results for these surveys are reported in Section 2.2.1.5.2.

Most of the individual VOC and PAH results from the various monitoring locations were below the detection limit. Of the VOCs detected, only acetone and ethanol were consistently measured at all six locations (18.1 to 57.0 $\mu g/m^3$ and 4.7 to 442.0 $\mu g/m^3$, respectively). Of the PAHs detected, the compounds with concentrations above the detection limit at all six locations were acenaphthene, acenaphthylene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(e)pyrene, chrysene, fluoranthene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene and pyrene. However, the measured PAH levels were not elevated when compared to appropriate New York State Annual Guideline Concentrations (AGCs) as specified in the CHASP.

2.1.2.4 Ecological Monitoring

Ecological monitoring activities consisting of benthic community sampling and aquatic habitat characterization were performed in fall 2004 and spring 2005 in the northern and southern near shore areas. As indicated in Section 2.1.1, ecological monitoring activities were conducted in September 2004, and details regarding the monitoring and results are presented in the *2004 Remedial Options Pilot Study Baseline Monitoring Summary Report* (Alcoa, April 2005b). As such, these results are not discussed further in this report except in comparison with the spring 2005 data. Seasonal differences would likely preclude direct comparisons between fall and spring data, and as such, specific comparisons between pre- and post-dredging/capping datasets are expected to be limited to within-season comparisons (i.e., fall pre-dataset compared to fall post-dataset, etc.). As such, only

limited comparisons between the fall 2004 and spring 2005 benthic data are made to identify potential seasonal differences.

Benthic community and near shore aquatic habitat surveys were conducted on May 11, 2005 to document baseline conditions in the targeted near shore ROPS areas. Sampling efforts were conducted along the ROPS northern and southern near shore areas, as well as at two upstream control locations (Figure A-17). All sampling activities were performed in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005) and modified *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (USEPA, July 1999) and Design Clarification Form (DCF) 004 (Appendix G).

To characterize the benthic community in the near shore areas, a multi-metric approach following USEPA rapid bioassessment protocols (RBPs) was used (USEPA, July 1999). Metrics are measures used to quantify aspects of community structure and function that change in predictable ways with increased human influence and/or perturbation (Barbour et al., 1995). These metrics also provide a consistent theoretical framework for analyzing complex assemblage data (USEPA, July 1999). Because benthic community data may be complex, several metrics are typically used to characterize communities. USEPA (July 1999) supports the use of metrics that are applicable to the specific ecoregion and best suited to evaluate anticipated effects. The effects of the dredging/capping activities on the benthic community will be assessed in the future by comparing post-construction community metrics to baseline metrics. The upstream control location characteristics will be used to evaluate natural changes in the different communities that may be the result of other stressors or environmental conditions not related to the near shore ROPS construction activities.

The near shore aquatic habitat data are presented using summary statistics. The data were collected by visual observation and are qualitative in nature. At the time of the spring 2005 sampling, rooted aquatic vegetation had not yet emerged from the near shore sediments. This is in contrast to conditions in fall 2004, when vegetation was present. As such, discussion of aquatic habitats in the near shore areas in spring 2005 is based primarily on visual observations of the near shore substrates, with supporting information being provided from the grain size and total organic carbon (TOC) results, and water quality measurements.

The metrics that were calculated for the near shore benthic community data and the results of the aquatic habitat characterization are presented below, along with brief discussions of the sampling methods and protocols that were used to collect these data.

2.1.2.4.1 Invertebrate Community Sampling

2.1.2.4.1.1 Monitoring Activities

Sampling of sediments associated with the invertebrate community assessment was conducted using a petite ponar grab sampler. A total of six petite ponar grab samples were collected within each of the northern and southern near shore areas (Figure A-17); visual field observations indicated that similar fine-grained substrates types were present in each sampling area (i.e., additional samples were not necessary since visual observations did not indicate different fine-grained substrates were present; DCF 004). Three petite ponar grab samples were also collected within each of the two upstream near shore control locations (Figure A-17). The upstream control locations were selected to have similar habitat and substrate characteristics as the site locations. The samples were taken at equally-spaced intervals (approximately every 100 ft in the northern near shore area and 60 ft in the southern near shore area) in each near shore area. Once collected, the grab samples were sieved using a U.S. standard No. 30 (0.6 millimeter [mm]) sieve to remove fine sediments, and then preserved in 91% isopropyl alcohol. In total, 18 benthic samples were submitted to Chadwick & Associates, Inc. for identification of benthic species and biomass.

2.1.2.4.1.2 Summary of Results

Results of the spring 2005 baseline sampling event are presented in Tables A-4 through A-6 and are also contained in Appendix B. Similar to the fall 2004 baseline benthic analysis (also included in Appendix B), results of the spring 2005 baseline benthic analysis show a relatively diverse and abundant benthic community residing in the ROPS near shore sediments. By comparison, the mean number of species present per sample in the northern near shore area in 2004 was 14 and in 2005 was 18. The mean number of species present in the southern near shore area in 2004 was 14 and in 2005 was 15. The percent distribution of order taxa, however, between fall 2004 and spring 2005 benthic datasets differed, likely indicating seasonal effects. In 2004, the majority of taxa in the northern and southern near shore areas (88% and 96%, respectively) represented 6 of the 16 orders identified. The 6 orders were *Diptera* (specifically midge larvae), *Oligochaeta* (aquatic worms), *Coleoptera* (beetle larvae), *Trichoptera* (caddis fly larvae), *Amphipoda* (scuds), and *Gastropoda* (snails). By comparison, the majority of taxa in 2005 in the northern and southern near shore areas (90% and 85%, respectively) represented 4 of the 15 orders identified, with different percent contributions. The 4 orders were *Diptera*, *Oligochaeta*, *Coleoptera*, and *Ephemeroptera* (mayfly larvae). A summary of percent distribution of these major taxa is provided below (Table A-4 lists all order taxa for 2005). These findings were similar between upstream control locations as well.

			Mean Percent Abundance by Dominant Order Taxa						
Year	**Season**	**Shore**	**Midge**	**Worms**	**Beetles**	**Mayflies**	**Caddis**	**Scuds**	**Snails**
2004	Fall	Northern	14	26	12	6	13	13	10
		Southern	26	2	25	0	12	28	3
2005	Spring	Northern	61	14	12	3	2	1	4
		Southern	53	8	16	8	3	5	0

The information in the table above shows a substantial shift in distribution and percent representation of order taxa from 2004 to 2005; this shift is likely the result of seasonal differences. Seasonal differences in the benthic community are often caused by changes in abiotic conditions (e.g., water temperature, photoperiod, food production, etc.) that influence benthic communities (e.g., recruitment and emergence, niche specialization, trophic interactions, etc.). In this case, it appears seasonal differences in benthic abundance are particularly pronounced for midge, caddis fly, and scud species.

To define the baseline macroinvertebrate community characteristics that will be used to evaluate the potential effects of the near shore dredging/capping activities, the macroinvertebrate communities of the sampled areas are described using seven metrics from the RPB approach (USEPA, July 1999). As recommended by USEPA, the metrics chosen for this analysis include measures of benthic abundance, diversity, tolerance, and life history adaptations. The seven site-specific metrics chosen for this analysis are: 1) total organisms; 2) biomass; 3) number of taxa; 4) diversity index; 5) tolerance index; 6) feeding guild; and 7) organism habit. These metrics and their associated values are discussed below.

1. Total Organisms: Count of all individuals in the sample. Used as the denominator for several other metrics, and also useful for observing differences in the number of organisms in each sample. Average results for the samples collected in the northern near shore area and upstream control locations were 114 and 164, respectively (Table A-5). Average results for the southern near shore area and upstream control samples were 51 and 20, respectively (Table A-5). The reason for higher total organisms counts in the northern near shore area is not known, but may be related to differences in habitat (i.e., slightly higher TOC, slightly lower turbidity, and less embedded gravel in the northern near shore area; Tables A-7 and A-8) and possibly shoreline structure (i.e., the northern near shore area is in a cove and appears

to be more protected from high flows; Figure A-17). Visual observations made during field sampling support this, as wave action and turbidity appeared to be higher in the southern near shore area.

2. Biomass: Measure of wet-weight sample mass. Useful for comparing sample differences in biomass and understanding the trophic food base between locations. Average results for the samples collected in the northern near shore area and upstream control locations were 140 and 303 milligrams (mg), respectively (Table A-5). Average results for the southern near shore area and upstream control samples were 133 and 374 mg, respectively (Table A-5). Higher biomass in the upstream control samples was due primarily to the presence of a few large organisms and/or many Dipterans. For example, in the northern upstream control, a few large mayfly and dragonfly larvae contributed to the higher biomass results observed, and one sample (NSCON-3) also had many Dipterans (Table A-6). In the southern upstream control, a few large dragonfly larvae and oligochaetes contributed to the higher biomass results observed.

3. Number of Taxa: Total number of taxa per sample; used to measure the overall variety of the species assemblage. Average results for the samples collected in the northern near shore area and upstream control locations were 18 and 20, respectively (Table A-5). Average results for the southern near shore area and upstream control samples were 15 and 9, respectively (Table A-5). The lower number of taxa observed in the southern near shore areas corresponds with the lower number of organisms also observed in these areas, which may be explained by the variations in environmental conditions previously discussed (see Total Organisms metric).

4. Diversity Index: Measures the diversity of the sample in terms of number of taxa and relative species abundance. The Diversity Index is based on the Shannon–Wiener Generic Diversity Calculation (Krebs, 1972) and is calculated as follows:

$$\bar{d} = \frac{c}{N}\left(N \log_{10} N - \sum n_i \log_{10} n_i\right)$$

where:
d = Shannon-Wiener Diversity Index
c = 3.321928 (converts base 10 log to base 2)
N = Total abundance of individuals
n_i = Total abundance of individuals in the ith taxon

The Shannon–Wiener Diversity calculation takes into account the number of individuals and the number of different genera in a given sample. The more genera that are present, and the more evenly distributed the numbers of individuals are in each genera, the higher the diversity index number and the higher the benthic diversity (impaired conditions generally lead to dominance by a few tolerant species and decreased diversity). After manipulation, the formula divides the number of individuals of each distinct genera present (determined by a series of counting rules) by the total number of individuals in each sample/replicate (i.e., generic relative abundance). These are then multiplied by the absolute value of the natural log of each distinct generic relative abundance value and then summed to give an index of benthic community diversity.

Average results for the samples collected in the northern near shore area and upstream control locations were 3.4 and 3.2, respectively (Table A-5). Average results for the southern near shore area and upstream control samples were 3.4 and 2.6, respectively (Table A-5). Lower diversity in the southern upstream control was due primarily to lower numbers of organisms and lower numbers of taxa being present in the samples as compared to other areas (Table A-6).

5. Tolerance Index: Calculated measure of organism tolerance or sensitivity to perturbation based on abundance and tolerance values ascribed originally by Hilsenhoff (1987). Can also be used to evaluate organic pollution. The Tolerance Index is based on the Hilsenhoff Biotic Index (Hilsenhoff, 1987) and is calculated as follows:

$$HBI = \sum \frac{n_i a_i}{N}$$

where:
HBI = Hilsenhoff Biotic Index
n_i = number of individuals in the ith taxon
a_i = tolerance value assigned to that taxon
N = total number of individuals in sample with tolerance values

The Tolerance Index uses pre-determined tolerance values for each benthic species ranging from 1-10 (the higher the number the more tolerant the organism to organic pollution or environmental perturbation). In general, the assigned tolerance value for a given species is multiplied by the number of individuals of that species in the sample/replicate and then divided by the total number of organisms in the sample/replicate for which there are tolerance values. These values are then summed to produce an index of benthic tolerance. The lower the resulting value, the larger the component of the sample made up of intolerant species, which may indicate better water quality.

Average results for the samples collected in the northern near shore area and upstream control locations were 6.8 and 6.9, respectively (Table A-5). Average results for the southern near shore area and upstream control samples were 6.6 and 6.1, respectively (Table A-5). Lower tolerance or sensitivity to perturbation in the southern near shore areas, particularly for the upstream control, is due primarily to the lack of certain tolerant species Phaenospectra sp., Procladius sp., and unidentified immature Tubificidae (Table A-6).

6. Feeding Guild: Functional feeding group measure that identifies feeding strategies based on food type and availability. Feeding groups can become skewed and unbalanced based on changes to environmental conditions (USEPA, July 1999). Dominant feeding groups in the samples collected from the northern near shore area and upstream control were primarily gatherers (collectors) (46% and 28%), filterers (19% and 24%), predators (14% and 15%), and scrapers (12% and 29%) (percentages of the organisms represented by these groups in the northern near shore and upstream control locations, respectively) (Table A-5). Dominant feeding groups from the southern near shore area and upstream control samples were generally similar, but with a greater proportion of gatherers. The dominant feeding groups in the southern near shore area and upstream control were gatherers (collectors) (57% and 64%), filterers (13% and 12%), predators (14% and 13%), and scrapers (14% and 8%) (percentages of the organisms represented by these groups in the southern near shore and upstream control locations, respectively) (Table A-5). Gatherers are typically more predominant in turbid environments (see Total Organisms metric).

7. Organism Habit: Mode of existence based on differing adaptations for movement and maintaining position. Similar to feeding guild in that this metric can become skewed and unbalanced based on changes to environmental condition (USEPA, July 1999). The dominant organism habits in the samples collected from the northern near shore area and upstream control were burrowers, clingers, climbers, and sprawlers with 39%, 28%, 23%, and 10%, and 23%, 43%, 24%, and 9% of the organisms being represented by these groups in these areas, respectively (Table A-5). The dominant habit groups in the

southern near shore area and upstream control samples were similar with burrowers, clingers, climbers, and sprawlers being 31%, 33%, 10%, and 20%, and 32%, 43%, 1%, and 23% of the organisms represented by these groups, respectively (Table A-5).

Although the baseline benthic metric results from spring 2005 appear to be slightly more variable than the baseline benthic metric results from fall 2004, they still provide a good foundation for comparison to future sampling events to determine potential changes in the benthic community structure due to the dredging/capping activities in the near shore areas.

2.1.2.4.2 Habitat Characterization

2.1.2.4.2.1 Monitoring Activities

The near shore aquatic habitats were surveyed using USEPA's modified RBPs (USEPA, July 1999). The near shore aquatic habitat evaluation was conducted by boat, visually estimating the presence and percent cover of different habitat types (primarily aquatic vegetation and different substrate types) observed in the near shore dredging/capping evaluation areas (Figure A-17). In addition, sediments from a co-located grab sample were collected concurrently at each benthic sample location and were submitted for TOC and grain size analysis (Table A-7). Water depth, water clarity using a Secchi disk, and water quality measurements were also taken at each grab sample location. Water quality measurements were taken within 1 ft of the river bottom and included water velocity, temperature, pH, conductivity, turbidity, and DO measurements (Table A-8). In total, 18 sediment samples each were submitted to Camp Dresser & McKee, Inc. (CDM) Soils Laboratory for grain size analysis and to Northeast Analytical, Inc. (NEA) for TOC analysis (Table A-7).

2.1.2.4.2.2 Summary of Results

The primary aquatic habitat identified in spring 2005 in the near shore areas was bare sediments. As previously discussed, rooted aquatic vegetation had not emerged yet from the sediments and was not observed in any near shore areas. The lack of vegetation, however, allowed greater visibility and documentation of near shore substrates not previously visible in fall 2004 when the vegetation was present. As such, it was visually observed that approximately 5 to 10% of the northern and southern near shore and upstream control substrates were comprised of rocks (i.e., cobbles and boulders). In addition, several pieces of large woody debris (i.e., downfalls) were observed in the northern near shore area. Based on laboratory analysis, the remaining substrates in the near shore areas were comprised primarily of fine sand and silt with some gravel and clay (Table A-7). The exception was three southern near shore locations (NSSB-2,-4,-5) where significant amounts of coarse gravel were identified. The coarse gravel in the southern near shore area was not evident visually during sampling and must have been embedded in near shore sediments (i.e., likely mixed with or covered by fine grained sediments). The presence of coarse gravel did not appear to influence the benthic community in the southern near shore area; no differences in the benthic communities were observed between the samples with coarse gravel (NSSB-2,-4,-5) and the samples without coarse gravel (NSSB-1,-3,-6; Tables A-4 through A-6). Mean TOC values were 2.0% and 1.0% for the northern near shore and upstream control areas, respectively, and 1.4% and 0.9% for the southern near shore and upstream control areas, respectively (Table A-7). For all locations, water quality parameters were consistent with previous water quality data collected from the Grasse River and comparable to other freshwater systems (Table A-8).

2.2 During-Construction Monitoring

During-construction monitoring was conducted to obtain timely information on the effects of ROPS activities, as well as operational performance information related to dredging and capping, such as depth of material dredged, cap coverage, and cap thickness. The during-construction monitoring activities are described in Sections 2.2.1 through 2.2.3, organized by construction component. Table A-3 presents a summary of each sampling event, including locations sampled, and total number of sample/measurements obtained. All monitoring activities were conducted in accordance with the procedures outlined in Attachment VI of the Operations Plan (Sevenson, May 2005) and/or ECNs/DCFs developed subsequent to the Operations Plan (Appendix G).

2.2.1 Debris and Sediment Removal/Dredging (Northern Near Shore, Work Zones 1 and 2)

Several monitoring events were performed in association with debris removal and dredging within the river (construction activities are described in Section 2 of the main body of this ROPS Documentation Report), including water column monitoring, sediment surface elevation/probing measurements, bathymetric measurements/remote sensing surveys, sediment sampling, air monitoring, ex-situ dredge material sampling, water treatment effluent sampling, and Geotube sampling. Changes were made to the monitoring program described in the ROPS Work Plan (Alcoa, February 2005) since dredging was not performed as originally envisioned. Actual monitoring activities and details regarding each monitoring component are presented below.

2.2.1.1 Water Column Monitoring

2.2.1.1.1 Monitoring Activities

Water column monitoring associated with installation of the silt curtain system was initiated on May 23, 2005, and monitoring during debris removal and dredging activities began on June 8, 2005 and continued daily through October 21, 2005 when these activities were occurring to assess immediate effects of debris removal/dredging on the water column. Monitoring included the collection of water column samples and water quality parameters at transects and local locations. Table A-9 presents a summary of the daily water column sampling activities and locations monitored during all in-river activities. Water column monitoring was performed using the equipment (i.e., Kemmerer and YSI) and protocol presented under baseline monitoring (Section 2.1.2.2.1) and in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005).

As part of this monitoring, stratification (as described in Section 2.1.2.2.1) of the water column was evaluated via vertical profiling of water temperature and conductivity (i.e., collection of these parameters every 2 ft in the water column). General guidelines were established for determining stratification considering data collected during Alcoa's Supplemental Remedial Studies (SRS) routine annual monitoring program (field activities and results from SRS program are provided in annual work plans and summary reports, the most recent of which include the *2005 Monitoring Work Plan* [Alcoa, March 2005] and the *2004 Data Summary Report* [Alcoa, April 2005c]). The stratification guidelines were developed based on a comparison of historical conductivities and temperatures measured during the SRS program at 0.2 and 0.8 times the total water column depth, and were aimed at determining whether both Grasse and St. Lawrence River waters were present at a given location. Guidelines for determining if the river was stratified included:

- Conductivity differences of at least 20 microSiemens per centimeter (µS/cm) between measurements obtained at 0.2 and 0.8 times the total water column depth; or

- Temperature differences of at least 3 degrees Celsius (^{o}C) between the measurements obtained at 0.2 and 0.8 times the total water column depth.

If stratification was identified based on these guidelines, an evaluation of field conditions, and judgment of experienced sampling personnel, the sampling protocol was altered such that grab samples above and below the demarcation of stratification were collected and composited separately at each location. The 17 days when stratification was present and sample locations were affected are summarized on Table A-9.

Water column samples and water quality parameters were typically collected before noon each day to allow the laboratory adequate time to meet the specified TAT. However, based on discussions with the Agencies, if there was a delay or shut-down in the 24-hour continuous removal operations, the water samples and parameters were not collected until approximately two hours after the re-start of in-river activities.

All water column samples were submitted to the ChemLab for PCB (Aroclor) and TSS analysis with results requested on a 24-hour TAT. Field data (i.e., water temperature, DO, specific conductivity, pH, and turbidity) obtained during water column monitoring were recorded in Personal Digital Assistants (PDAs) and distributed electronically for inclusion on Form 8A (Appendix H).

Water column samples were collected at designated transects and local locations (both perimeter and interior to the silt curtains) along with additional supplemental locations as presented below.

Silt Curtain Installation Turbidity Monitoring

Turbidity monitoring was conducted during the containment system anchor installation to assess any effects of these activities on turbidity levels in the water column. Measurements were conducted at three transects (i.e., ROPS-WCT5, ROPS-WCT14, and ROPS-WC131; Figure A-14). Turbidity monitoring was conducted multiple times per day at 0.2, 0.5, and 0.8 times the total water column depth in accordance with the monitoring protocol described in Section 2.1.2.2.1. Results of these monitoring activities indicated no significant increases in turbidity levels at the downstream transects as a result of anchor installation or curtain deployment. Data obtained during these monitoring activities are included in Appendix B.

Routine Transect Water Column Monitoring

Water column monitoring was conducted daily during in-river debris removal/dredging at the same transects sampled during the baseline monitoring event, including ROPS-WCT5, ROPS-WCT14, and ROPS-WC131 (Figure A-14). As described in Attachment VI of the Operations Plan (Sevenson, May 2005), water column samples were collected during silt curtain installation from May 25-June 7, 2005 at these same transect locations. Monitoring was performed consistent with the procedures described under baseline monitoring (Section 2.1.2.2.1), including the collection of water column samples (i.e., grab samples from three depths at three stations for a total of nine grabs composited into one sample unless stratification was present) and water quality parameters at the center location of each transect. Stratification was evaluated at the center station of each transect.

Routine Perimeter Local Location Water Column Monitoring

Water column samples and water quality parameters were collected at the local locations around the perimeter of the silt curtain system during removal activities. The specific local locations sampled were determined based on the area or work zone in which construction activities were occurring, and included one location adjacent to the active removal area, one location adjacent to but downstream of the active removal area, and one location

immediately downstream of the silt curtain. These perimeter local monitoring locations are presented on Figure A-14 and included D1-D4.

The specific locations sampled were determined as follows:

- During removal activities in the northern near shore area and Work Zone 1, samples were collected at D1, D2, and D4;
- During removal activities in Work Zone 2, samples were collected at D2, D3, and D4; and
- During concurrent removal activities in both Work Zones 1 and 2, samples were collected at D1-D4.

At each local location, the total water column depth was measured using a depth finder, and grab samples were collected at 0.2, 0.5, and 0.8 times the total water column depth (i.e., 3 depths). Grab samples were then composited by location in glass carboys unless stratification was present. If stratification was present, grab samples above and below the demarcation of stratification were collected and composited separately. The composite sample was divided into sample jars for laboratory analysis. Water quality parameters were obtained at each sampling depth at all locations, and stratification was evaluated at each local location.

Interior Local Location and Supplemental Water Column Monitoring

In addition to transect and perimeter water column sampling, supplemental filtered water column samples were collected on three occasions in June in response to elevated PCB levels that were observed downstream at D4, ROPS-WCT14, and ROPS-WC131 during debris and sediment removal activities in Work Zone 1. To investigate these elevated levels, Alcoa collected an additional five liters of water (beyond that needed for unfiltered PCB and TSS samples as described above under transect and perimeter local location monitoring) at select transects (ROPS-WCT14 and ROPS-WC131) and perimeter local water column locations (D2 and D4) on June 17 and 20, 2005 and submitted them to the ChemLab for filtered PCB (Aroclor) analysis. Filtering was performed by running the water through a 0.45 MAGNA nylon filter (one liter at a time) under a pressure of approximately 30 pounds per square inch (psi). The filter and the fifth liter of water were submitted for analysis. Adequate water for filtered PCB (Aroclor) analysis was also collected June 22, 2005 (along with unfiltered PCB and TSS samples) at ROPS-WCT14, ROPS-WC131, D2, D4, and at interior (i.e., within the silt curtained area) local water column locations (D5-D7; Figure A-14). All samples were submitted for analysis on a 24-hour TAT. Results of these analyses were used to assess levels of filtered versus unfiltered PCBs at each location, provide additional information regarding the source of PCBs downstream, and evaluate potential options for management of these PCBs (further described in Section 2.2.1.1.2).

Perimeter local locations (D5-D7) were also monitored on July 7, 2005 consistent with the local monitoring protocol described above under the perimeter local location monitoring (i.e., monitoring and collection of samples for unfiltered PCB and TSS analysis) to assess PCB levels within and outside the silt curtain setup.

Scow Movement Turbidity Monitoring

The silt curtain was opened at the upstream end to allow scow movement in and out of the work zone. As a result, additional turbidity monitoring was performed at the silt curtain opening to identify increased turbidity due to the movement of the scows. Turbidity monitoring was conducted during scow transport out of the silt curtained area at D0 (located within opening of silt curtains during scow transport; Figure A-14) on June 16, 17, and 22, 2005. Measurements at D0 were consistent with measurements collected at ROPS-WCT5 on these same days, indicating that scow transport did not result in increased turbidity levels outside of the curtained area. The turbidity measurements obtained during this monitoring are reported in Appendix B.

2.2.1.1.2 Summary of Results

Routine ROPS Water Column Monitoring

Average water column PCB, TSS and turbidity levels measured at the upstream (ROPS-WCT5), local (D1-D4) and downstream (ROPS-WCT14 and ROPS-WC131) monitoring stations during debris and sediment removal activities are presented in Figure A-18. A distinct spatial trend is observed in all three parameters: levels are lowest at the upstream station (ROPS-WCT5), higher at the local stations situated adjacent to the work area (D1, D2 and D3), highest at the downstream end of the work area (D4), and decline with distance downstream of the work area (ROPS-WCT14 and ROPS-WC131).

PCB levels measured at the upstream location were below the 0.065 µg/L detection limit, except for two days (0.101 µg/L on July 7, 2005 and 0.139 µg/L on August 30, 2005). PCB levels measured at the local monitoring stations adjacent to the work area (D1, D2 and D3) were, on average, 2 to 23 times higher than those measured upstream (0.062 to 0.738 µg/L), indicating PCBs were released into the bypass channel during debris and sediment removal activities. The highest PCB concentrations were consistently observed at D4, immediately downstream of the work area, and averaged 1.772 µg/L during debris and sediment removal activities. The maximum PCB concentration measured at D4 was 9.229 µg/L (July 21, 2005). PCB levels measured at ROPS-WCT14 and ROPS-WC131 were generally 2 to 3 times lower (averaging 0.745 and 0.673 µg/L, respectively) than those observed at D4 due to the dilution and mixing of water escaping the work area with river water entering from upstream and the deposition of solids that escaped the work area. Maximum PCB concentrations measured at ROPS-WCT14 and ROPS-WC131 were 3.151 µg/L (July 21, 2005) and 4.402 µg/L (July 20, 2005), respectively.

Overall, PCB concentrations measured during the ROPS exceeded the 2 µg/L action level (applicable to downstream stations ROPS-WCT14 and ROPS-WC131) on 8 of the 88 days of debris and sediment removal activities. These exceedances generally occurred during debris and sediment removal activities in Work Zone 1: six in July (July, 8, 19-22, and 26, 2005); one on August 25, 2005; and one on September 10, 2005.

TSS levels were generally low throughout the river during debris and sediment removal activities. At ROPS-WCT5, TSS levels averaged 3.17 mg/L (range of non-detect to 20.00 mg/L). TSS levels at the local monitoring stations adjacent to the work area (D1, D2 and D3) were slightly higher, averaging between 3.46 and 4.66 mg/L. The highest TSS concentrations were observed at D4 and averaged 6.91 mg/L, slightly more than two times the levels observed at ROPS-WCT5. The maximum TSS concentration measured at D4 was 24.40 mg/L (July 15, 2005). TSS levels measured at ROPS-WCT14 and ROPS-WC131 were lower than those observed at D4 and similar to levels observed at the other local monitoring stations (averaging 4.41 and 3.94 mg/L, respectively). Maximum TSS concentrations measured at ROPS-WCT14 and ROPS-WC131 were 22.00 mg/L (October 15, 2005) and 18.00 mg/L (October 14, 2005), respectively. The TSS action level of 25.00 mg/L over background (ROPS-WCT5) was not exceeded at the downstream stations (ROPS-WCT14 and ROPS-WC131) during debris and sediment removal activities.

Turbidity levels throughout the river were generally low during debris and sediment removal activities. At ROPS-WCT5 (the upstream/background station), turbidity averaged 1.6 NTU (range of 0.1 to 15.2 NTU). Turbidity at the local monitoring stations adjacent to the work area (D1, D2 and D3) was higher, averaging between 2.0 and 3.9 NTU. The highest turbidity was observed at D4 and averaged 5.7 NTU, about 3.5 times higher than that observed at ROPS-WCT5. The maximum turbidity level measured at D4 was 17.6 NTU (August 26, 2005). Turbidity levels measured at ROPS-WCT14 and ROPS-WC131 were similar and about 1.7 times lower than those observed at D4 (averaging 3.5 and 3.3 NTU, respectively). Maximum turbidity levels of 16.0 NTU and 20.1 NTU were observed at ROPS-WCT14 and ROPS-WC131, respectively, on October 15,

2005. The turbidity action level of 25.0 NTU (at ROPS-WCT14 or ROPS-WC131) over background (ROPS-WCT5) was not exceeded during debris and sediment removal activities.

Supplemental Water Column Monitoring

The results of the four supplemental water column monitoring events conducted June 17, June 20, June 22, and July 7, 2005 are described below.

Samples collected on June 17 and June 20, 2005 were analyzed for both unfiltered (whole water) and filtered (dissolved) PCBs to examine the extent to which dissolved and/or particulate-associated PCBs were escaping the containment system and causing the elevated PCB measurements at D4 and the downstream transects. The filtered PCBs measured at the local monitoring stations during the June 17, 2005 survey were lowest at D2 (0.104 µg/L) and highest at D4 (2.289 µg/L), representing between 72 and 83% of the PCBs measured immediately outside of the containment system. At the downstream transects (ROPS-WCT14 and ROPS-WC131), filtered PCBs ranged from 0.528 to 0.695 µg/L, representing between 75 and 83% of the PCBs measured at these locations. These results indicated that most (72 to 83%) of the PCBs measured outside of the containment system were in the dissolved form. Filtered and unfiltered PCB concentrations measured during the June 20, 2005 survey were below the detection limit at all locations.

The June 22, 2005 survey consisted of the collection of water samples within the containment system to understand potential PCB gradients, if any, within the containment system, and provide additional data regarding the contribution of dissolved and particulate PCBs to those measured inside and outside of the containment system. Unfiltered (whole water) PCB levels measured within the containment system were higher than those measured outside of the containment system. Inside[2] the silt curtains, unfiltered PCBs ranged from 3.367 to 3.678 µg/L, of which between 49 and 59% were in dissolved form. Unfiltered PCBs measured immediately outside of the containment system ranged from 0.400 to 2.595 µg/L, and those measured at the downstream locations ranging from 0.329 to 1.021 µg/L. However, the filtered PCBs at these locations represented between 66 and 89% of the total PCBs measured outside of the containment system, indicating that the containment system was more effective at retaining particulate-associated PCBs within the work area relative to those in dissolved form. TSS levels measured inside and outside of the containment system are consistent with the PCB data; levels measured at the downstream location within the containment system (D7) were 10.80 mg/L while those measured immediately downstream (outside) of the containment system are about two times lower (5.60 mg/L).

PCB, TSS, and turbidity levels measured inside the containment system on July 7, 2005 exhibited a distinct spatial gradient: levels were highest in Work Zone 1 (closest proximity to ongoing construction activities) and lowest in Work Zone 3 (furthest from ongoing construction activities). Specifically, PCB, TSS, and turbidity levels in Work Zone 1 (at D5) were 10.102 µg/L, 41.60 mg/L and 40.7 NTU, respectively, while those in Work Zones 2 (at D6) and 3 (at D7) were about 1.4 to 2.6 times lower (5.432 µg/L, 27.20 mg/L, and 30.0 NTU, and 3.977 µg/L, 16.00 mg/L, and 18.3 NTU, respectively). Further reductions in PCB, TSS, and turbidity were observed immediately outside of the containment system (at D4); PCB, TSS and turbidity levels were about 1.5 times lower (2.537 µg/L, 10.80 mg/L, and 10.6 NTU, respectively) relative to those at D7. The observed reduction in TSS and turbidity across the containment system (i.e., between D7 and D4) is consistent with the observations from the June 22, 2005 survey.

[2] The sample collected at D6 was not included in the comparisons since the measured dissolved PCB, particulate PCB and TSS levels, as well as the relationships between parameters, were much different than those for other samples collected on this day. The reason why this sample differed from the others collected on this day is not known.

2.2.1.2 Sediment Surface Elevation and Probing Measurements and Results

Sediment surface elevation and probing measurements were conducted along the same grid used during the baseline monitoring events (i.e., 25-ft by 25-ft grid in the main channel and 25-ft by 10-ft grid in the side slope and near shore areas) throughout debris removal and dredging activities to provide real-time information regarding the amount of material removed and remaining in the targeted areas. Sediment surface elevation and probing measurements were collected along the same grid nodes consistent with the procedures used during the 2005 baseline monitoring event as described in Section 2.1.2.1.1 (i.e., elevation measurements obtained by locating the grid node and surveying the water surface elevation via RTK surveying techniques and measuring the total water depth, and probing conducted by manually advancing a pipe into the sediment).

Probing and elevation measurements were conducted over multiple events in the northern near shore area and within the main channel dredging areas (Work Zones 1 and 2) between August 3 and October 24, 2005 to progressively assess the sediment bed elevation changes resulting from dredging activities. Data obtained during each of these probing and elevation measurement events were provided real-time to the Agencies in the form of draft figures indicating measurements determined at specific grid node locations. This iterative process allowed for real-time discussions and decision-making regarding modifications to construction activities. It should be noted, however, that limitations associated with working in a river environment do not allow the ability to return to the exact same location over multiple sampling rounds thereby introducing variability in the measurements not attributed to dredging activities. Further, the vertical accuracy of the RTK survey equipment is approximately 0.2 ft in the river and the water depth measurements are collected to the nearest 0.1 ft.

The following summarizes the during-construction sediment surface elevation and probing measurement events in chronological order for the targeted debris removal and dredging areas within the northern near shore and main channel work zones. Targeted grid node locations are presented on Figure A-1. Field data obtained during the sediment surface elevation and probing activities were recorded in PDAs and distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

Northern Near Shore Area

Removal in the northern near shore area was to be conducted to a depth of 1.0 ft (i.e., removal of 1.0 ft of sediment) throughout the entire targeted area. To evaluate the depth of material removed, elevation measurements were collected at each grid node within the northern near shore removal area for calculation of the post-dredging sediment bed elevation (i.e., water surface elevation minus the total water depth). The post-dredging sediment surface elevation was then compared with the baseline sediment surface elevation (May 2005) to assess the amount of material removed at each grid node (i.e., difference in sediment surface elevations equates to the amount of material removed). Elevation measurements were conducted as summarized below.

- August 3 and 4, 2005 – The first round of during-construction measurements was collected along the 25-ft by 10-ft grid in the northern near shore area following removal to confirm that the targeted depth of removal (1.0 ft) had been achieved at each grid node. These measurements indicated that the targeted depth of removal had not been achieved at every grid node (total of 88 grid nodes in the targeted area) and, as a result, additional removal activities were conducted at 46 grid nodes identified as not having achieved the required removal depth.

- August 17-19, 2005 – Following completion of the additional excavation activities at the select grid nodes described above, elevation measurements were collected at the 46 grid nodes where removal targets were not initially met. The required depth of removal was achieved at all but one node. This final location was remedied and re-measured on August 22, 2005.

Figure A-19 presents the 2005 baseline grid node locations along with the during-construction grid node location (post-dredging), and final resulting difference in sediment surface elevation from May 2005 (baseline event) to August 2005 (post-dredging events).

As indicated above, the targeted removal depth was 1.0 ft throughout the entire northern near shore area. Considering all grid node measurements (total of 88 grid nodes in the targeted area), the average removal depth based on the sediment surface elevation measurements was 1.8 ft. As shown on Figure A-19, the maximum removal depth was 4.2 ft at node 250 and minimum removal depth was 0.6 ft at node 27. Removal was limited at node 27 as the point was located adjacent to a submerged dock. All other grid node locations achieved, at a minimum, the targeted 1.0 ft removal depth. All probing and elevation measurements for the northern near shore area are presented in Appendix F.03.

Main Channel Area (Work Zones 1 and 2)

Both sediment surface elevation and probing measurements were conducted in Work Zones 1 and 2 to evaluate the volume of material removed and the sediment depth remaining following dredging as summarized below.

- August 16, 2005 – Sediment surface elevation and probing measurements were initiated in Work Zone 1 at eight locations (selected through discussions with Sevenson) to evaluate the thickness (volume) of sediment remaining following the initial dredging passes, based on the fact that individual grid node elevation measurements indicated that the targeted elevation of sediment removal had been reached in some locations. The following eight locations were selected and identified based on Sevenson's dredging grid (Appendix F.05): WZ1-F-16, WZ1-F-10, WZ1-G-8, WZ1-H-10, WZ1-N-4, WZ1-M-8, WZ1-M-14, and WZ1-N-13. Sediment probing measurements and visual observations of cores collected at these locations indicated that measurable sediment remained.

- August 17, 2005 – Sediment surface elevation and probing measurements were conducted on a 50-ft by 50-ft grid (subset of the original 25-ft by 25-ft main channel grid) throughout Work Zone 1 to assess the thickness of sediment removed and remaining. The 50-ft by 50-ft grid included four rows of grid nodes starting with node 185, 183, 181, 179, 177, and 175 (Figure A-20). The results of this round of probing indicated measurable sediment remained throughout the majority of Work Zone 1.

- August 19, 23-25, and 29; September 1, 12, and 16, 2005 – Dredging continued in Work Zone 1 and sediment surface elevation and probing measurements were performed continuously along the 50-ft by 50-ft grid (established on August 17, 2005) to evaluate the progress of dredging in Work Zone 1 and depth of sediment removed and remaining. Sediment cores were also collected during this timeframe (Section 2.2.1.4) to assess potential relationships between the depth of material remaining and residual PCBs.

- September 22-23, 2005 – Following the September 2005 storm event that resulted in significantly increased river flows (i.e., over 10,000 cubic feet per second [cfs]), bed surface elevation and probing measurements were collected along the 50-ft by 50-ft grid (established on August 17, 2005) to evaluate river conditions as described in the scope of work entitled "Sediment Core Collection and Elevation Measurements in Work Zone 1 Following the September 2005 Storm Event" (September 21, 2005; Attachment A-2). Results of the probing did not indicate significant change in sediment surface elevation due to the high flow event.

- October 4-6, 2005 – Dredging was discontinued in Work Zone 2 due to low production in Work Zone 1, and per ECN 026, final sediment surface elevation measurements were obtained along the 25-ft by 25-ft grid (25-ft by 10-ft grid in the side slope area) within Work Zone 2 to evaluate conditions following

dredging and prior to cap placement. The sediment surface elevations obtained from this event were used to determine the cap material thickness placed (Section 2.2.3.2).

- October 17, 2005 – Additional sediment surface elevation measurements were collected at and around the grid nodes targeted for removal via mechanical excavation (i.e., 179, 183, 381, and 418; Figure A-20) to develop additional bathymetry for these areas. Elevations were determined at the four grid nodes surrounding the targeted grid node (e.g., 160, 178, 180, and 199 for grid node 179) and at an additional four locations approximately 10 to 15 ft away from the targeted grid node.

- October 22-24, 2005 – The final post-dredging sediment surface elevation measurement event was conducted in Work Zone 1 per ECN 029. Measurements were collected along the 25-ft by 25-ft grid (25-ft by 10-ft in side slope area) to document conditions following completion of dredging activities and prior to cap placement. The elevations obtained from this event were used to determine the cap material thickness placed (Section 2.2.3.2).

Figures A-20 and A-21 present the 2005 baseline grid node locations within Work Zones 1 and 2, respectively along with the during-construction grid node locations (post-dredging), and final resulting difference in sediment surface elevation from May 2005 (baseline event) to October 2005 (post-dredging events).

The intent was to remove all PCB-containing sediment to the extent possible in Work Zone 1 (Alcoa, February 2005). Despite extensive dredging efforts in Work Zone 1, sediment still remained. Considering all grid node measurements in Work Zone 1 (total of 325 grid nodes in the targeted area), the average thickness of removal based on the sediment measurements was 3.2 ft. The maximum thickness of removal was 7.4 ft at node 473.

In addition, per ECN 028, dredging in Work Zone 2 was discontinued prior to completion of the work planned in this area based on the recognition that it could not be completed in the available remaining construction season. As a result, considering all grid node measurements in Work Zone 2 (total of 195 grid nodes in the targeted area), the average thickness of removal based on the elevation measurements is 0.8 ft. The maximum thickness of removal was 4.4 ft at node 695.

Measurements for some nodes within Work Zones 1 and 2 indicate that sediment surface elevations increased following dredging as opposed to decreased (i.e., negative values on Figure A-20 and A-21). The majority of these nodes are located along the side slope areas with a few nodes in the main channel. As discussed above, there are limitations associated with working in a river environment (i.e., variable bottom conditions, inability to return to the exact same location especially considering the steepness of the side slope area, and vertical accuracy of the RTK survey equipment and water depth measurements) that may affect these values. In addition, there may have been sloughing of material during side slope removal and baseline probing at some nodes in the main channel indicated a thin layer of sediments underlain by rock. All probing and elevation measurements for Work Zones 1 and 2 are presented in Appendix B.

2.2.1.3 OSI Surveys

OSI conducted several remote sensing surveys to obtain site-specific information pertaining to hydrodynamic, bathymetric, and geophysical conditions in the ROPS work areas. Specifically, one velocity study, three multibeam bathymetry surveys and one sub-bottom profiling investigation were performed during and immediately after debris and sediment removal activities. Descriptions of each survey are presented in Section 2.2.1.3.1, while results of these surveys are discussed in Section 2.2.1.3.2.

2.2.1.3.1 Monitoring Activities

Velocity Study

OSI conducted a velocity study in the river to help understand circulation patterns through and around the silt curtain containment system. The study was performed from July 21-24, 2005 and consisted of five "mappings" or discrete surveys of the work area. Each mapping consisted of two components: 1) a boat-mounted 1,200 kHz acoustic doppler current profiler (ADCP) that measured current velocities along 10 transects situated around the silt curtain containment system; and 2) two acoustic doppler velocimeters (ADVs) that measured current velocities at fixed locations adjacent to the containment system. The ADCP measured current velocities (magnitude and direction) in 0.4-meter bins (vertically) at locations spaced approximately every 10 ft along each of the 10 study transects (two located upstream of the silt curtains, four in the bypass channel, and three downstream of the silt curtains; Figure A-22). The ADVs obtained measured current velocities (magnitude and direction) in 10-minute average intervals approximately mid-depth between the bottom of the silt curtain system and the river bed (approximately one ft above the sediment bed) at various locations around the containment system. One ADV was deployed at D4 for the duration of the study (i.e., all five mappings). The second ADV was used as a roaming unit, and was deployed at different stations during the mappings #3-#5 (i.e., D3 during mapping #3, D2 during mapping #4, and D1 during mapping #5; Figure A-22); data were not obtained from the roaming ADVs in mappings #1 and #2 due to operational difficulties. Stage height data recorded in the lower Grasse River at the Outfall 001, approximately 300 ft upstream of the containment system, and information pertaining to releases from the Snell Lock on the St. Lawrence Seaway were used to facilitate the evaluation of the velocity data.

A total of 1,365 velocity measurements (818 from the ADCP and 547 from the ADVs) were collected during the study. These data are included in electronic form in Appendix P. Various figures developed during the analysis of these data, but not presented in the main body of this report, are also included in Appendix P.

Bathymetry Surveys

OSI conducted three multibeam bathymetry surveys at various stages of the debris and sediment removal activities to obtain estimates of sediment removal volumes from the ROPS area; one each on September 12-13, September 30, and October 22, 2005. The two September surveys were conducted throughout Work Zones 1 and 2 during debris and sediment removal activities. The September 12-13, 2005 survey also included the collection of elevation information from the armored cap area (Section 2.3.3). The October survey was performed after dredging activities were completed, and focused solely on the expanded Work Zone 1 area and the upstream portion of Work Zone 2; it did not extend through the entire Work Zone 2 area since dredging was not conducted in the downstream portion of the work zone subsequent to the September 30, 2005 survey.

During each survey, water depth measurements were obtained using a Reson Seabat Multibeam echo sounder, which provided high resolution depth measurements at a density of one measurement every one square ft of river bottom, resulting in over 320,000 and 238,000 measurements within Work Zones 1 and 2 during the September and October surveys, respectively. Survey vessel navigation, trackline control, and position fixing were accomplished using a Trimble 7400 OTF RTK DGPS interfaced with OSI's PC-based hydrographic software package "MareTrack II". Data collected during these surveys are provided in Appendix O and discussed in Section 2.2.1.3.2.

Sub-Bottom Profiling Survey

In conjunction with the October 22, 2005 multibeam bathymetry survey, OSI attempted to obtain sub-bottom characterization information of the dredge area to better understand river bottom conditions within Work Zone

1. Efforts to map the sub-surface stratigraphy of river sediments were previously attempted in 2003 as part of the ice jam investigation (Alcoa, April 2004). Both electromagnetic (ground penetrating radar [GPR]) and acoustic (Odom and CHIRP) technologies were tested during these efforts. None of the methods tested were deemed effective; variable sub-surface conditions, the presence of gas in the near-surface sediments and the presence of coarse, compact glacial till sediments were all cited as potential causes for the inability of these technologies to obtain usable information regarding the sub-surface stratigraphy of the river sediments (Alcoa, April 2004). However, some of the factors that contributed to the difficulty in characterizing the sub-bottom conditions in 2003 were potentially minimized and/or eliminated during the sediment removal activities (i.e., considerable amounts of coarser sediments and any associated gas in those sediments had been removed from the river). For this reason, a sub-bottom profiling survey was conducted following dredging activities in an attempt to obtain useful information pertaining to river bottom conditions within the work zone.

For this survey, a Odom Echotrac DF3200 MKIII dual frequency (acoustic) depth sounder was used to obtain sounding information along several transects situated parallel to the river flow throughout the work areas (Figure A-23). Electromagnetic techniques (i.e., GPR) were deemed unsuitable due to the deeper water depths within the work zone and, thus, were not employed during this survey. The dual frequency depth sounder collects sub-surface information through the use of two signals: a high frequency signal (200 kiloHertz [kHz]) that reflects off the sediment surface (identifies water depth); and a low frequency signal (24 kHz) that penetrates into the sediments and bounces off internal sediment reflectors (providing sub-surface stratigraphic information).

2.2.1.3.2 Summary of Results

Velocity Study

Data collected during the velocity study were used along with the 2003 multibeam bathymetry data to estimate river flow at each of the velocity study transects (Figures A-24 and A-25). The flow balances indicate that, for four of the five mappings, flows entering the study area from upstream (Line 1) ranged from about 400 to 520 cfs. These values compare well with those measured at the United States Geological Survey (USGS) gage at Chase Mills (432 to 560 cfs for July 21-24, 2005). A flow of about 750 cfs was estimated from the Mapping #2 data; this flow is much higher than those measured during the other four mappings and likely reflects influences from a pressure wave moving through the work area during the mapping period. Flow balances for each survey show that roughly 60 to 80% of the flow entering from upstream travels through the bypass channel, with the remaining 20 to 40% flowing through the work area. Some flow exchange between the work area and bypass channel was observed. However, considering the uncertainty associated with these flow estimates (+/- 25% on average, based on evaluation of individual measurements collected along each transect) and the apparent affects of pressure waves, this exchange represents a relatively small proportion of the total flow traveling through the containment system (i.e., work through flow). Most of the work-through flow exited the containment system from Work Zone 3.

Vertically-averaged velocities measured at the sampling locations along each transect are presented as vector diagrams in Figures A-26 and A-27. The vector diagrams are useful tools for assessing velocity information since they provide information pertaining to both the magnitude and direction of the measured current velocity field. These figures indicate an increase in velocity as water travels through the bypass channel; this is expected given the constricted nature of the bypass channel while the containment system is in place. As water exits the bypass channel, velocities decline due to the increased cross-sectional area, but also exhibit a complex circulation pattern that forms at the downstream side of the containment system. In general, water movement follows the contour of the river bottom and becomes focused along the middle and northern side of the channel (Lines 7, 8 and 9). However, eddy and back-currents are also observed along the northern portion of Line 7 and,

in some instances, at Line 10 (immediately outside of the downstream portion of the containment system at monitoring location D4), where erratic, bi-directional flow was observed for most of the survey period (Figure A-28). The effects of pressure waves on velocities in the river is most pronounced at the downstream transects (Lines 8 and 9), where lower velocities are consistently observed. The reduced velocities in this area are the result of the pressure waves; the upstream movement of water reduces the overall downstream transport at these locations.

Influences from the pressure waves on current velocities complicate the interpretation of the velocity study data. In some instances, the movement of water upstream with the pressure wave reduces the normal downstream current velocities (more so at the transects located further downstream), while in other instances the pressure waves may cause higher downstream velocities due to the return of the wave downstream after reflecting off of upstream obstructions. Timing issues further complicate the evaluation of these data, since pressure waves generally affect the ROPS area for a period of 30 minutes or so, whereas each mapping of velocity measurements required about 1.5 to 3 hours to complete. Because of this, velocity measurements collected at some transects were affected by a pressure wave moving upstream, while measurements at other transects during the same mapping were affected by the return of the pressure wave downstream. Comparison of velocity measurements at D4 to estimated times of water releases from the Snell Lock suggest that the effects of pressure waves were likely prevalent in four of the five mappings; Mapping #4 appears to be least influenced by pressure waves since no releases from the Snell Lock were identified during the conduct of this mapping (Figure A-29). This is supported by the relatively good flow balance achieved during this mapping. Therefore, of the five mappings, Mapping #4 is considered the most representative of water movement in and around the work area under normal flow conditions.

Bathymetry Surveys

Sediment surface elevations measured in Work Zones 1 and 2 during the September 12-13, 2005 survey are presented in Figure A-30. The map of the river bottom developed from these sediment surface elevation measurements indicates an irregular bottom topography containing boulder/rock outcrops in some portions of Work Zone 1, features not evident in the pre-dredging survey (i.e., the 2003 multibeam survey; Figure A-7). These topographic features likely explain some of the difficulties experienced in removing target sediments from areas of the work zones.

Changes in sediment surface elevation between the pre-ROPS (2003) and September 12-13, 2005 surveys indicate that 2 to 4 ft of sediment and debris were removed from most of Work Zone 1; less material was removed from Work Zone 2 during this period (Figure A-31). Based on these changes in sediment surface elevation, it was estimated that approximately 16,700 cubic yards (cy) and 2,800 cy of material was removed from Work Zones 1 and 2, respectively, through September 12-13, 2005.

The river bottom topography mapped on September 30, 2005 is presented in Figure A-32. Sediment surface elevation differences between these and the survey results from September 12-13, 2005 illustrate the progress made in removing sediments during this approximate 17-day period (Figure A-33). The most notable observations from the September 30, 2005 survey are the upstream-to-downstream striations in the river bottom left by the dredge head and the volume of material removed from the expanded Work Zone 1 area. Limited activity occurred within Work Zone 2 during this period. Comparison of the sediment surface elevations measured on September 30, 2005 to those from September 12-13, 2005 indicates that approximately 2,600 cy and 1,000 cy of sediment were removed from Work Zones 1 and 2, respectively, between these surveys.

The river bottom topography mapped on October 22, 2005, after all dredging activities were completed, is presented in Figure A-34. The most notable observations from the October 22, 2005 survey are the arched dredge cuts made by the cutterhead dredge that are evident in the middle-to-northern portion of Work Zone 1

and at the downstream portion of the expanded Work Zone 1 area. Comparison of the sediment surface elevations measured on October 22, 2005 to those from September 30, 2005 indicates that approximately 1,300 cy of sediment were removed from Work Zones 1 and 2 between these surveys (Figure A-35). Overall, the October 22, 2005 results indicate a total of 20,600 cy and 3,800 cy of sediment and debris were removed from Work Zones 1 and 2, respectively, during the ROPS.

Sub-Bottom Profiling Survey

The dual frequency depth sounding equipment received reflections from the high frequency (200 kHz) signal that provided information pertaining to the depths/elevations of the sediment surface at each of the surveyed transects. However, the low frequency (24 kHz) signal was unable to penetrate into the sediments and, thus, this technology was not able to provide any useful information pertaining to the sub-bottom conditions within the work area.

2.2.1.4 Sediment Sampling

2.2.1.4.1 Monitoring Activities

Multiple rounds of sediment sampling were conducted during construction in both the northern near shore and main channel dredge areas. Sediment coring was conducted to evaluate river bottom conditions as removal activities progressed during the ROPS. All sediment samples were collected via coring using manual or vibracoring collection techniques. Note that per DCF 012 a standard ponar dredge was available for use if necessary. All sediment cores collected as part of the during-construction monitoring program from the northern near shore and main channel work zones are presented on Figure A-36 through A-38. Each core collection event is summarized below.

Northern Near Shore Area

Eight locations were sampled in the northern near shore area on two occasions. On August 3 and 4, 2005, eight samples were collected within the northern near shore area, as it was initially believed that dredging activities were complete in this area. However, as indicated in Section 2.2.1.2, additional dredging was required in select areas as the required 1.0 ft removal depth was not achieved at 46 grid node locations. Therefore, an additional round of eight samples was collected on August 19, 2005 following sediment bed elevation measurements that confirmed completion of dredging activities at all but one grid node location. The location of the northern near shore sediment samples are presented on Figure A-36.

The northern near shore sediment samples were collected using manual collection techniques in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005). The horizontal location and water surface elevation of each sample was determined and recorded using RTK survey techniques. Sediment cores were collected using 3-in diameter Lexan tubing with a check valve push core apparatus. Cores were manually advanced into the sediment approximately 1.0 ft as the desired sample was to be representative of the upper 3 in of the sediment column. At each sample location, total water depth and sediment probed were recorded. The top 3 in of each core were homogenized in disposable aluminum pans and the sediments were placed into sampling jars for analysis. Photographs of each sample were obtained (included in Appendix N), and physical characteristics including general soil type (sand, silt, clay, and organic matter/other matter) as determined using the Unified Soil Classification System (USCS), and the approximate grain size category (fine, medium, coarse) were observed and recorded on Form 3A (Appendix H). Samples were handled, packaged, and shipped according to the protocol provided in Attachment VI of the Operations Plan (Sevenson, May 2005).

Samples were submitted to NEA for PCB (Aroclor), TOC, bulk density, and percent moisture analyses. Samples were submitted to CDM Soils Laboratory for grain size analysis with results on a standard TAT.

Main Channel Area (Work Zones 1 and 2)

Sediment sampling was conducted in Work Zones 1 and 2 using manual and vibracoring collection techniques. Per Attachment VI of the Operations Plan (Sevenson, May 2005), sediment sampling was to be conducted following completion of production dredging and cleanup passes; however, additional sediment sampling was conducted throughout the project to evaluate dredging effectiveness and river bottom conditions. These additional sampling events were typically documented in ECNs (Appendix G), individual sampling scope of work documents (Attachment A-2), and/or discussed during the ROPS weekly status meeting (and ultimately documented in the meeting minutes). All sampling events were approved by USEPA or their on-site representative prior to initiation. The ROPS during-construction sediment core collection events are summarized below in chronological order.

- August 16, 2005 – Eight sediment cores were collected in Work Zone 1 using manual collection techniques from the same locations where sediment surface elevation and probing measurements were collected in Work Zone 1 (Section 2.2.1.2). These eight locations were selected and identified based on Sevenson's dredging grid and included WZ1-F-16, WZ1-F-10, WZ1-G-8, WZ1-H-10, WZ1-N-4, WZ1-M-8, WZ1-M-14, and WZ1-N-13. Cores were visually observed for the type and amount of sediment present. This sampling event was discussed in the August 16, 2005 weekly meeting.

- August 24-25, 2005 – Per the scope of work entitled "Sediment Core Collection in the Main Channel Within Work Zone 1" (dated August 24, 2005; Attachment A-2), a total of 10 sediment cores were collected manually at grid nodes 217, 261, 263, 298, 302, 335, 377, 381, 418, and 452 within Work Zone 1. Cores were collected to understand post-dredging conditions in areas exhibiting an increase, decrease, and no change in sediment depth between the August 17 and 19, 2005 sediment surface elevation measurement events, and to provide coverage of the work zone.

- August 30, 2005 – Per the scope of work entitled "Sediment Core Collection via Vibracoring in the Main Channel" (dated August 29, 2005; Attachment A-2), a total of 12 sediment cores were collected via vibracoring, with six cores collected from each of Work Zones 1 and 2. This sampling program was initiated when it became apparent that PCB-containing sediments remained after initial dredging efforts. Cores were collected at grid nodes 179, 257, 343, 351, 418, 492, 571, 635, 640, 735, 820, and 847 (Figures A-37 and A-38) to investigate physical and chemical characteristics of the sediment column at a variety of in-river conditions and obtain representative areal coverage throughout the work zones, including locations where:

    - The current top of sediment surface elevation was at or below the pre-dredging predicted sediment bottom;
    - Several feet of sediment were removed during initial dredging, and efforts beyond this resulted in little to no change in sediment surface elevation;
    - The area was representative of dredging in the vicinity of the main silt curtain and within the side slopes;
    - Several feet of sediment were removed during initial production dredging efforts, and additional efforts indicated removal of additional sediment;
    - Less than 1.0 ft of sediment removed during initial production dredging efforts, efforts beyond this resulted in no change in the sediment surface elevation;
    - Areas of sediment at lower elevations may not yet have been impacted by the ROPS dredging removal efforts (allow for observation of undisturbed sediment above native material); and

- Debris removal efforts indicated the presence of large boulders and firm to stiff clay.

Results obtained from this sampling event were correlated by depth within the sediment column to post-dredge/current conditions in the river.

- September 12-13, 2005 – A total of 12 sediment cores were collected via vibracoring in Work Zone 1 per the scope of work entitled "Sediment Core Collection via Vibracoring in the Main Channel" (dated September 12, 2005; Attachment A-2). Cores were collected at nodes 175, 183, 193, 225, 273, 294, 339, 375, 422, 496, 544, and 548 (Figure A-37) to further investigate physical and chemical characteristics of the sediment column after multiple dredging passes and correlate elevation within the sediment column to post-dredging/current conditions in the river. This program supplemented the cores collected in Work Zone 1 as part of the August 30, 2005 collection effort.

- September 22, 2005 – A total of 10 sediment cores were collected using manual techniques following the September 2005 storm event to evaluate river conditions in Work Zone 1. Sediment cores were collected as described in the scope of work entitled "Sediment Core Collection and Elevation Measurements in Work Zone 1 Following the September 2005 Storm Event" (September 21, 2005; Attachment A-2). Sediment cores were collected at grid nodes 175, 183, 225, 257, 273, 339, 375, 422, 496, and 566. An eleventh location (grid node 452) was targeted for collection, however, field crews were unable to recover sediments from this location (Figure A-37). This program targeted several locations sampled during the September 12-13, 2005 event for purposes of comparison.

- September 30, 2005 – Per ECN 026 (Appendix G), sediment cores were collected from a total of 13 locations within Work Zone 2 via vibracoring to understand PCB concentrations prior to cap placement. The cores were collected at grid nodes 602, 606, 610, 674, 678, 682, 708, 746, 750, 754, 779, 816, and 853 (Figure A-38). No additional dredging was performed in Work Zone 2 after these cores were collected.

- October 10-12, 2005 – As outlined in ECN 031 (Appendix G), a total of 15 sediment cores were collected from Work Zone 1 via vibracoring to investigate the physical and chemical characteristics of the sediment column prior to and after dredging with the swinging ladder cutterhead dredge (the final removal equipment used during the ROPS). Cores were collected at grid nodes 175, 217, 225, 257, 273, 298, 343, 351, 377, 422, 492, 561, 564, 568, and 572 (Figure A-37). An additional four sediment cores (not included in ECN 031) were collected at nodes 179, 183, 381, and 418 after the completion of mechanical removal activities in these areas.

- October 22, 2005 – This event included the collection of 28 cores and served as the final during-construction sediment sampling event after dredging was completed and prior to cap placement in Work Zone 1. This event was conducted as described in ECNs 029 and 031 (Appendix G). Per ECN 029, a total of 25 sediment cores were collected from Work Zone 1 via vibracoring to determine PCB levels and the extent of PCB-impacted materials, and to assess the relationship between local conditions and post-dredging PCB residual concentrations. Cores were collected along the existing 25-ft by 25-ft grid at nodes 175, 177, 181, 185, 257, 261, 265, 273, 331, 335, 339, 343, 381, 412, 414, 418, 422, 488, 490, 494, 498, 561, 564, 568, and 572 (Figure A-37). In addition, cores were also collected at nodes 298, 351, and 377 (Figure A-37) in accordance with ECN 031, which specified that the cores be included as part of that ECN would be collected again after cutterhead dredging was completed (the other 11 cores specified for collection in ECN 031 were also duplicatively included for collection as part of ECN 029).

Sediment samples were collected in accordance with protocols contained in Attachment VI of the Operations Plan (Sevenson, May 2005). The location of each sample and the water surface elevation was determined and

recorded using RTK survey techniques. At each sample location, water surface elevation, total water depth, and sediment depth probed were recorded. Sediment cores collected using manual techniques were obtained using 3-in diameter Lexan tubing with a with a check valve push core apparatus. Sediment cores collected via vibracoring were obtained using a specially designed boat equipped with vibracoring equipment and aluminum tubing. Cores were advanced until refusal using either manual or vibracoring techniques.

Upon collection, each core was split, photographed, and physical characteristics including general soil type (sand, silt, clay, and organic matter/other matter) as determined using the USCS and the approximate grain size category (fine, medium, coarse), were observed and recorded in field books. Core photographs are provided in Appendix N. Cores were segmented at 0 to 3 in, 3 to 6 in, 6 to 12 in, and every 6 in thereafter. Flexibility was allowed during core segmentation for altering the sampling intervals to conform with stratigraphic boundaries if such boundaries were visible. Samples were handled, packaged, and shipped according to the protocol provided in Attachment VI of the Operations Plan (Sevenson, May 2005).

Samples were submitted to NEA for PCB (Aroclor), TOC, bulk density, and percent moisture analyses. Samples were submitted to CDM Soils Laboratory for grain size analysis. PCB (Aroclor) sample results necessary for decision making were requested on a 48-hour TAT and other results were requested on a standard TAT. Results were distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

Comparisons of sediment recoveries and probing depths at each of the sampling locations indicated that the sediments recovered during the manual coring efforts did not always represent the full depth of sediment in the work area (i.e., the manual cores did not penetrate and retrieve sediments from the full sediment column). For this reason, and to better understand the depth of sediments remaining in the work area, vibracoring techniques were used in place of manual coring after the August 24-25, 2005 sediment sampling survey. The one exception to this was the manual coring survey conducted on September 22. Manual cores were collected during this survey given that the purpose of this sampling event was to visually characterize surface sediments within the work area.

2.2.1.4.2 Summary of Results

As discussed in Section 2.2.1.4.1, several sediment sampling events were conducted in the northern near shore and throughout the work area during ROPS construction activities. The results of the sampling efforts are summarized for each survey in the sub-sections below. A complete data package consisting of photographs of the sediment cores post-collection/pre-processing, analytical results for the sediment samples, and vertical distributions of physical and chemical parameters measured in each of the sediment cores is provided in Appendix N.

Northern Near Shore Area

Sediment samples collected on August 3-4, 2005 contained an average surface PCB concentration of 2.2 ppm (range of non-detect to 18.4 ppm). TOC, percent solids, and bulk density in the surface sediments averaged 1.1%, 64% and 0.93 g/cm^3, respectively. Surface sediments in the northern near shore area after dredging was complete (August 19, 2005) contained an average surface PCB concentration of 1.9 ppm (range of 0.18 to 6.85 ppm). TOC, percent solids, and bulk density in the surface sediments averaged 1.8%, 68% and 1.04 grams per cubic centimeter (g/cm^3), respectively.

Main Channel Area (Work Zone 1) Manual Cores: August 16, 2005

The eight cores collected during this survey were used for the visual observation of remaining sediments within Work Zone 1 and, thus, were not processed and submitted to the laboratory for physical and chemical testing. The remaining sediment thickness observed clearly indicated the need for further debris and sediment removal.

Main Channel Area (Work Zone 1) Manual Cores: August 24-25, 2005

Results of the manual core survey indicated distinct spatial differences in terms of sediment recoveries and physical and chemical properties in sediments collected from the northern half of the Work Zone 1 relative to those collected from the southern half of the Work Zone 1. Cores collected from the northern half of the work zone (Cores 217, 298, 335, 377 and 452; Figure A-37) contained between 6 and 15 in of sediment and had depth-averaged PCB concentrations of 35 to 55 ppm (one exception is Core 377 which contained 220 ppm PCB). Depth-averaged TOC levels and percent solids in these cores averaged 1.2% (range of 0.5 to 2.5%) and 75% (range of 62 to 84%), respectively. Cores collected from the southern half of the work zone (Cores 261, 263, 302, 381 and 418; Figure A-37) contained thicker sediments (18 to 28 in) with higher depth-averaged PCB concentrations (80 to 680 ppm). Depth-averaged TOC levels and percent solids in these cores averaged 2.6% (range of 1.0 to 5.4%) and 64% (range of 56 to 74%), respectively.

Main Channel Area (Work Zones 1 and 2) Vibracores: August 30, 2005

Vibracores collected from Work Zone 1 (Cores 179, 343, 351, 418 and 492; Figure A-37) contained between 18 and 30 in (average of 23 in) of sediment, except for Core 257, which contained substantially more sediment (68 in). Overall, between 6 and 24 in (average of 15 in) of the recovered sediments contained PCB concentrations in excess of 1 ppm. Review of the photographs (Appendix N) for these cores indicated a distinct visual change in sediment type that correlated well with the measured change in PCB concentration PCB-containing sediments generally were darker in color and less dense relative to the lighter colored, denser, relatively uncontaminated material that was observed below the contaminated sediments. This stratigraphic change was coincident with changes in PCB concentration as well as physical properties (i.e., bulk density, TOC and percent solids), suggesting that vibracoring had fully penetrated through the contaminated sediment column and into the native river sediments (Figure A-39). Overall, depth-averaged PCB levels in the contaminated layer of these sediments ranged from 65 to 750 ppm (average of 281 ppm), with a maximum PCB concentration of 1,870 ppm (Core 418). TOC, percent solids and bulk density in the contaminated layer were variable throughout the work zone, ranging from 0.2 to 14.0%, 34 to 92%, and 0.35 to 1.30 g/cm^3, respectively.

Cores collected from Work Zone 2 (Cores 571[3], 635, 640, 735, 820 and 847; Figure A-38) were generally thicker and contained higher PCB concentrations relative to those collected from Work Zone 1. This was expected given that much of the dredging activity conducted prior to sampling occurred in Work Zone 1. Overall, between 23 and 67 in (average of 39 in) of sediment were recovered from the Work Zone 2 cores, of which 9 to 47 in (average of 32 in) contained PCB concentrations in excess of 1 ppm. Most of the cores exhibited a similar stratigraphic change denoting the interface between PCB-containing and relatively clean sediments as described above. Overall, depth-averaged PCB levels in the contaminated layer of these sediments ranged from 37 to 489 ppm (average of 269 ppm), with a maximum PCB concentration of 2,200 ppm (Core 571). TOC, percent solids and bulk density in the contaminated layer were variable throughout the work zone, ranging from 0.1 to 6.0%, 27 to 90%, and 0.19 to 1.40 g/cm^3, respectively.

[3] Core 571 actually resides in what is called the "expanded Work Zone 1 area." This "expanded Work Zone 1 area" was created subsequent to the August 30, 2005 sediment sampling event. Since Core 571 was situated in Work Zone 2 at the time of sampling, it is included in the discussion of the Work Zone 2 cores.

Main Channel Area (Work Zone 1) Vibracores: September 12-13, 2005

Vibracores collected in Work Zone 1 during this survey contained between 14 and 55 in (average of 35 in) of sediment, of which 5 to 30 in (average of 19 in) contained PCB concentrations in excess of 1 ppm. Overall, depth-averaged PCB levels in the contaminated layer of these sediments ranged from 14 to 389 ppm (average of 119 ppm), with a maximum PCB concentration of 763 ppm (Core 544). TOC, percent solids and bulk density in the contaminated layer were variable throughout the work zone, ranging from 0.2 to 6.8%, 30 to 91%, and 0.32 to 1.70 g/cm^3, respectively.

Main Channel Area (Work Zone 1) Manual Cores: September 22, 2005

The 11 cores collected during this survey were used for the visual characterization of surface sediments within the expanded Work Zone 1; cores were not processed or submitted to the laboratory for physical and chemical testing. Surface sediments were generally loose, dark grey/brown materials composed of fine sands and silts. These observations were similar to those made during previous surveys.

Main Channel Area (Work Zone 2) Vibracores: September 30, 2005

Vibracores collected in Work Zone 2 during this survey generally contained between 15 and 54 in (average of 34 in) of sediment, except for Core 708 which contained 84 in of sediment (Figure A-38). The thicker sediment deposits were expected given that dredging activity conducted within Work Zone 2 prior to September 30 was limited. The depth of PCB-containing sediments (i.e., those with PCB concentrations greater than 1 ppm) ranged from 10 to 70 in. However, unlike the earlier sampling events, only 3 of the 13 cores penetrated into relatively uncontaminated native sediments. Overall, depth-averaged PCB levels in the contaminated layer of these sediments ranged from 43 to 484 ppm (average of 291 ppm), with a maximum PCB concentration of 2,380 ppm (Core 779). TOC, percent solids, and bulk density in the contaminated layer were variable throughout the work zone, ranging from 0.2 to 6.7%, 34 to 91%, and 0.31 to 1.90 g/cm^3, respectively.

Main Channel Area (Work Zone 1) Vibracores: October 10-12, 2005

Vibracores collected in Work Zone 1 during this survey contained between 13 and 50 in (average of 31 in) of sediment, of which 6 to 35 in (average of 18 in) contained PCB concentrations in excess of 1 ppm. Overall, depth-averaged PCB levels in the contaminated layer of these sediments ranged from 5 to 225 ppm (average of 78 ppm), with a maximum PCB concentration of 510 ppm (Core 572). TOC, percent solids, and bulk density in the contaminated layer were variable throughout the work zone, ranging from 0.1 to 23.0%, 18 to 95%, and 0.16 to 1.70 g/cm^3, respectively.

Main Channel Area (Work Zone 1) Vibracores: October 22, 2005 (Post-Dredging/Pre-Capping)

Vibracores collected in Work Zone 1 during this survey contained between 8 and 66 in (average of 35 in) of sediment, of which 3 to 32 in (average of 17 in) contained PCB concentrations in excess of 1 ppm. Overall, surface sediment PCB concentrations varied over two orders of magnitude, ranging from 1.3 to 598 ppm, and averaging 150 ppm. Depth-averaged PCB levels in the contaminated layer of these sediments ranged from 1.3 to 314 ppm (average of 79 ppm), with a maximum PCB concentration of 1,160 ppm (Core 572). TOC, percent solids and bulk density in the contaminated layer were variable throughout the work zone, ranging from 0.1 to 17.0%, 20 to 94%, and 0.21 to 1.80 g/cm^3, respectively.

2.2.1.5 Air Monitoring

2.2.1.5.1 Monitoring Activities

Air monitoring was conducted during intrusive construction activities, including sediment removal operations, contaminated sediment dewatering and loadout, shaker screen and press operation, and landfill operations. The during-construction air monitoring program included two components: CHASP air monitoring as outlined in the CHASP (Alcoa, April 2005a) and Attachment VI of the Operations Plan (Sevenson, May 2005); and air monitoring associated with the operation of the SLF Cell 3 as described in ECN 014 and the SLF Cell 3 Air Monitoring Plan (Alcoa, June 2005). All components of the during-construction air monitoring program are interrelated, as the program originally developed in the CHASP included elements of air monitoring directly relevant to operation of the SLF. However, the SLF Cell 3 Air Monitoring Plan (Alcoa, June 2005) was developed at the request of the Agencies to outline air monitoring activities to be conducted specific to the SLF, including the addition of sampling station SLF located northeast of the landfill.

Table A-10 presents a summary of the daily air monitoring sampling activities and locations monitored during all intrusive construction work activities. All field sampling information for the CHASP and SLF air monitoring activities was documented on Forms 2A, 2B, and 2C (Appendix H), and in bound field books. All samples were submitted to Con-Test for analysis on a requested 48-hour TAT.

CHASP Air Monitoring Activities

The CHASP air monitoring program conducted during intrusive activities included continuous air monitoring at six air monitoring stations (Figure A-15). The continuous air monitoring program included the components listed below.

- Daily monitoring using RTMM for PM_{10} was conducted during intrusive activities.

  Monitoring for PM_{10} was initiated on June 6, 2005 at the six locations using the DustTrak meters consistent with the baseline monitoring event. Monitoring was initiated on the morning of June 6, 2005 given that dredging activities were anticipated to start that day. However, commencement of actual dredging was delayed until June 14, 2005. The time period between June 6 and 13, 2005 served as the dredging system shake-out period. DustTrak data collection was maintained until dredging began, and continued daily through October 26, 2005 at the six CHASP air monitoring stations during all intrusive activities. On occasions when high volume samples (described below) were not collected, meters were allowed to run into the weekend (even if intrusive activities were not occurring) through the use of the external batteries to power the DustTrak meters. As a result, in some instances data were collected throughout some portion of the weekend. Meters were downloaded at a minimum of once per day (additional downloads were made as a result of community concerns). Data were distributed electronically for inclusion on Form 8C (Appendix H) as described in Section 2 of the main body of this ROPS Documentation Report.

- High volume samples were collected at all six air monitoring stations for PCB analysis, consistent with the baseline monitoring event.

  Daily high volume sampling was initiated on June 14, 2005 concurrent with the start of dredging and continued for two weeks through June 28, 2005. High volume samples were set at all six air monitoring stations (Figure A-15), and samples from the three closest downwind monitoring stations (based on the typical prevailing wind direction) submitted to Con-Test for PCB analysis on a 48-hour TAT. The downwind monitoring stations were determined through observation of meteorological conditions and

data obtained from the National Weather Service weather station at the Massena International Airport – Richards Field (Station ID: KMSS) consistent with the baseline monitoring event. The data obtained from the weather station were supplemented with "on-the-ground" daily observations and through the use of a windsock located near the sediment processing area and Outfall 001 staging area. Following this two week sampling period and based on PCB analytical results, high volume sampling was reduced to once weekly starting July 5, 2005 with the sample from the closest downwind station submitted for analysis.

- Daily monitoring using RTMM for VOCs was conducted in association with worker safety.

  Daily monitoring occurred at the dredge and shaker screen, and weekly sampling was also conducted as described in Section 2 of the main body of this ROPS Documentation Report. Results obtained during this air monitoring did not indicate the need to modify the program (i.e., results indicated that VOCs were not a concern during the ROPS).

In addition to the PCB portion of the CHASP air monitoring program, high volume samples were collected during two events for analysis of PAHs, PM_{10}, and VOCs at all six air monitoring stations. Collection was performed consistent with the baseline event (described in Section 2.1.2.3.1). Events were conducted during the initial days of dredging in the top 2.0 ft of sediments (conducted June 22-23, 2005) and during the initial days of dredging at depths below the top 2.0 ft of sediments (conducted July 14-15, 2005). During the July 14-15, 2005 sampling event, four of the six laboratory-supplied VOC summa canisters malfunctioned due to problems with the regulators (i.e., canisters sent by laboratory with defective regulators that were not discovered until canisters were sent back to the laboratory for analysis). Per discussions with USEPA and New York State Department of Health (NYSDOH), the VOC monitoring portion of this event (including concurrent monitoring using both the MiniRAE PID and summa canisters) was conducted again on July 26-27, 2005.

SLF Cell 3 Operational Air Monitoring Activities

As part of the SLF Cell 3 air monitoring activities (ECN 014), potential changes in ambient air due to SLF activities were monitored at two primary locations, including a new high volume sampling location established between the SLF and local residences (Location SLF; Figure A-15) and Location #3 from the CHASP monitoring activities. These locations were selected to provide sampling coverage upwind and downwind of SLF Cell 3 considering the west/southwest prevailing wind direction and residences located in proximity to the SLF. On days when the wind was from a direction other than west or southwest, CHASP Location #1 was also used to provide sampling coverage between SLF Cell 3 and the community.

This sampling program commenced on August 8, 2005 concurrent with operation of the SLF. During the first two weeks of SLF operation, daily high volume PCB samples were collected over a 24-hour exposure duration (consistent with the baseline and CHASP high volume sampling) at Location SLF and Location #3. High volume samples were set, retrieved, and submitted for analysis daily at these two locations from August 8-19, 2005. Following this two-week event, high volume sampling was reduced to once per week through November 9, 2005 at Location SLF and #3 with the sample from the downwind location only submitted for analysis. As indicated above, for days when the wind direction was from the north/northeast at the start of sampling, a high volume sample was set and retrieved at Location #1, and potentially submitted for analysis depending on the prevailing wind direction over the course of the entire day. Samples were set and retrieved at Location #1 on August 20, 24, and 30, and October 12, 2005. Only the samples from August 30, 2005 and October 12, 2005 were submitted for analysis as this was the only high volume sampling day where this location was actually downwind.

A DustTrak meter (consistent with those used during the baseline and CHASP air monitoring) was also set at Location SLF for daily PM_{10} monitoring. These DustTrak meters were downloaded daily from August 8-November 12, 2005 during SLF activities to assess potential particulate migration from the SLF.

Note that per ECN 032, the location of two air monitoring stations associated with SLF air monitoring (the upwind perimeter dust monitor associated with worker safety [i.e., Health and Safety Plan air monitor location] and Location SLF) were adjusted to alleviate safety concerns associated with accessing and collecting samples from these locations.

2.2.1.5.2 Summary of Results

In accordance with the Operations Plan, CHASP, and SLF Cell 3 monitoring plan (ECN 014), results from daily monitoring of PCBs were evaluated during the first two weeks of dredging and operation of the SLF to assess potential impacts of the site activities and a possible reduction to the sampling frequency. Of the 33 samples set/retrieved between June 14 and 28, 2005 (i.e., initial two weeks of dredging), 29 had total PCB concentrations below the detection limit. PCB concentrations for the four remaining samples ranged from 0.0060 to 0.0245 $\mu g/m^3$. Of the 20 samples set/retrieved and analyzed between August 8 and 19, 2005 (i.e., initial two weeks of SLF activities), 8 had total PCB concentrations below the detection limit. Concentrations for the other 12 samples ranged from 0.0030 to 0.0108 $\mu g/m^3$. Since these PCB concentrations were well below the action level criterion of 0.100 $\mu g/m^3$, the sampling frequency for PCBs was reduced to weekly.

No corrective actions were required during construction activities. Results for all 87 PCB samples collected during the ROPS were at least an order of magnitude lower than the action level of 0.100 $\mu g/m^3$, including 63 samples with PCB concentrations below the detection limit (~0.003 $\mu g/m^3$). The action level criterion of 0.150 mg/m^3 for PM_{10} levels above background was exceeded during at least one 15-minute interval per day and at least at one location during 17 of the 111 days when continuous PM_{10} monitoring was performed[4,5,6]. On 13 of these days, exceedances occurred at only one location. USEPA was notified after each instance and no actions beyond the on-going dust suppression were required. Several factors (e.g., fog, high humidity, medium/high pollen, heavy precipitation) that can affect the accuracy of the DustTrak meters were noted in the field during most of the days with exceedances (www.tsi.com). On a few occasions, nearby roadwork, grass mowing, and equipment malfunction were noted as possible causes for the elevated readings.

Although the action level of 0.150 mg/m^3 is applicable to PM_{10} concentrations above background, the action level was compared to actual 15-minute PM_{10} readings after the daily data from each instrument were retrieved so that immediate action could be taken if needed. Based on this comparison, 0.150 mg/m^3 was exceeded during at least one 15-minute interval per day during 30 of the 111 days when continuous PM_{10} concentrations were measured; however, due to environmental conditions identified above, no additional actions beyond the on-going use of dust suppression techniques were required by USEPA.

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[4] For days when the predominant wind direction fluctuated between two directions, two sets of maximum PM_{10} concentrations above background were calculated using the PM_{10} levels coming from both wind directions as background levels. A day was counted as exceeding the PM_{10} criterion if exceedances occurred at any location in both calculations.

[5] Throughout some weekends, additional PM_{10} data were collected when no dredging/processing activities were being performed. As such, they were not compared to the PM_{10} criterion. These data can be found in Appendix B.

[6] Because the recording of 15-minute average PM_{10} concentration started at different times at all monitoring locations each day, it was necessary to match the overlapping times in order to subtract the appropriate background concentration from measurements at each location. This was done by first identifying the background location based on predominant wind direction and expanding its dataset to be for every minute by assigning the same PM_{10} level to the previous 14 minutes. For each location, the appropriate background PM_{10} for each 15-minute interval was found by averaging the values from the appropriate times from the newly expanded dataset. The PM_{10} concentration above background was then calculated for every 15-minute interval via subtraction and compared to the action level criterion of 0.150 mg/m^3.

Real-time PM_{10} measurements were generally corroborated by or lower than PM_{10} results from 24-hour exposure samples. During the intensive sampling event on June 22-23, 2005, the laboratory results from the PM_{10} samples exposed for 24 hours confirmed the average PM_{10} values from the real-time DustTrak meter (differences of 0.001 to 0.005 mg/m^3 between the average 15-minute real-time readings and the analytical results), except for results from AIR4 (Location #4) where the 24-hour exposure result was 0.019 µg/m^3 and the average real-time field reading was 0.003 µg/m^3. During the intensive sampling event on July 14-15, 2005, the average field measurements exceeded the laboratory results at all six locations by 0.010 to 0.023 µg/m^3. Thus, the real-time readings appear to be conservative measures against which to compare PM_{10} corrective action levels.

No corrective actions were required based on total VOC concentrations measured in the field during three intensive monitoring surveys on June 22-23, July 14-15, and July 26-27, 2005. To compare the results against the action level criterion of 5 ppm above background, total VOC concentrations above background were calculated at every 15-minute interval at every location[7]. During the June 22-23, 2005 survey, the maximum total VOC concentration above background did not exceed 5 ppm at any of the six monitoring locations. During the July 14-15 and July 26-27, 2005 surveys, the maximum total VOC concentrations above background were generally low at each location (range of 0.0 to 0.2 ppm) with the exception of AIR4 (Location #4) on July 14-15, 2005 (67.3 ppm) and AIR4 (Location #4) and AIR5 (Location #5) on July 26-27, 2005 (8.1 and 13.6 ppm, respectively). These values for maximum total VOCs above background as measured in the field are not confirmed by the summation of analytical results for individual VOCs from the corresponding 24-hour exposure sample. The user's manual for the PID instrument does not list which individual VOCs are included in the total VOC measurement; therefore, it is not possible to properly compare the field and laboratory data. However, the laboratory results are believed to be more precise than those measured directly by the field instrument and, for this reason, the field measurements were considered suspect. Furthermore, the accuracy of PID meters is known to be affected by weather conditions (i.e., humidity; www.raesystems.com). As a result, no corrective actions were required.

Results from most of the individual VOCs measured at the various monitoring locations were below the detection limit. Of the VOCs detected, only 2-butanone was consistently measured at all six locations during the three intensive surveys. Detectable levels of 2-butanone ranged from 1.6 to 104.0 µg/m^3.

Most of the individual PAH results from the various monitoring locations were below the detection limit. Of the PAHs detected, the compounds that were above the detection limit at all six locations during the two intensive surveys were acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, 1-methylnaphthalene, 2-methylnapthalene, naphthalene, phenanthrene, and pyrene. However, these PAH levels were not considered elevated in consideration of background/baseline concentrations.

[7] Because the recording of 5-minute running VOC average concentrations started at different times at all monitoring locations each day, it was necessary to find the overlapping times in order to subtract the appropriate background concentration from measurements at each location. This was done by first identifying the background location based on predominant wind direction and expanding its dataset to be for every minute by assigning the same VOC level to the previous 4 minutes. For each of the non-background locations, the 15-minute running VOC average was found by averaging every three 5-minute running average starting with the first one for the sampling event. For each location, the appropriate background VOC for each 15-minute interval was found by averaging the values from the appropriate times from the newly expanded dataset for the background location. VOC concentrations above background were then calculated for every 15-minute interval via subtraction and compared to the action level criterion of 5 ppm.

2.2.1.6 Ex-situ Dredge Material Sample Collection

2.2.1.6.1 Monitoring Activities

Samples were collected from the ex-situ dredge material sample piles for waste characterization between June 17 and October 20, 2005. Samples were obtained from both the filter cake and sand piles located on the processing pad prior to transport to the SLF for disposal in accordance with the procedure provided in Attachment VI of the Operations Plan (Sevenson, May 2005) and ECNs developed later during the project (described below).

Initially, each filter cake and sand pile was sampled once the size of the pile had reached approximately 500 cy by collecting 10 grab samples using a decontaminated shovel, compositing the grab samples into a five-gallon bucket with a lid, shaking the bucket for approximately two minutes, and transferring the homogenized sample into the laboratory supplied glassware. All samples were visually characterized, including general soil type (sand, silt, clay, and organic matter/other matter) as determined using the USCS, and the approximate grain size category (fine, medium, coarse). Field information generated during sample collection was recorded on Form 7 (Appendix H). Each composite sample was submitted to the ChemLab for PCB and percent moisture analysis with results requested on a standard TAT. Samples were collected from both the filter cake and sand piles.

Starting July 7 and continuing through August 9, 2005, samples were collected once weekly for PCB analysis in accordance with ECN 009, as separation of materials during the processing operations was no longer critical to the determination of disposal location. However, it was believed that collection of some data would prove useful in supporting the evaluation of long-term remedial options for the river. In addition (as further specified in ECN 009 Revision #1), samples were also submitted to NEA for TOC analysis and the CDM Soils Laboratory for grain size analysis.

Beginning the week of August 16, 2005, sample collection was modified per ECN 009 Revision #1 to include collection of these samples three times per week (samples occasionally limited to collection twice per week depending on construction activities) to obtain additional data to evaluate potential relationships between the characteristics of the material being dredged and PCB detections in the water column. The final change to the ex-situ dredge material sample collection began August 29, 2005 as described in ECN 009 Revision #2. At this time, the sample method was changed from one composite sample from each of the filter cake and coarse fraction/sand materials to one sample of each material collected upon arrival at the processing pad from the conveyors, to allow for better identification of the approximate in-river location of the dredge materials being sampled. All samples were collected using a decontaminated shovel and placed into five-gallon pails with transferring of materials to laboratory supplied glassware as described above. All results were requested on a standard TAT from NEA and the CDM Soils Laboratory, and the majority of results were requested on a standard TAT from the ChemLab except for those results submitted August 19 and 22, 2005 which were requested on a three-day TAT and August 26 and 29, 2005 which were requested on a 24-hour TAT.

In summary, samples were collected from both filter cake and sand piles on the following dates.

- June 17, 2005
- June 24, 2005
- June 30, 2005
- July 7, 2005
- July 14, 2005
- July 21, 2005
- July 28, 2005
- August 3, 2005
- September 1, 2005
- September 2, 2005
- September 9, 2005
- September 12, 2005
- September 14, 2005
- September 15, 2005
- September 27, 2005
- September 28, 2005

- August 9, 2005
- August 16, 2005
- August 19, 2005
- August 22, 2005
- August 24, 2005
- August 26, 2005
- August 29, 2005
- October 5, 2005 (two sampling events)
- October 6, 2005
- October 11, 2005
- October 12, 2005 (two sampling events)
- October 18, 2005 (two sampling events)
- October 20, 2005

2.2.1.6.2 Summary of Results

Average PCB, TOC, percent solids, and particle sizes (as represented by the median particle size [i.e., D_{50}]) measured in the sand and filter cake fractions of the dredged material are presented in Figure A-40. As expected, the filter cake fraction generally contained higher PCB and TOC content, lower solids contents, and smaller particles sizes relative to the sand fraction. On average, the filter cake samples contained 93.4 ppm PCBs (range of 7.0 to 325.9 ppm) and 4.7% TOC (range of 1.8 to 8.3%), generally consisted of 44% sand, 55% fines, and 1% clay, with an average D_{50} of 0.075 mm (range of 0.058 to 0.139 mm)[8]. The sand samples averaged 15.1 ppm PCBs (range of 2.5 to 49.2 ppm; includes average of results for samples from August 9 and September 28, 2005 – see below), 0.8% TOC (range of non-detect [0.1%] to 5.4%), and generally consisted of 97% sand and 3% fines. The sand samples had an average D_{50} of 0.225 mm (range of 0.175 to 0.441 mm).

Two sand samples collected on August 9 and September 28, 2005 contained anomalously high total PCB concentrations of 91.3 ppm and 68.7 ppm, respectively. These PCB levels are more than two times greater than those measured in any of the other 30 sand samples collected during the ROPS. At the direction of Alcoa, a portion of the archived sample from August 9, 2005 was re-extracted and re-analyzed in the laboratory. The total PCB concentration in this re-analyzed sample was 7.2 ppm. Nothing unusual was noted about the sample by either the field crew or laboratory personnel, and the chain-of-custody and all other documentation for the original samples collected on August 9, 2005 were confirmed. Because the percent recoveries for the matrix spike/matrix spike duplicate (MS/MSD) samples were both 0%, the archived sample from September 28, 2005 was re-extracted and re-analyzed. A total PCB concentration of 12.9 ppm was reported for this re-analyzed sample; the MS/MSD percent recoveries for this sample were also 0%. Results for the laboratory quality assurance samples for both sets were acceptable. As such, the results for the original sample and its re-extraction were considered valid for each sample set and, therefore, the average for each day was used in the statistics presented above.

2.2.1.7 Water Treatment Effluent Discharge Monitoring

2.2.1.7.1 Monitoring Activities

In compliance with NYSDEC and State Pollutant Discharge Elimination System (SPDES) permit requirements, treated effluent discharge water was monitored when return water was released to the river. During normal

[8] Grain size data for filter cake samples collected on July 7 and July 14, 2005 were excluded from the averages. The filter cake sample from July 21 was re-tested by the laboratory on August 5, 2005 since reports of 10-20% gravel in the filter cake samples did not match the physical characteristics observed. Samples were visually described as silt and fine sand by the field crew, with no observation of gravel. The field crew also noted that the dredge material coming from the filter press was compressed. Re-testing of the filter cake sample from July 21 indicated that no gravel was present in the sample, and that the particles retained on the #4 sieve were clumps of finer material. Unfortunately, filter cake samples from July 7 and July 14 were not available for re-testing, but based on results from the July 21 testing and visual descriptions provided in the field, the gravel portions of these samples are also believed to be clumps of finer material.

operating conditions, effluent was discharged downstream of Alcoa's permitted Outfall 004 in Building 156 between June 14 and November 2, 2005 following processing through the ROPS wastewater treatment system. As needed, the ROPS wastewater treatment system was supplemented by existing Alcoa storm water treatment facilities in Building 156, which in turn discharged via permitted Outfall 004. An automated ISCO sampling device connected directly to the effluent pipe monitored flow rates continuously and collected effluent samples for routine analysis of the following parameters:

- Daily: pH, total dissolved solids (TDS), and TSS;
- Bi-weekly: PCBs (Aroclor 1221 [see below], 1242, 1248, 1254, 1260);
- Weekly: aluminum (total), cyanide (total), fluoride (total), and individual PAHs; and
- First and fifth weeks of effluent discharge: whole effluent toxicity (WET).

During weekdays, all samples were collected as 4-hour composites, except pH which was taken as a grab sample. On Saturdays, grab samples were collected; when dredging occurred for more than 8 hours on a Saturday, a 4-hour composite sample was taken. On occasions when dredging occurred on Sunday, 4-hour composites were collected. Each effluent sample was submitted to the ChemLab for analysis with results requested with various required TATs (24-hour for pH and TSS; 48-hour for PCBs; weekly for TDS, aluminum, cyanide, fluoride, and PAHs). WET samples, consisting of two 24-hour samples, were sent to Aquatec Biological Services, Inc. (Aquatec) for acute toxicity testing with results requested on a 7-day TAT. In addition, flow results from the field crew were required on a 24-hour TAT.

Samples were also collected weekly at several steps along the wastewater treatment process. These internal process samples were collected from the filtrate tank effluent, prior to the sand filters, prior to the carbon filters, and after the carbon filters. They were submitted to ChemLab for PCB and TSS analysis with results requested on 48- and 72-hour TATs, respectively.

The following changes were made to sampling protocol during the ROPS:

- On July 20, 2005, daily grab pH samples were collected from the sample port directly in the effluent line instead of from the ISCO sampling tube. The change was initiated based on results from additional pH contingency sampling done on July 19, 2005 as a precaution for future exceedances. More details are provided in Section 2.2.1.7.2.
- On June 15, 2006, results for Aroclor 1221 were reported after this Aroclor was observed in the samples collected from the river.
- A third toxicity sampling event was conducted on October 12, 2005 because a new polymer had been added to the wastewater process line. This was in addition to the two required acute effluent toxicity samples collected over two consecutive 24-hour periods from June 15-17 and August 13-14, 2005. Results are discussed in Section 2.2.1.7.2.
- Electrical power to the ISCO unit was inadvertently shut down for an extended period of time (October 2, 2005 14:57 to October 4, 2005 19:30, immediately prior to the Monday sampling composite). No daily samples were missed; however, flow monitoring data are unavailable from Sunday (zero flow) until Monday, October 4, 2005 01:13. An Environmental Excursion or Event (EEE) report was submitted. Independent flow estimates were compared with previous data and were submitted to the State for a record of flow. Corrective action was taken to prevent further power shut downs, principally identifying the power source and making personnel aware of its importance.

Field data obtained during collection are included in Appendix B.

2.2.1.7.2 Summary of Results

Results for the treated effluent discharge water sampling are divided below into four sections: 1) exceedances of effluent limits; 2) elevated levels but no violation of effluent limits; 3) results for additional sampling; and 4) results for internal process samples.

Exceedances of Effluent Limits

Results of the weekly wastewater discharge monitoring indicate the dredge return water discharge complied with the NYSDEC criteria for wastewater discharge on all but two days (August 16 and 17, 2005)[9]. On these days, the ROPS treated discharge effluent failed to maintain the empty bed contact time (EBCT) of 18 minutes as required by the Effluent Limitations and Monitoring Requirements (ELMR). The exceedances occurred from 20:37 to 21:09 on August 16, 2005 and from 20:30 to 20:38 on August 17, 2005, with a peak flow rate of about 3.08 million gallons per day (MGD) (2,139 gallons per minute [gpm]) observed during these periods. The EBCT associated with this peak flow during the exceedances was 17.68 minutes. The exceedance was a result of a failure in the emergency pager system set to notify personnel when discharge rates reached 1,950 gpm. Corrective action was taken and flows were monitored more closely. Also, a warning light was installed on the pad to alert the water treatment operator when flows reached 1,850 gpm. Alcoa informed NYSDEC of this non-compliance and documented it and the associated corrective actions taken in an EEE report. NYSDEC was also notified of the 24-hour peak flow exceedance (whose criterion is based on the EBCT) during those two days with IQAT Form 8D (Appendix H).

Elevated Levels But No Effluent Limit Violations

On July 19, 2005, the results for the daily monitoring grab sample showed a calibrated pH meter reading of 9.42. Following the high discharge pH reading, the IQAT followed the pH Contingency Sampling Protocol, in which process samples were taken upstream of the discharge point throughout the system.

pH Contingency Sampling Protocol Locations	Time	pH
Filtrate from Filter press	09:53	6.99
Pre-Sand Filters	09:50	7.07
Pre-Carbon Filters	09:45	6.96
Post-Carbon Filters (Pre-Secondary Bag Filters)	09:40	6.98

At 9:50 AM, Alcoa contacted the NYSDEC and explained the situation and sampling results. With concurrence from NYSDEC, additional pH samples were obtained at the locations listed below with the calibrated pH meter.

Sampling Locations	Time	pH
Discharge Effluent – original regular daily grab using the ISCO sampling line (as per the Standard Operating Procedure [SOP])	09:35	9.42
Discharge Effluent – repeat of regular daily grab using the ISCO sampling line (after NYSDEC approval)	10:05	8.95
Discharge Effluent – direct grab from the sampling port not using the ISCO sampling line (after NYSDEC approval)	10:10	6.95
Outfall 004 Discharge into the Grasse River (after NYSDEC approval)	10:25	6.85

[9] On August 15, the maximum 24-hour flow of 3.0 MGD exceeded the criterion of 2.9 MGD from 20:50 to 20:55. However, since the instantaneous flow criterion is based on the ELMR specification of at least an 18 minute EBCT for carbon adsorption and the EBCT for the August 15, 2005 event was 18.18 minutes (calculated based on the actual mass of carbon [141,563 pounds] in the treatment vessels), the maximum flow in fact met the requirement for that day.

This additional sampling indicated that the sampling line was a major source of alkalinity and was contributing to the high pH observed in discharge effluent samples that used the ISCO sampling line. At 1:05 PM, Alcoa spoke again with NYSDEC indicating that the pH result for July 19, 2005 was not considered to be an exceedance to ELMR, as it was not considered to be representative of the treated effluent from the wastewater treatment plant. In accordance with direction from NYSDEC, the following corrective actions were to be implemented:

- Future daily grab pH samples would be taken at the sample port directly in the effluent line in lieu of the ISCO tubing. The SOP would also be updated to reflect this new practice.
- The ISCO sampling line will be replaced immediately with a new line. The removed line will be inspected for potential algae growth, material buildup, or corrosion.
- A discussion of this incident will be documented and forwarded to NYSDEC in the ELMR July data cover letter submittal.

These actions were implemented and no further elevated pH readings were measured.

The September 29, 2005 sampling event resulted in a detectable concentration of 82 parts per trillion (ppt) for PCB Aroclor 1242 in the effluent discharge sample. The permitted limit was established at 300 ppt so no violation in the permit occurred. However, in accordance with the NYSDEC permit requirements, a written report was filed and corrective action taken to prevent further detections, including increasing the frequency of backwashes of the sand and carbon filter system and bag filter replacements.

Results of Additional Sampling

As mentioned in the Section 2.2.1.7.1, an additional sampling event was conducted for acute toxicity testing on October 12, 2005 to ascertain the effect of a new polymer in the wastewater process line. Similar to results from the two previous acute toxicity tests on June 15 to 17, 2005 and July 13 to 14, 2005, the lethal dose for half of the group (48-hour LD50) was reported as >100% for both test species, resulting in the calculated toxicity units of <1 TUa, which is well below the acute toxicity effluent limit of 2.2 TUa. Full laboratory reports were submitted with the Alcoa's Discharge Monitoring Reports (DMR) for the months following receipt of the analytical results.

Results for Internal Process Samples

PCBs and TSS measurements collected at various stages of wastewater treatment process demonstrated the effectiveness of the system at removing these constituents from the dredge return water prior to discharge. PCBs levels measured prior to treatment via the carbon filters averaged 10.0 µg/L (range of 1.9 to 49.4 µg/L), while those measured after carbon filter treatment were all below the detection limit of 0.065 µg/L. Substantial reductions in TSS levels were also observed through the system. TSS levels in the filtrate tank effluent averaged 10.0 mg/L (range of non-detect to 66.0 mg/L). Similar levels were observed prior to treatment via sand filters (average of 11.0 mg/L, range of non-detect to 34.8 mg/L). TSS levels measured prior to treatment via carbon filters averaged 1.4 mg/L (range of non-detect to 4.8 mg/L), while those measured post-carbon filter treatment were always below detectable levels.

2.2.2 Armored Capping

Several monitoring events were performed in association with placement of the armored cap in the main channel of the river, including water column monitoring, sediment surface elevation measurements, bathymetry, and cap material sampling. Details regarding each of these monitoring components are presented below.

2.2.2.1 Water Column Monitoring

2.2.2.1.1 Monitoring Activities

Water column monitoring associated with armored capping was conducted daily from September 23-October 21, 2005 (when these activities were occurring) to assess any immediate effects of these activities on the water column. Monitoring during armored capping included the collection of water column samples and water quality parameters at transects and local perimeter locations. Table A-9 presents a summary of the daily water column sampling activities and locations monitored during all in-river activities. Water column monitoring was performed using the equipment (i.e., Kemmerer and YSI) and protocol presented under baseline monitoring (Section 2.1.2.2.1) and in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005).

As part of this monitoring, stratification (as described in Section 2.1.2.2.1) of the water column was evaluated via vertical profiling of water temperature and conductivity (i.e., collection of these parameters every 2 ft in the water column) to determine how samples were to be composited. If stratification was observed, the sampling protocol was altered to collect representative samples above and below the demarcation of stratification. Stratification was not present during armored capping water column sampling; therefore, samples were collected per the protocol described below.

Water column samples and water quality parameters were typically collected before noon each day to allow the laboratory adequate time to meet the 24-hr TAT; however, based on discussions with the Agencies, if there was a delay or shut-down in operations, the samples and parameters were not collected until approximately two hours after the re-start of in-river activities.

All water column samples were submitted to the ChemLab for PCB (Aroclor) and TSS analysis. Field data (i.e., water temperature, DO, specific conductivity, pH, and turbidity) obtained during water column monitoring were recorded in PDAs and distributed electronically for inclusion on Form 8A (Appendix H) as described in Section 2 of the main body of this ROPS Documentation Report.

Details on routine monitoring at transect and local perimeter locations are presented below.

Transect Water Column Monitoring

Water column monitoring was conducted daily during armored capping at transects ROPS-WCT14 and ROPS-WC131 (Figure A-14). Monitoring was performed consistent with the procedures described under baseline monitoring (Section 2.1.2.2.1) including the collection of water column samples (i.e., grab samples from three depths at three stations for a total of nine grabs composited into one sample) and water quality parameters at the center location of each transect. Water column monitoring during armored capping was conducted concurrently with monitoring during dredging activities from September 27-October 21, 2005, as dredging in Work Zone 1 was ongoing during placement of the armored cap. As a result, transect monitoring activities associated with armored capping were completed as described under Section 2.2.1.1.1.

Perimeter Local Location Water Column Monitoring

Water column samples and water quality parameters were collected at perimeter local monitoring locations adjacent to and downstream of the silt curtain (C2 and C3; Figure A-14). Monitoring and sampling at these perimeter local locations were conducted consistently with the protocol outlined under Section 2.2.1.1.1 (i.e., grab samples were collected at 0.2, 0.5, and 0.8 times the total water column and composited and water quality parameters were obtained at each sampling depth at all locations).

2.2.2.1.2 Summary of Results

Average water column PCB, TSS, and turbidity levels measured at the upstream (ROPS-WCT14), local (C2 and C3) and downstream (ROPS-WC131) monitoring stations during armored cap activities are presented in Figure A-41. Debris and sediment removal was occurring upstream in Work Zone 1 on 15 of the 22 days of armored cap activities and, thus, PCB, TSS, and turbidity levels measured at the upstream location (ROPS-WCT14) likely reflect the impact of these activities, and not the armored capping.

PCB levels measured upstream, adjacent to and downstream of the armored cap area were relatively similar and exhibit no clear spatial trend. PCB levels at the upstream transect averaged 0.204 µg/L (range of non-detect to 1.211 µg/L), while levels adjacent to the armored cap area were slightly higher (C2; average of 0.239 µg/L and range of non-detect to 1.652 µg/L). PCB levels at the local (C3; average of 0.159 µg/L and range of non-detect to 1.136 µg/L) and downstream transect (ROPS-WC131; average of 0.152 µg/L and range of non-detect to 0.956 µg/L) were nearly identical. PCB concentrations measured at all four locations during the armored capping activities were always below the 2 µg/L action level.

TSS levels were relatively low at all locations during armored capping activities. At the upstream location, TSS levels ranged from 2.00 to 22.00 mg/L, with an overall average of 5.48 mg/L. TSS concentrations at C2, adjacent to the armored cap area, were similar, ranging from 1.60 to 18.00 mg/L and averaging 4.90 mg/L. The highest TSS levels were observed immediately downstream of the armored cap area (C3; average of 5.82 mg/L and range of 2.40 to 17.60 mg/L), while those at ROPS-WC131 were only slightly lower (average of 5.35 mg/L and range of 1.60 to 18.00 mg/L). The TSS action level of 25.00 mg/L over background (i.e., ROPS-WCT14) at the downstream transect was not exceeded during armored capping activities.

Similar to TSS levels, turbidity levels were relatively low at all locations. Upstream levels ranged from 0.7 to 16.0 NTU, with an average of 3.4 NTU. Turbidity levels at C2 ranged from 0.5 to 16.5 NTU with an overall average of 3.5 NTU. Downstream levels averaged 4.2 NTU (range of 1.0 to 18.2 NTU) and 4.0 NTU (range of 0.7 to 20.1 NTU) at C3 and ROPS-WC131, respectively. Turbidity levels at ROPS-WC131 were always below the action level of 25.0 NTU over background.

2.2.2.2 Sediment Surface Elevation Measurements and Results

Sediment surface elevation measurements were conducted along the same grid used during the baseline monitoring events (i.e., 25-ft by 25-ft grid) throughout the armored cap area to provide real-time information regarding the amount of material placed in the targeted areas. Sediment surface elevation measurements were collected consistent with the procedures used during the 2005 baseline monitoring event as described in Section 2.1.2.1.1 (i.e., elevation measurements obtained by locating the grid node and surveying the water surface elevation via RTK survey techniques and measuring the total water depth) along with the use of a plate affixed to the bottom of the probing rod to account for undulating surfaces.

Elevation measurements were conducted over multiple events in the armored cap area between September 24 and October 21, 2005 to assess the sediment bed elevation changes resulting from placement of cap materials. Limitations associated with working in a river environment do not allow the ability to return to the exact same location over multiple sampling rounds, which may introduce variability in the measurements. Further, the vertical accuracy of the RTK survey equipment is approximately 0.2 ft in the river and the water depth measurements are collected to the nearest 0.1 ft.

The armored cap was composed of various layers depending on whether placement was occurring in the upstream or downstream half of the targeted area. The upstream half included placement of base, filter, and armor layers, and the downstream half included placement of filter (in two lifts) and armor layers. Each layer had a required target thickness along with allowable tolerances as provided in the Operations Plan (Sevenson, May 2005) and ECN 027 (Appendix G), respectively. As a result, a targeted elevation range was calculated at each grid node using the sediment bed elevation, target cap material thickness, and allowable tolerance. An elevation measurement was then obtained at each grid node during cap placement to assess whether an adequate amount of cap material had been placed without exceeding allowable tolerance (per ECN 027). Surveyors worked real-time in the field with Sevenson during placement of each cap layer to confirm that proper cap material elevation and thickness was achieved at each grid node. Field data obtained during the sediment surface elevation and probing activities were recorded in PDAs and distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

Figure A-42 presents the 2005 baseline grid node locations within the armored cap area along with the final cap material thickness for each layer at each node location. Considering all grid node measurements in the armored cap area, information regarding the achieved cap material thicknesses is presented in the table below.

Armored Cap Layer	Target Thickness	Average Thickness	Minimum Thickness	Maximum Thickness
Upstream Half of the Armored Cap Area				
Base Layer	6 in with tolerance of +6 in (0.5 ft + 0.5 ft)	0.7 ft	0.5 ft	1.0 ft
Filter Layer	6 in with tolerance of +3 in (0.5 ft + 0.3 ft)	0.6 ft	0.5 ft	0.7 ft
Armored Layer	13 in with tolerance of +6 in (1.1 ft + 0.3 ft)	1.3 ft	1.1 ft	1.6 ft
Total Cap	25 in with tolerance of +12 in (2.1 ft + 1.0 ft)	2.5 ft	2.1 ft	3.1 ft
Downstream Half of the Armored Cap Area				
Filter 2 Layer	3 in with tolerance of +3 in (0.3 ft +0.3 ft)	0.4 ft	0.3 ft	0.5 ft
Filter 1 Layer	3 in with tolerance of +3 in (0.3 ft +0.3 ft)	0.4 ft	0.3 ft	0.5 ft
Armored Layer	13 in with tolerance of +6 in (1.1 ft + 0.5 ft)	1.3 ft	1.1 ft	1.6 ft
Total Cap	19 in with tolerance of +12 in (1.6 ft + 1.0 ft)	2.1 ft	1.7 ft	2.5 ft

Note:
1. The actual thicknesses (i.e., average, maximum, and minimum) are provided to the nearest tenth of a ft as the survey rod used to measure water depths (and ultimately cap material thickness) only read to a tenth of a ft.

The required cap thickness was achieved at all grid node locations within the allowable range. All probing and elevation measurements for the armored cap area are presented in Appendix B. Multibeam data collected post-cap placement were also considered to provide additional information regarding thickness of the armored cap. These data indicated variability in thickness across the surface of the cap. These data are further discussed in Section 2.3.3.

2.2.2.3 Cap Material Sampling

2.2.2.3.1 Monitoring Activities

Samples of the armored cap base layer material (i.e., sand) were collected on September 21 and 26, 2005. Three grab samples were collected from the staging area stockpile using a shovel, composited in a five-gallon bucket with a lid, and shaken for approximately two minutes. The homogenized material was then transferred into laboratory supplied glassware and submitted to NEA for TOC analysis and CDM Soils Laboratory for grain size analysis, with results requested on a standard TAT. All samples were visually characterized, including general soil type (sand, silt, clay, and organic matter/other matter) as determined using the USCS, and the approximate grain size category (fine, medium, coarse).

Sampling and analysis of the filter and armor layers were not conducted as part of the during-construction monitoring program. Field data obtained during cap material sampling were recorded on Form 4 (Appendix H) and distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

2.2.2.3.2 Summary of Results

The two cap material samples collected during construction of the armored cap contained varying levels of TOC; the September 21, 2005 sample contained 0.63% TOC while the September 26, 2005 sample contained 3.10% TOC. Particle size distributions for the two cap material samples were similar and within the range of particle size distributions specified for the base layer of the armored cap (Sevenson, May 2005; Figure A-43). However, the sample collected on September 26, 2005 contained a slightly higher percentage of material passing the #40 sieve (i.e., finer) than was specified.

2.2.3 Capping in the Near Shore and Work Zones 1 and 2

Several monitoring events were performed in association with placement of a sand cap over the dredge areas in the northern near shore and main channel areas and a thin-layer cap in the southern near shore of the river, including water column monitoring, sediment surface elevation measurements, bathymetry, and cap material sampling. Details regarding each of these monitoring components are presented below.

2.2.3.1 Water Column Monitoring

2.2.3.1.1 Monitoring Activities

Water column monitoring associated with capping in the near shore and Work Zones 1 and 2 began in November 2005 to assess immediate effects of these activities on the water column. Water column monitoring was also conducted within the silt curtain containment system to assess conditions prior to removal of the silt

curtains. Monitoring during capping included the collection of water column samples and water quality parameters at transects and local perimeter locations. Table A-9 presents a summary of the daily water column sampling activities and locations monitored during all in-river activities. Water column monitoring was performed using the equipment (i.e., Kemmerer and YSI) and protocol presented under baseline monitoring (Section 2.1.2.2.1) and in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005).

As part of this monitoring, stratification (as described in Section 2.1.2.2.1) of the water column was evaluated via vertical profiling of water temperature and conductivity (i.e., collection of these parameters every 2 ft in the water column) to determine if the sampling intervals needed to be field adjusted. If stratification was observed, the sampling protocol was to be altered to collect representative samples above and below the demarcation of stratification. Stratification was not present during capping water column sampling; therefore, samples were collected for PCB, TSS, and field data per the same protocol described for armored capping in Section 2.2.2.1.1.

Details on routine monitoring at transect and local perimeter locations during capping activities in the northern near shore, Work Zones 1 and 2 including monitoring the air curtains, and southern near shore, along with sampling prior to silt curtain removal are presented below.

Northern Near Shore Water Column Monitoring

Water column monitoring was conducted during capping in the northern near shore area on September 13-17 and 22, 2005. During capping in the northern near shore, monitoring was conducted at transects ROPS-WCT5, ROPS-WCT14, and ROPS-WC131 and at the local perimeter locations D1, D2, and D4 consistent with the procedure described under the water column monitoring in during debris removal/dredging in the northern near shore area (Figure A-14; Section 2.2.1.1.1). As shown on Table A-9, the majority of the days that capping was occurring in the northern near shore, debris removal and/or dredging activities were also occurring in the main channel dredge area; therefore, water column monitoring associated with these activities was conducted concurrently.

Work Zones 1 and 2 Water Column Monitoring

Water column monitoring was conducted during capping in Work Zones 1 and 2 from October 22-November 10, 2005 (Table A-9). During capping in these work zones, monitoring was conducted at all transects (i.e., ROPS-WCT5, ROPS-WCT14, and ROPS-WC131) and at select local perimeter locations depending on which work zone was being capped (i.e., D1, D2, D3, and/or D4) consistent with the procedure described under the water column monitoring in during debris removal/dredging (Figure A-14; Section 2.2.1.1.1).

Air Curtain Turbidity Monitoring

Turbidity monitoring was conducted to assess the performance of the air curtains during capping activities in Work Zones 1 and 2 in accordance with ECN 024. This monitoring was conducted daily mid-morning and afternoon from October 22-November 10, 2005 at ROPS-WCT5 and US-1 (located just upstream of the air curtain) at 0.2, 0.5, and 0.8 times the total water column depth in accordance with the monitoring protocol described in Section 2.1.2.2.1 (Figure A-14). Results of these monitoring activities indicated similar turbidity levels at ROPS-WCT5 and US-1, locations identified as providing background and upstream data for capping activities. Data obtained during these monitoring activities are included in Appendix B.

Southern Near Shore Thin-Layer Capping Water Column Monitoring

Water column monitoring was conducted during thin-layer capping in the southern near shore between November 15 and 17, 2005. During capping in this area, monitoring was conducted at transects ROPS-WCT5,

ROPS-WCT14, and ROPS-WC131 and at a single perimeter local monitoring location downstream of the silt curtain (C1, Figure A-14). Monitoring was performed consistent with the procedures described under baseline monitoring (Section 2.1.2.2.1).

Silt Curtain Removal Water Column Monitoring

Prior to the removal of the main channel dredging/capping silt curtain system, water column monitoring was conducted in accordance with ECN 035 (Appendix G) to confirm that PCB and TSS concentrations within the silt curtained area were acceptable in consideration of background levels (i.e., PCB and TSS levels within silt curtained area did not exceed those at ROPS-WCT5). Water column monitoring was conducted on November 10-12, 2005 at one transect (i.e., ROPS-WCT5) and four interior local locations (D8, D9, D10, and D11; Figure A-14). Monitoring and sampling at transect and local locations was conducted consistent with the protocol outlined under Section 2.1.2.2.1 (i.e., grab samples were collected 0.2, 0.5, and 0.8 times the total water column and composited and water quality parameters were obtained at each sampling depth at all locations). The samples collected on November 12, 2005 were not analyzed, as the results from November 11, 2005 indicated acceptable conditions for main channel dredging/capping silt curtain removal.

2.2.3.1.2 Summary of Results

Northern Near Shore and Work Zones 1 and 2

Average water column PCB, TSS, and turbidity levels measured at the upstream (ROPS-WCT5), local (D1-D4) and downstream (ROPS-WCT14 and ROPS-WC131) monitoring stations during capping activities in Work Zones 1 and 2 are presented in Figure A-44. Data collected from inside the containment system (D8, D9, and D10) are also included. The data presented in Figure A-44 are only representative of times when capping in the main channel work area was occurring; this figure does not include data collected during near shore capping activities since sediment removal activities in the main channel work area, which affect the water column data collected at the local and downstream monitoring locations, were being performed concurrently with capping activities in the northern near shore. For this reason, the data collected during these days were incorporated into the discussion of water quality during debris and sediment removal activities (Section 2.2.1.1.2).

PCB levels measured upstream of the capping work area were non-detect during capping activities. Inside the work area (stations D8, D9, and D10) PCB levels were generally below detectable limits as well; PCBs were only detected in 4 of the 36 samples (0.191 to 0.386 µg/L). PCB levels measured adjacent to the containment system (D1, D2, and D3) were always below the detection limit. The highest PCB concentrations observed during capping activities were observed at D4, where levels averaged 0.154 µg/L (range of non-detect to 0.522 µg/L). Average PCB levels declined with distance downstream of the work area, averaging 0.135 µg/L (range of non-detect to 0.432 µg/L) at ROPS-WCT14 and 0.041 µg/L (range of non-detect to 0.113 µg/L) at ROPS-WC131. PCB concentrations measured during the main channel capping activities were always below the 2 µg/L action level.

TSS levels measured at the upstream station and adjacent to the work area were relatively similar, ranging from 2.04 to 3.05 mg/L on average. Similar levels were observed at the upstream boundary inside the containment system (D10, 2.74 mg/L). Higher TSS levels were observed within the containment system at stations D8 and D9, averaging 4.26 mg/L and 4.50 mg/L, respectively. Similar to the PCB data, the highest TSS levels were observed immediately downstream of the work (D4; average of 7.38 mg/L and range of non-detect to 20.40 mg/L). TSS levels declined with distance downstream of the work area, averaging 6.49 mg/L at ROPS-WCT14 and 4.04 mg/L at ROPS-WC131. The TSS action level of 25.00 mg/L over background (i.e., ROPS-WCT5) at the downstream transect was not exceeded during capping activities.

Similar to TSS levels, turbidity levels measured at the upstream station and adjacent to the work area were relatively similar, ranging 1.8 to 2.5 NTU on average. Turbidity levels were higher inside the containment system, averaging 3.4 NTU (D10), 5.5 NTU (D9), and 4.8 NTU (D8). Turbidity levels downstream of the work area were lower, and exhibited a decline with distance away from the capping activities. At these locations, turbidity levels averaged 3.8 NTU (D4), 3.5 NTU (ROPS-WCT14), and 2.4 NTU (ROPS-WC131). The turbidity action level of 25.0 NTU over background (i.e., ROPS-WCT5) at the downstream transect was not exceeded during capping activities.

Southern Near Shore Thin-Layer Capping

Average water column PCB, TSS, and turbidity levels measured at the upstream (ROPS-WCT5), local (C1), and downstream (ROPS-WCT14 and ROPS-WC131) monitoring stations during the three days of thin-layer cap construction in the southern near shore area are presented in Figure A-45. PCB levels measured at all four locations were below the detection limit. TSS levels measured at the upstream and downstream locations were similar, ranging between 4.00 and 4.24 mg/L. TSS levels at the local station adjacent to the capping activities were higher, averaging 9.73 mg/L (range of 4.80 to 18.00 mg/L), indicating some solids release during capping activities. Turbidity measurements are consistent with the TSS data; measurements upstream and downstream of the capping area are similar (average of 1.1 NTU and range of 1.0 to 1.3 NTU), while those measured at the local monitoring station were higher (average of 1.7 NTU, range of 1.4 to 2.0 NTU). The PCB, TSS, and turbidity action levels were not exceeded.

Silt Curtain Removal

Prior to silt curtain removal, all five sampling locations had PCB concentrations below the detection limit, with the exception of the sample collected at D8 on November 10, 2005 (0.191 µg/L). TSS levels at all locations were similar for both days, ranging between 4.40 and 5.20 mg/L. Turbidity measurements measured at the five locations were similar as well, however, varied between the two sampling days. Turbidity levels on November 10, 2005 ranged from 2.4 to 3.0 NTU, while those from November 11, 2005 were lower (range of 0.9 to 1.1 NTU).

Samples collected at WCT5, WCT14 and WC131 during silt curtain removal (on November 12 and November 14, 2005) contained PCBs below the detection limit. TSS and turbidity levels at all three locations were similar on both days, ranging between 2.00 and 4.00 mg/L, and 1.0 to 1.4 NTU, respectively. The PCB, TSS and turbidity action levels were not exceeded.

2.2.3.2 Sediment Surface Elevation Measurements

Sediment surface elevation measurements were conducted along the same grid used during the baseline and during-construction dredging monitoring events (i.e., 25-ft by 25-ft grid in the main channel and 25-ft by 10-ft grid in the side slope and near shore areas) throughout capping activities to provide real-time information regarding the amount of cap material placed. Sediment surface elevation measurements were collected consistent with the procedures used during the 2005 baseline monitoring event as described in Section 2.1.2.1.1 (i.e., elevation measurements obtained by locating the grid node and surveying the water surface elevation via RTK survey techniques and measuring the total water depth).

Elevation measurements were conducted over multiple events in October and November 2005 in Work Zones 1 and 2 and the southern near shore area to assess the bed elevation changes resulting from placement of cap materials. Limitations associated with working in a river environment do not allow the ability to return to the exact same location over multiple sampling rounds, which may introduce variability in the measurements.

Further, the vertical accuracy of the RTK survey equipment is approximately 0.2 ft in the river and the water depth measurements are collected to the nearest 0.1 ft.

The cap was composed of sand with a target thickness restoring the northern near shore area to its original elevation, 1.0 ft in Work Zones 1 and 2, and 0.3 to 0.5 ft in the southern near shore area. Allowable tolerances were also provided for the northern near shore of +/-0.3 ft per ECN 022 (Appendix G), and Work Zones 1 and 2 of +0.5 ft per ECN 033 (Appendix G). To assess the total cap thickness placed, an elevation measurement was obtained at each grid node during placement for comparison with either the post-dredge elevation measurement (Work Zones 1 and 2) or the 2005 baseline elevation measurement (northern and southern near shore area). Surveyors worked real-time in the field with Sevenson during cap placement to confirm that each grid node achieved the proper cap material thickness within the allowable tolerance or cap thickness range. Field data obtained during the sediment surface elevation and probing activities were recorded in PDAs and distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

Figure A-46 presents the 2005 baseline grid node location and the difference between the pre-removal and post-capping sediment surface elevations for the northern near shore area. Figures A-47 and A-48 illustrate the post-dredging grid node location and final cap material thickness at each grid node location for Work Zones 1 and 2, respectively. Figure A-49 presents the 2005 baseline grid node location and final cap material thickness for the southern near shore area at each node location. Considering all grid node measurements in these targeted cap area, information regarding the achieved cap material thicknesses is presented in the table below.

Cap Component	Target Thickness	Average Thickness	Minimum Thickness	Maximum Thickness
Northern Near Shore	Restore to original elevation within +/- 3 in (0.3 ft)	0.0 ft	-0.3 ft	+0.3 ft
Work Zone 1	12 in with a tolerance of +6 in (1.0 ft + 0.5 ft)	1.3 ft	1.0 ft	1.5 ft
Work Zone 2	12 in with a tolerance of +6 in (1.0 ft + 0.5 ft)	1.2 ft	1.0 ft	1.5 ft
Southern Near Shore	3 to 6 in (0.3 ft to 0.5 ft)	0.4 ft	0.3 ft	0.5 ft

Note:

1. The actual thicknesses (i.e., average, maximum, and minimum) are provided to the nearest tenth of a ft as the survey rod used to measure water depths (and ultimately cap material thickness) only read to a tenth of a ft.

The required cap thickness was achieved at all grid node locations within the allowable tolerance. All probing and elevation measurements for the cap areas are presented in Appendix B. Multibeam data collected post-cap placement were also considered to provide additional information regarding thickness of the caps. These data indicated variability in thickness across the surfaces of the caps. These data are further discussed in Section 2.3.3.

2.2.3.3 Cap Material Sampling

2.2.3.3.1 Monitoring Activities

Weekly cap material samples were collected throughout capping activities in the dredge areas and southern near shore area. Samples were collected as described under Section 2.2.2.3.1 (i.e., three grab samples from the

staging area stockpile, composited, and submitted for laboratory analysis). All samples were submitted to NEA for TOC analysis and CDM Soils Laboratory for grain size analysis with results requested on a standard TAT.

In summary, a total of six cap material samples were collected during capping in the near shore areas and Work Zones 1 and 2 on the dates listed below.

- September 8, 2005
- September 13, 2005
- October 25, 2005
- November 3, 2005
- November 10, 2005
- November 14, 2005

Field data obtained during cap material sampling were recorded on Form 4 (Appendix H) and distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

2.2.3.3.2 Summary of Results

The TOC content of the materials used for the construction of caps in the northern near shore and main channel dredge areas and the southern near shore thin-layer capping area were variable. The two samples collected on September 8 and September 13 for placement in the northern near shore area had TOC contents of 0.71 and 1.50%, respectively. The three samples for the main channel dredge area collected on October 25, November 3, and November 10, 2005 were lower, averaging 0.59% (range of 0.45 to 0.67%). The TOC content in the one sample collected on November 14 for the southern near shore area capping was 2.00%. The particle size distributions for the cap material samples were generally within the range of distributions for native Grasse River surface sediments in the near shore and main channel work areas (Figure A-50).

2.3 Post-Construction Monitoring

Post-construction monitoring (fall 2005) was performed to gather data following completion of construction activities to assess potential short-term effects from dredging and/or capping operations. Longer-term monitoring (anticipated for 2006) will be developed in coordination with the Agencies considering the results of the baseline, during-, and post-construction monitoring programs. The 2005 post-construction monitoring program called for sediment sampling, sediment surface elevation measurements, bathymetry, water column monitoring, underwater video of the armored cap area (coverage presented in Appendix L), and ecological monitoring, as defined in the Operations Plan (Sevenson, May 2005) and ECN 036 (Appendix G).

2.3.1 Sediment Sampling

2.3.1.1 Monitoring Activities

Sediment sampling was conducted in Work Zones 1 and 2 and the northern and southern near shore areas from November 28-December 1, 2005 following the completion of all in-river ROPS construction activities. A total of 29 cores were collected during this event to assess short-term PCB entrainment in the cap placed following dredging and the thin-layer cap. Cores were collected as follows:

- Eleven cores from Work Zone 1;
- Four cores from Work Zone 2 since dredging in this area was not completed as originally intended;
- Eight cores from the northern near shore area; and
- Six cores from the southern near shore area.

The locations of all sediment cores collected as part of the post-construction monitoring program are presented on Figure A-51.

The majority of the sediment cores were collected using vibracore collection techniques. Three core locations within the near shore area were collected using manual techniques (NS5-N, NS7-N, and NS6-S; Figure A-51) as water depths prohibited use of the vibracore boat. All cores were collected consistent with the protocols described in Section 2.2.1.4.1.

Cores were segmented every 2 in to the cap/native sediment interface (as determined by visual observation) and then 0 to 3 in, 3 to 6 in, 6 to 12 in, and every 6 in thereafter. Core photographs are provided in Appendix N. Samples were submitted to NEA for PCB (Aroclor), TOC, bulk density, and percent moisture analyses. Samples were submitted to CDM Soils Laboratory for grain size analysis. All results were requested on a standard TAT. Samples were handled, packaged, and shipped according to the protocol provided in Attachment VI of the Operations Plan (Sevenson, May 2005). Results were distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report.

2.3.1.2 Summary of Results

Results of the post-construction sampling efforts are summarized by ROPS area below. A complete data package consisting of photographs of the sediment cores post-collection/pre-processing, analytical results for the sediment samples, and vertical distributions of physical and chemical parameters measured in each of the sediment cores is provided in Appendix N.

Main Channel

PCB concentrations measured in each of the sediment cores collected from the main channel (Cores 175 through 779; Figure A-51) are provided in Figures A-52 and A-53. On average, the vibracores contained 42 in (range of 15 to 86 in) of cap material and native sediment. Cap thickness in these cores ranged between 6 and 30 in (average of 18 in). PCB levels in the cap material were generally low (i.e., less than 3 ppm); however, four of the 15 cores (Cores 177, 185, 568, and 610) contained elevated PCB concentrations (26, 13, 55, and 8 ppm, respectively) at the surface of the cap, indicating contaminated material that was in suspension or resuspended during cap placement had settled on top of the cap surface. PCB concentrations at the cap surface in the other 11 cores averaged 0.9 ppm (range of 0.1 to 2.9 ppm). Overall, the average surface PCB concentration for all 15 cores was 7.4 ppm. Elevated PCB concentrations were also observed in the bottom portions of the cap (i.e., sections of the cap immediately above the native sediments), suggesting mixing of the cap material and native sediments occurred during placement.

TOC levels in the cap material were variable ranging from 0.04 to 4.70% with an overall average of 0.72%. Percent solids and bulk density also varied across cores, ranging from 38.1 to 93.2% and 0.6 to 1.7 g/cm^3, respectively.

Northern Near Shore

PCB concentrations measured in each of the eight cores collected from the northern near shore area (Cores NNS-1 through NNS-8; Figure A-51) are provided in Figure A-54. Cores collected from this region contained, on average, 23 in (range of 12 to 38 in) of cap material and native sediment. Cap thickness in six of the eight cores ranged from 5 and 26 in; cap material was not observed in cores NNS-1 and NNS-2. Overall, the average cap thickness for the six cores that contained cap material was 16 in (12 in if all eight cores are considered). PCB concentrations in the cap material were always below 1 ppm, except at the sediment-cap interface in cores

NNS-3 (3.6 ppm), NNS-4 (1.2 ppm) and NNS-8 (5.3 ppm), which may have resulted from the entrainment of contaminated material in suspension in the cap material or the mixing of the cap material and native sediments during placement. PCB concentrations at the cap surface the six cores that contained cap material ranged from non-detect to 0.73 ppm, with an overall average of 0.30 ppm (0.24 ppm if all eight cores are considered).

TOC levels of the cap for the six cores with cap material ranged from 0.17 to 2.00%, with an overall average of 0.85%. Percent solids and bulk density in this material also varied across cores, ranging from 73.1 to 85.8% and 1.0 to 1.6 g/cm^3, respectively.

Southern Near Shore

PCB concentrations measured in each of the six cores collected from the southern near shore area (Cores SNS-1 through SNS-8; Figure A-51) are provided in Figure A-55. Cap thickness in five of the six vibracores collected from the southern near shore ranged from 2 to 6 in; cap material was not observed in cores SNS-2. Overall, the average cap thickness for the five cores that contained cap material was 3.0 in (2.5 in if all six cores are considered). PCB concentrations in the cap material were generally below 1 ppm, and were below detectable limits in many instances. PCB levels at the cap surface for four of the five cores that contained cap material ranged from non-detect to 0.12 ppm, with an overall average of 0.06 ppm. The fifth core that contained cap material (i.e., SNS-4) contained a surface PCB concentration of 3.34 ppm. This core was not included in the surface PCB average for this region because of the unusually high gravel content (18.8%) reported at the surface of the cap; this elevated gravel content is much higher than those measured for other cap material samples (range of 0.2 to 6.7%) and much more consistent with levels observed in native river sediment.

TOC, percent solids and bulk density of the cap were comparable for the four cores that contained cap material (not including SNS-4), averaging 0.5%, 82% and 1.4 g/cm^3, respectively.

2.3.2 Sediment Surface Elevation Measurements and Results

Sediment surface elevation measurements were collected in October and November 2005 both within and outside the targeted dredging/capping areas as part of/ the post-construction monitoring program to measure the depth of material removed and document/confirm the thickness of cap material placed consistent with the procedures used during the 2005 baseline monitoring event as described in Section 2.1.2.1.1 (i.e., elevation measurements obtained by locating the grid node and surveying the water surface elevation via RTK survey techniques and measuring the total water depth). Post-construction sediment surface elevation measurements included collection of measurements outside of the perimeter of the ROPS targeted areas along the existing 25-ft by 25-ft grid (25-ft by 10-ft grid in the side slopes and near shore areas) established during the baseline monitoring events to document final sediment surface elevations at these locations.

Figures A-56 through A-60 illustrate the final sediment surface elevation measurement and grid node location (within and outside of ROPS targeted areas) along with the 2005 baseline elevation post-dredging grid node locations. Similar to the during-construction monitoring, limitations associated with working in a river environment do not allow the ability to return to the exact same location over multiple sampling rounds which may introduce variability in the measurements. Further, the vertical accuracy of the RTK survey equipment is approximately 0.2 ft in the river and the water depth measurements are collected to the nearest 0.1 ft.

2.3.3 Multibeam Bathymetry

2.3.3.1 Monitoring Activities

OSI collected multibeam bathymetry data from the armored cap area during two surveys conducted as part of the ROPS during-construction monitoring activities. The first survey was conducted on September 12-13, 2005; data obtained during this survey were used to define sediment surface elevations prior to cap construction (Figure A-12). The second survey was conducted on October 22, 2005, after completion of cap construction. Sediment surface elevations were measured at a density of approximately one per square ft, resulting in over 80,000 measurements for each survey (see Section 2.2.1.3.1 for additional details).

OSI conducted the last multibeam bathymetry survey on November 18, 2005, after completion of all in-river construction activities, to document the final post-ROPS river bottom topography in the main channel and armored cap areas. Multibeam data were not collected in the northern near shore dredge/cap and southern near shore thin-layer cap areas as the shallow nature of these areas precluded the application of the depth sounding equipment. Bathymetry data were not collected from the armored cap area during this survey as well as the October 22, 2005 multibeam survey described above represented post-construction conditions. The November 18, 2005 survey was conducted using the same equipment and techniques as described in Section 2.2.1.3.1.

2.3.3.2 Summary of Results

A map of the post-capping multibeam elevation measurements for the armored cap area obtained October 22, 2005 is provided in Figure A-61. Comparison of these measurements to the pre-capping conditions indicates that approximately 2,600 cy of materials were placed in the armored cap area (Figure A-62). This volume is less than the 3,800 cy estimated by Sevenson, which was based on the volume of the bucket used during capping and the number of bucket loads of cap material placed. The lower volume estimated via the multibeam surveys qualitatively makes sense, given that: 1) the method used to determine the volume of cap material placed in the river provides only a rough estimate of the cap material volume; 2) consolidation of the cap material and/or native sediment may have occurred between placement and measurement; and 3) there may have been some loss (downstream) of cap material during cap placement. Overall, the post-capping elevation measurements indicate an average cap thickness of 1.89 ft and 1.33 ft in the upstream (with base layer) and downstream (without base layer) halves of the armored cap area.

A map of the post-capping elevation measurements for the main channel dredge area obtained November 18, 2005 is provided in Figure A-63. The most notable observation from this survey is the mottled topography that follows that of the pre-capped condition; this is the result of placing a relatively uniform cap over the variable dredge surface. Comparison of these measurements to the pre-capping conditions indicates that approximately 11,600 cy of materials were placed in the main channel area, representing an average cap thickness of approximately 1.08 ft (Figure A-64). However, on a smaller scale, the post-capping data indicate that about 57% of the work area contained 12 in or more of cap material, and about 41% of the work area contained between 12 and 18 in of cap material. Consolidation of cap material following placement coupled with variability in cap thickness between the manual survey grid node measurements used to verify thickness during construction are likely causes of the observed differences between the multibeam results and manual survey measurements.

The volume estimated from the multibeam surveys is less than the 13,100 cy estimated from operational data (i.e., the volume of the bucket used during capping times the number of bucket loads placed). The lower volume estimated via the multibeam surveys qualitatively makes sense, given that: 1) the method used to determine the volume of cap material placed in the river provides only a rough estimate of the cap material

volume; 2) consolidation of the cap material and/or native sediment may have occurred between placement and measurement; and 3) there may have been some loss (downstream) of cap material during cap placement.

2.3.4 Water Column Monitoring

2.3.4.1 Monitoring Activities

Post-construction water column monitoring was to be conducted one, three, and five weeks after ROPS construction. The first water column monitoring round was conducted November 22, 2005. The water column monitoring rounds planned for three and five weeks after completion of ROPS construction could not be performed due to the onset of winter and unsafe weather conditions, as cold temperatures resulted in ice cover over the river.

The post-construction water column round completed included the collection of water column samples and water quality parameters at ROPS-WCT5, ROPS-WCT14, and ROPS-WC131 (Figure A-14) consistent with the baseline monitoring event (Section 2.1.2.2.1). Water column samples were submitted to the ChemLab for PCB (Aroclor) and TSS analysis. All water column monitoring activities were conducted in accordance with Attachment VI of the Operations Plan (Sevenson, May 2005). Field data obtained during water column monitoring were recorded in PDAs and distributed electronically as described in Section 2 of the main body of this ROPS Documentation Report for inclusion on Form 8A (Appendix H).

2.3.4.2 Summary of Results

PCB, TSS, and turbidity measurements collected during the post-construction monitoring survey were lower than those measured during the ROPS construction activities and consistent with levels measured historically in this stretch of the river. PCB concentrations were below the 0.065 µg/L detection limit (Aroclor) for all locations. TSS and turbidity levels were similar at all locations, ranging from below the detection limit (1.43 mg/L) to 2.0 mg/L and 1.1 to 1.3 NTU, respectively. Overall, these levels are consistent with those typically measured in the fall during the past few years (PCBs - non-detect to 0.066 µg/L; TSS – non-detect to 6.6 mg/L; turbidity – 0.8 to 4.4 NTU [Alcoa, April 2004; Alcoa, April 2005b]).

2.3.5 Underwater Video

On November 22, 2005, underwater video coverage was obtained of the armored cap area along three transects running parallel to river flow. These transects extended the length of the 25-ft by 25-ft grid; specific transect locations are shown on Figure A-65. Video coverage was obtained upstream to downstream with the camera facing downstream. Representative video coverage is provided in Appendix L. In general, the video footage confirms that coverage of the armor stone material was achieved during placement across these transects.

2.3.6 Ecological Monitoring

Post-construction monitoring in the near shore areas was to include fall 2005 benthic community sampling and aquatic habitat characterization consistent with the activities conducted during the baseline monitoring event (Section 2.1.2.4). Fall post-construction data were to be compared to fall 2004 baseline data (collected in September 2004) to potentially reduce seasonal differences and allow for an evaluation of changes due to

construction activities. However, it was not feasible to collect the post-dredging/capping benthic samples as construction activities were not completed until late fall 2005 and samples would not have been collected until late November or early December when environmental conditions would have been different from September. As a result, it is anticipated that the first post-dredging/capping benthic sampling event will occur in spring 2006.

2.4 SRS Resident Fish Monitoring

2.4.1 Monitoring Activities

As part of the annual Grasse River SRS trend monitoring program (which was not part of the ROPS), the fall resident fish sampling was performed between August 29 and September 21, 2005 in accordance with the 2005 Monitoring Work Plan (Alcoa, March 2005). Sampling efforts were conducted in the Massena Power Canal and four stretches of the lower Grasse River: Background; Upper; Middle; and Lower (Figure A-66) for adult (≥ 25 centimeters [cm]) smallmouth bass (*Micropterus dolomieui*) and adult (≥ 25 cm) brown bullhead (*Ictalurus nebulosus*). In addition, young-of-year (YOY; <6.5 cm) spottail shiner (*Notropis hudsonius*) samples were collected from each of four locations within the Study Area: near Outfall 001; near the Unnamed Tributary; at the mouth of the river; and within the Background Stretch. In total, 144 fish samples (not including QA/QC samples) were submitted to NEA for analysis of PCB (Aroclor) and lipids.

2.4.2 Summary of Results

Results of the 2005 resident fish trend monitoring study are provided in Tables A-11 and A-12, and presented graphically in Figure A-67. A discussion of these results is provided by species below.

Smallmouth Bass

Lipid-normalized PCB levels exhibit a distinct spatial trend; PCB levels were near or below the detection limit in the Background Stretch, highest in the Upper Stretch (where ROPS-related activities occurred) and decline with distance downstream (Figure A-67, panel d). Average lipid-normalized PCB concentrations were 604, 566, and 488 ppm in the Upper, Middle, and Lower Stretches, respectively. However, the overlapping error bars (i.e., 95th percentile confidence limits) indicate that differences across locations are not statistically significant. The average lipid-normalized PCB concentration in smallmouth bass from the Power Canal averaged about 182[10] ppm, about 2.5 to 3.3 times lower than those from the Grasse River proper.

On a wet-weight basis, average PCB concentrations in smallmouth bass were highest in the Upper Stretch (4.02 ppm, range of 0.93 to 12.00 ppm) and similar in the Middle (5.19 ppm, range of 2.99 to 8.81 ppm) and Lower Stretches (4.85 ppm, range of 2.46 to 12.40 ppm; Figure A-67, panel a). Overlapping error bars representing the 95th percentile confidence limits indicate that these differences are not statistically significant. PCB levels in 2 of the 5 smallmouth bass samples from the Background Stretch were below detection (about 0.05 ppm); detectable PCB levels in the other three samples averaged 0.1 ppm (range of 0.11 to 0.12 ppm). The average PCB concentration in smallmouth bass from the Power Canal was 0.6 ppm wet, with levels ranging from below detection to 1.6 ppm.

[10] One smallmouth bass sample from the Power Canal was excluded from the lipid-normalized average due to extremely low lipid content of the sample (0.05%).

Brown Bullhead

Similar to the trend observed in the smallmouth bass, lipid-normalized PCB levels were lowest in the Background Stretch, highest in the Upper Stretch and decline with distance downstream (Figure A-67, panel e). The average lipid-normalized PCB levels were 741, 516, and 381 ppm in Upper, Middle, and Lower Stretches, respectively.

Average wet-weight PCB concentrations were highest in the Upper Stretch (15.13 ppm, range of 2.48 to 25.50 ppm) and declined with distance downstream (10.48 ppm, range of 2.76 to 15.10 ppm in the Middle Stretch; 8.58 ppm, range of 3.36 to 16.00 ppm in the Lower Stretch; Figure A-67, panel b). Four of the five samples collected from the Background Stretch were near or below the detection limit; one sample (FS1-142-BB) contained a PCB concentration of 0.36 ppm, about three times higher than any other bullhead collected from this stretch. The overall average PCB concentration for bullhead from this region was 0.2 ppm.

YOY Spottail Shiner

Similar to both smallmouth bass and brown bullhead, PCB levels in spottail shiners were highest downstream of the ROPS area (i.e., 422 ppm, near the Unnamed Tributary) and declined to the River Mouth (250 ppm; Figure A-67, panel f). Shiner samples collected upstream of the ROPS area had lower average PCB concentrations (3 ppm and 194 ppm in the Background Stretch and at Outfall 001, respectively).

On a wet-weight basis, PCB concentrations in YOY spottail shiner from near the Unnamed Tributary averaged 19.53 ppm (range of 18.60 to 20.30 ppm) and declined to about 9.14 ppm (range of 8.87 to 9.48 ppm) at the River Mouth. PCB levels in the Background Stretch and near Outfall 001 averaged 0.15 (range of 0.13 to 0.17 ppm) and 7.0 ppm (range of 5.54 to 7.84 ppm), respectively.

The fish PCB data for 2005 are unique in that increases relative to recent years occur for all species and all locations. Natural variability is substantial and the historical record includes other examples of year-to-year increases, but no other examples in which increases occurred in all cases. The presumed ROPS-related increases can be given context by comparison to the changes in fish PCB concentrations following the 1995 dredging in the vicinity of Alcoa's Outfall 001, which removed about 2,600 cy of sediment that contained some of the highest PCB concentrations measured in the river. The fish sampled in 1995 about 1 to 2 months after the dredging was completed had PCB levels similar to those measured the year before; most were slightly lower, a few were slightly higher. Between 1995 and 2004, PCB levels have exhibited a downward trend. In fact, in several instances, the PCBs measured in 2004 were the lowest on record (Alcoa, April 2005c). This historic decline was not interrupted by the 2003 ice jam scour event, which moved considerable sediment from an area of the river comparable in size to Work Zone 1; the fish sampled in 2003 about 5 months after the ice jam scour had PCB levels similar to those measured the year before. The increases in 2005 associated with ROPS-related PCB releases provide the only clearly identifiable interruption to this historic downward trend.

3. References

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Tables

Table A-1
Environmental Data Library for ROPS-related Monitoring Results

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Survey	Component	Data Table in Appendix B	Other [1]
2003	Multibeam bathymetry surveys	---	Draft CCLGR Addendum
2004 Baseline	Probing/elevation measurements	sed_probe_ROPS	2004 ROPS Baseline Report
	Sediment sampling	sed_aro_ROPS, sed_char_ROPS	
	Water column monitoring	water_aro_ROPS, water_field_ROPS	
	River flow and stage measurements	ChaseMills_ROPS	
	Geotechnical investigation	---	
	Ecological monitoring	benthic_comm_ROPS, fish_comm_ROPS, veg_aquatic_ROPS, veg_floodplain_ROPS	
2005 Baseline	Probing/elevation measurements	sed_probe_ROPS	---
	Water column monitoring	water_aro_ROPS, water_field_ROPS	IQAT Form 8A in Appendix H
	River flow and stage measurements	ChaseMills_ROPS	---
	Air monitoring	air_field, air_realtime_PM10, air_realtime_VOC, air_lab	IQAT Forms 2A thru 2C, 8B & 8C in Appendix H
	Ecological monitoring	benthic_comm_ROPS	Appendix A
During-Construction	Probing/elevation measurements	sed_probe_ROPS	---
	Multibeam bathymetry surveys	---	Appendix O
	OSI Velocity Surveys	---	Appendix P
	Sediment sampling	sed_aro_ROPS, sed_char_ROPS	Appendix N; IQAT Form 3A in Appendix H
	Water column monitoring	water_aro_ROPS, water_field_ROPS	IQAT Form 8A in Appendix H
	River flow and stage measurements	ChaseMills_ROPS	---
	Air monitoring	air_field, air_realtime_PM10, air_realtime_VOC, air_lab	IQAT Forms 2A thru 2C, 8B & 8C in Appendix H
	Ex-situ dredge material sampling	dredge_material_ROPS	IQAT Form 9B in Appendix H
	Effluent discharge monitoring	treated_effluent_discharge_lab_ROPS	IQAT Form 8D in Appendix H
	Geotube sampling	geotube_study_ROPS	Appendix K
	Cap material sampling	cap_material_ROPS	IQAT Form 4 in Appendix H; Appendix J
Post-Construction	Sediment sampling	sed_aro_ROPS, sed_char_ROPS	Appendix N
	Probing/elevation measurements	sed_probe_ROPS	---
	Multibeam bathymetry surveys	---	Appendix O
	Water column monitoring	water_aro_ROPS, water_field_ROPS	IQAT Form 8A in Appendix H
	Ecological monitoring [2]	---	---

Notes:
1. Draft CCLGR Addendum - Alcoa, April 2004; 2004 ROPS Baseline Report - Alcoa, April 2005b; all others refer to 2005 ROPS Documentation Report
2. The post-construction ecological monitoring event was not conducted because ROPS construction was not completed until late fall and thus, would have delayed sample collection until late November/early December when environmental conditions differ from those in September, the month when the 2004 baseline samples were collected. It is anticipated that the first post-dredging/capping benthic sampling event will occur in spring 2006.

Table A-2
ROPS Data Quality Objectives and Monitoring Components

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Overall Data Quality Objective[1]	Monitoring Objective[1]	Monitoring Component[1,2]
ALL COMPONENTS		
Develop refined understanding of the pre-construction physical and chemical conditions within the river areas targeted for possible dredging and/or capping (i.e., main channel, side slopes, near shore areas)	Determine pre-construction sediment depths and/or elevations in all targeted areas	Manual probing/sediment elevation measurements (baseline)
	Document spatial and vertical distributions of PCBs, TOC, bulk density, and grain size in sediments within targeted dredging areas	Sediment core/grab sample collection (baseline)
Determine system-wide impacts of construction activities, if any, on PCB levels in the water column and fish	Document the spatial and temporal variations in water column PCB concentrations and compare to data collected from previous years	Routine water column PCB monitoring (SRS program - 2005)
	Document the spatial and temporal variations in fish tissue PCB concentrations and compare to data collected from previous years	Routine resident fish trend monitoring (SRS program - fall 2005)
DREDGING COMPONENT		
Quantify the downstream transport of PCBs that occurs as a result of dredging activities	Compute net PCB flux transported to lower river during dredging activities	Water column monitoring at upstream, local, and downstream sampling locations (during construction)
Determine PCB levels and sediment volumes that remain after dredging	Determine post-dredging PCB levels and sediment elevations (to estimate volumes)	Manual probing/sediment elevation measurements (baseline, during construction)
	Compare post-dredging sediment PCB concentrations to pre-dredging conditions	Sediment core collection (during construction, post construction)
Assess the relationship between local conditions and post-dredging PCB residual concentrations to the extent possible	Determine post-dredging sediment elevations and PCB concentrations and compare to river bottom characteristics, pre-dredging PCB concentration profiles, other operational parameters	Manual probing/sediment elevation measurements (baseline, during construction)
		Sediment core collection (baseline, during construction)
Determine the effectiveness of post-dredging capping as a means to isolate PCB-containing residual sediment	Determine post-capping PCB concentration profiles in residual sediments/cap	Manual probing/sediment elevation measurements (baseline, during construction, post construction)
	Compare profiles to post-production dredging PCB levels	Sediment core collection (post construction)
Determine impacts of dredging activities, if any, on PCB concentrations in the air	Compare during-construction PCB concentrations in air to baseline conditions	Air monitoring (baseline, during construction)

Table A-2
ROPS Data Quality Objectives and Monitoring Components

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Overall Data Quality Objective[1]	Monitoring Objective[1]	Monitoring Component[1,2]
ARMORED CAP COMPONENT		
Determine the ability of the native sediments to support an armored cap designed to withstand the forces (observed during the 2003 event) imposed by water flowing under an ice jam	Compare post-construction cap surface elevations to pre-capping conditions	Sediment elevation measurements (baseline, during construction, post construction)
	Further evaluate geotechnical properties of sediments in relation to armor cap design	Geotechnical core collection (baseline)
Assess impacts of capping activities, if any, on the downstream transport of PCBs in the water column	Compare during-construction PCB concentrations in water to baseline conditions	Water column monitoring at upstream, local and downstream sampling locations (during construction)
NEAR SHORE AREA COMPONENT		
Quantify the downstream transport of PCBs that occurs as a result of dredging activities and assess impacts of capping activities, if any, on the water column	Compute net PCB flux transported to lower river during dredging activities and compare during-construction PCB concentrations in water to baseline conditions	Water column monitoring at upstream, local and downstream sampling locations (during construction)
Determine the ability of thin-layer capping to isolate PCB-containing sediments in the near shore areas	Compare post-construction cap surface elevations to pre-capping conditions	Sediment elevation measurements (baseline, during construction, post construction)
	Determine vertical PCB profiles in sediment cores and compare to pre-capping conditions	Sediment core collection (post construction)
Document changes in habitat caused by dredging or thin-layer capping in near shore areas	Assess post-construction invertebrate community study results (RBP metrics) and compare to pre-construction conditions	Invertebrate community assessment (baseline, post construction)
	Assess post-construction habitat characteristics and compare to pre-construction conditions	Habitat characterization (baseline, post construction)
Evaluate sedimentation rates in near shore areas of the river	Estimate deposition rates from vertical concentration profiles of PCBs and/or cesium-137	High-resolution sediment core collection (baseline)
	Compare deposition rates to those estimated for main channel samples	
Determine impacts of dredging activities, if any, on PCB concentrations in the air	Compare during-construction PCB concentrations in air to baseline conditions	Air monitoring (baseline, during construction)

Notes:
1. A longer-term monitoring program is being developed in coordination with the Agencies pending the results of the monitoring components identified above. This program will be initiated in 2006.
2. In addition to the monitoring components listed above, cap material, water treatment effluent, and dredge material stockpile sampling were performed. Also, meteorological conditions were obtained during construction, as possible.

PCB = polychlorinated biphenyl
RBP = Rapid Bioassessment Protocol
SRS = Supplemental Remedial Studies
TOC = total organic carbon

Table A-3
2004/2005 ROPS Data Collection Summary

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Media	Number of Sampling Events	Number of Locations	Number of Samples or Measurements [1]	Analyses
2004 BASELINE MONITORING				
Sediment Cores	1	44	318	PCBs, bulk density, moisture content, TOC, grain size
Sediment Elevation/Probing Measurements [2]	2 grid elevation 1 upstream survey/probing	1,156 probing 1,427 elevation 273 probing 557 elevation	1,274 probing 2,850 elevation 273 probing 557 elevation	---
Geotechnical Investigation [3]	1	2	4	Moisture content, grain size, USCS classification, direct shear, standard penetration
Ecological [4]	1	45	53	Invertebrate species composition and biomass, grain size, TOC
2005 BASELINE MONITORING				
Sediment Elevation/ Probing Measurements	1	1,163 probing 1,435 elevation	1,163 probing 1,435 elevation	---
Water Column	2	3 transects	6	PCBs, TSS
Air	3 1	6 6	18 6	PCBs PAHs, PM_{10}, VOCs
Ecological	1	18	18	Invertebrate species composition and biomass, grain size, TOC
2005 DURING-CONSTRUCTION MONITORING				
Water Column [5]	129	up to 3 transects up to 15 local locations	867	PCBs, TSS
Sediment Elevation/ Probing Measurements [6]	continuous	752	continuous	---
Sediment Cores [7]	2 northern near shore 6 main channel	16 northern near shore 94 main channel	16 northern near shore 680 main channel	PCBs, bulk density, moisture content, TOC, grain size
Air [8]	36	up to 7 locations	86 12 18	PCBs PAHs, PM_{10} VOCs
Ex-Situ Dredge Material [9]	32	2	64 56 58	PCBs TOC grain size
Water Treatment Effluent [10]	outfall discharge internal processing	1 4	108 20	pH, TSS, TDS, PCBs, full suite PCBs, TSS
Geotube Sampling [11]	4 Geotube filtrate 11 Geotube sediment 4 Combined filtrate	4 12 ports 4	4 14; 78 4; 1	PCBs, TSS PCBs; percent solids PCBs, TSS; full suite
Cap Material [12]	8	1	8	TOC and grain size
2005 POST-CONSTRUCTION MONITORING				
Sediment Cores	1	29	314	PCBs, bulk density, moisture content, TOC, grain size
Sediment Elevation Measurements	1	389	389	---
Water Column	1	3 transects	3	PCBs, TSS

Table A-3
2004/2005 ROPS Data Collection Summary

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Notes:

1. Count does not include QA/QC samples (i.e., duplicates and matrix spike/matrix spike duplicates). Count does not include replicates of the same samples analyzed for various parameters.
2. Two rounds of measurements were conducted along the grid, with each round including both probing and elevation measurements; the number of measurements include those from both rounds.
3. Moisture content, grain size, and USCS classification analyses were performed on all 4 samples, SPT was performed on the 2 borings locations (which included all sample intervals).
4. Ecological monitoring includes benthic community sampling and aquatic habitat characterization.
5. Water column monitoring was performed at select transects and local monitoring locations depending on the construction activity. The number of transects and local water column locations represents the total number of each monitoring location. If stratification was present, samples were collected above and below the demarcation of stratification (i.e., 2 samples). Turbidity measurements (and other parameters) were collected during water column sampling and on other days as requested by the Agencies (e.g., air curtain use, movement of scows, etc.) as described in Section 2.
6. Sediment elevation/probing measurements were conducted continuously to provide real-time information during construction activities. The number of probing and elevation measurements represents the total number of locations within the targeted ROPS areas.
7. Sediment cores were collected during multiple events. The number of locations represents the total number of cores collected. Two additional sediment core collection events were completed with cores visually observed (i.e., no samples submiitted for laboratory analysis).
8. Air monitoring included the collection of high volume samples for PCBs daily (transitioning to weekly) during intrusive activities, PAHs and PM_{10}, and VOCs during three events. Dust monitoring also occurred daily and total VOC monitoring occurred during the three events where high volume samples were collected for VOCs using real-time monitoring via meters.
9. The filter cake and sand ex-situ material dredge piles were sampled via three grab samples composited into one and submitted initially for PCB analysis only; ECN 009 Revision #1 and Revision #2 resulted in TOC and grain size analysis later in the sampling program.
10. Dredge return water monitoring included collection of samples from the outfall discharge and during the wastewater treatment process (internal processing). Full suite of analyses included total aluminum, total cyanide, total fluoride, and individual PAH analyses. The effluent flow rate was also monitored during days when the outfall was in operation (~daily).
11. Geotube monitoring included collection of filtrate and sediment samples from each of the four Geotubes, and the combined filtrate (sump). Geotube sediment was collected from three ports along each Geotube. Full suite of analyses included total cyanide, pH, fluoride, and SPDES permit analyses.
12. The cap material pile was sampled via three grab samples composited into one and submitted for TOC and grain size analysis.

ECN = Engineering Change Notice
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
PM_{10} = particulate matter less than 10 microns
QA/QC = quality assurance/quality control
ROPS = Remedial Options Pilot Study
SPDES = State Pollutant Discharge Elimination System
SPT = Standard Penetration Test
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
USCS = Unified Soil Classification System
VOCs = volatile organic compounds

Table A-4
2005 Baseline Ecological Monitoring - Percent Benthic Abundance by Order Taxa

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

	Area:	**Northern Near Shore**							**Southern Near Shore**							**Upstream Control**							
																North Near Shore				**South Near Shore**			
	Collection Date:	**5/11/05**							**5/11/05**							**5/11/05**				**5/11/05**			
	Sample Location:	**NSNB-1**	**NSNB-2**	**NSNB-3**	**NSNB-4**	**NSNB-5**	**NSNB-6**	**Average**	**NSSB-1**	**NSSB-2**	**NSSB-3**	**NSSB-4**	**NSSB-5**	**NSSB-6**	**Average**	**NSCON-1**	**NSCON-2**	**NSCON-3**	**Average**	**NSCON-4**	**NSCON-5**	**NSCON-6**	**Average**
Percent Abundance (Order Taxa)	Ephemeroptera	0	0	1	15	0	1	3	17	2	0	3	14	9	8	1	1	3	2	9	0	6	5
	Odonata	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	4	5	0	3
	Megaloptera	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0
	Coleoptera	7	3	4	7	26	26	12	28	10	14	14	27	3	16	16	5	6	9	9	35	38	27
	Trichoptera	0	1	4	4	2	0	2	6	0	10	0	0	1	3	1	2	2	2	0	0	0	0
	Diptera	83	68	60	72	53	31	61	17	61	62	56	55	65	53	76	80	76	77	65	50	50	55
	Hydracarina	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
	Isopoda	0	0	0	0	0	0	0	6	0	0	17	0	7	5	0	4	0	1	0	0	0	0
	Amphipoda	0	4	1	0	0	1	1	0	10	10	6	0	7	5	0	0	3	1	0	0	0	0
	Turbellaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nematoda	0	1	0	0	0	1	0	0	2	0	1	0	2	1	0	1	0	0	0	0	0	0
	Oligochaeta	10	22	16	0	8	26	14	28	15	5	0	0	3	8	4	5	6	5	4	10	6	7
	Hirudinea	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gastropoda	0	1	5	1	6	10	4	0	0	0	0	0	2	0	0	0	3	1	0	0	0	0
	Pelecypoda	0	0	8	1	4	4	3	0	0	0	0	0	0	0	0	0	0	0	9	0	0	3

Note:
1. Locations are shown on Figure A-17.

Table A-5
2005 Baseline Ecological Monitoring - Benthic Metrics

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

		Area:	**Northern Near Shore**							**Southern Near Shore**							**Upstream Control**							
																	North Near Shore				**South Near Shore**			
		Collection Date:	**5/11/05**							**5/11/05**							**5/11/05**				**5/11/05**			
		Sample Location:	**NSNB-1**	**NSNB-2**	**NSNB-3**	**NSNB-4**	**NSNB-5**	**NSNB-6**	**Average**	**NSSB-1**	**NSSB-2**	**NSSB-3**	**NSSB-4**	**NSSB-5**	**NSSB-6**	**Average**	**NSCON-1**	**NSCON-2**	**NSCON-3**	**Average**	**NSCON-4**	**NSCON-5**	**NSCON-6**	**Average**
Benthic Metrics	Abundance	Total Organisms	29	161	134	169	85	108	114	18	41	21	87	22	117	51	68	81	344	164	23	20	16	20
		Biomass (mg)	17	136	237	104	116	227	140	148	54	38	123	56	376	133	213	289	407	303	262	622	239	374
	Richness	Number of Taxa	11	17	23	21	16	18	18	13	17	10	17	12	22	15	12	19	28	20	12	8	6	9
		Diversity Index	3.2	3.0	3.9	3.4	3.3	3.4	3.4	3.5	3.7	3.0	3.2	3.3	3.6	3.4	2.7	3.5	3.5	3.2	3.2	2.6	2.1	2.6
	Tolerance	Tolerance Index	6.9	7.4	6.7	6.3	6.5	7.2	6.8	6.8	6.5	6.5	6.7	6.2	6.6	6.6	7.2	6.9	6.7	6.9	5.6	6.9	5.9	6.1
	Feeding Guild	% Filterer	14	3	32	38	22	7	19	0	5	14	8	18	34	13	6	32	34	24	26	10	0	12
		% Gatherer	52	57	36	37	38	56	46	72	76	60	43	55	35	57	34	28	23	28	54	45	94	64
		% Predator	10	6	17	17	22	10	14	11	7	24	16	14	9	14	15	19	13	15	9	25	6	13
		% Scraper	0	32	7	5	7	19	12	17	2	0	31	14	18	14	43	16	29	29	9	15	0	8
		% Shredder	24	1	7	3	11	7	9	0	5	2	1	0	1	2	3	4	1	3	2	5	0	2
		% Piercer	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
		% Parasite	0	1	0	0	0	1	0	0	2	0	1	0	2	1	0	1	0	0	0	0	0	0
	Organism Habit	% Burrower	41	55	46	26	31	35	39	44	32	62	17	14	15	31	29	25	14	23	17	15	63	32
		% Climber	24	4	32	38	27	11	23	0	11	0	0	19	32	10	7	33	30	24	4	0	0	1
		% Swimmer	0	4	2	0	0	1	1	0	11	10	8	5	7	7	0	0	3	1	4	0	0	1
		% Clinger	21	35	15	15	36	44	28	39	19	19	52	43	24	33	59	28	42	43	26	65	38	43
		% Sprawler	14	2	6	21	6	8	10	17	27	10	23	19	23	20	4	14	10	9	48	20	0	23

Note:
1. Locations are shown on Figure A-17.

mg = milligram (wet weight)
% = percent

Table A-6
2005 Baseline Ecological Monitoring - Benthic Taxa and Species Counts

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

			Area:	Northern Near Shore						Southern Near Shore						Upstream Control					
																North Near Shore			South Near Shore		
			Collection Date:	5/11/05						5/11/05						5/11/05			5/11/05		
			Sample Location:	NSNB-1	NSNB-2	NSNB-3	NSNB-4	NSNB-5	NSNB-6	NSSB-1	NSSB-2	NSSB-3	NSSB-4	NSSB-5	NSSB-6	NSCON-1	NSCON-2	NSCON-3	NSCON-4	NSCON-5	NSCON-6
Invertebrate Species	**Tolerance Value**	**Feeding Guild**	**Organism Habit**	**Number of Organisms**																	
INSECTA																					
EPHEMEROPTERA																					
Caenis amica	6	Gatherer	Sprawler				7		1	2	1		2		7			10			
Caenis latipennis	6	Gatherer	Sprawler			1	18							2	4						
Hexagenia sp.	6	Gatherer	Burrower							1			1	1		1	1		1		1
Leptophlebia sp.	4	Gatherer	Swimmer																1		
ODONATA																					
Coenagrionidae	8	Predator	Climber												1						
Dromogomphus spinosus	4	Predator	Burrower																	1	
Enallagma sp.	8	Predator	Climber														1	4			
Epicordulia princeps	NA	Predator	Climber																1		
Ischnura sp.	9	Predator	Climber			1															
MEGALOPTERA																					
Sialis sp.	4	Predator	Burrower											1							
COLEOPTERA																					
Berosus sp.	5	Gatherer	Swimmer											1							
Dubiraphia sp.	6	Gatherer	Clinger	2	5	5	12	22	28	3	2	3	11	5	3	11	4	20	2	7	6
Haliplus sp.	5	Piercer	Climber								1										
Optioservus sp.	4	Scraper	Clinger							1			1					1			
Promoresia sp.	2	Scraper	Clinger								1										
Stenelmis sp.	5	Scraper	Clinger							1					1						
TRICHOPTERA																					
Hydroptila sp.	6	Piercer	Clinger				1														
Micrasema sp.	2	Shredder	Clinger															1			
Oecetis sp.	5	Predator	Clinger				3			1							2	2			
Phylocentropus sp.	5	Filterer	Burrower		1	2	3	2				2			1	1		4			
Polycentropus sp.	6	Predator	Clinger			3															
DIPTERA																					
Ablabesmyia sp. 1	8	Predator	Sprawler		2	3			3		1	1									
Ceratopogoninae	6	Predator	Burrower	1	5	12	16	14	5	1	2	3	12		7	7	8	18			
Chironomus sp.	10	Gatherer	Burrower		2											7	5				
Cladopelma sp.	9	Gatherer	Burrower	4			12						2								
Cladotanytarsus sp.	5	Gatherer	NA			3	1														
Clinotanypus sp.	8	Predator	Burrower		2							1									
Coelotanypus sp.	4	Predator	Burrower											1							1
Cricotopus bicinctus	7	Scraper	Clinger				1														
Cricotopus sp.	7	Shredder	Clinger																	1	
Cryptochironomus sp.	8	Predator	Sprawler			1												4			
Demicryptochironomus sp.	8	Gatherer	Burrower														1				1
Diamesa sp.	5	Gatherer	Sprawler																7		
Dicrotendipes sp.	8	Gatherer	Burrower		2	8	3		1						1	1	1	7			
Hydrobaenus sp.	8	Scraper	Sprawler																2		
Microtendipes sp.	6	Filterer	Clinger					1			1	1	3		3		2	16	1	2	
Nanocladius sp.	7	Gatherer	Sprawler						1												
Orthocladius/Cricotopus sp.	6.5	Gth/Shrd	Sprawler									1	1		3		3		1		
Unid. Orthocladiinae	5	Gatherer	Burrower	1																	
Pagastiella sp.	7	Gatherer	NA			1		2			4			1							
Paracladopelma sp.	7	Gatherer	Sprawler											1							
Parakiefferiella sp.	4	Gatherer	Sprawler								7							4			
Paralauterborniella sp.	8	Gatherer	Clinger			1	1	1			3			1	1		2	7			
Paratendipes sp.	6	Gatherer	Burrower		40					1	4	6			4						
Phaenopsectra sp.	7	Scraper	Clinger		50	3	5	1	9	1			26	3	18	29	13	88		3	
Polypedilum sp	6	Shredder	Climber	7	2	10	5	9	8		2					2	2	4			
Procladius sp.	9	Predator	Sprawler	2		3	8	4	3					1	3	3	4	16		4	
Psectrocladius sp.	8	Gatherer	Sprawler	2									1								
Pseudochironomus sp.	5	Gatherer	Burrower	3		6	8														6
Simulium sp.	5	Filterer	Clinger	4									4						3		

Table A-6
2005 Baseline Ecological Monitoring - Benthic Taxa and Species Counts

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

			Area:	Northern Near Shore						Southern Near Shore						Upstream Control					
																North Near Shore			South Near Shore		
			Collection Date:	5/11/05						5/11/05						5/11/05			5/11/05		
			Sample Location:	NSNB-1	NSNB-2	NSNB-3	NSNB-4	NSNB-5	NSNB-6	NSSB-1	NSSB-2	NSSB-3	NSSB-4	NSSB-5	NSSB-6	NSCON-1	NSCON-2	NSCON-3	NSCON-4	NSCON-5	NSCON-6
Invertebrate Species	**Tolerance Value**	**Feeding Guild**	**Organism Habit**	**Number of Organisms**																	
Stempellina sp.	4	Gatherer	Sprawler				1														
Tabanus sp.	5	Predator	Sprawler																1		
Tanypus sp.	10	Predator	Sprawler				1														
Tanytarsus sp.	6	Filterer	Climber		4	30	59	13	4		1			4	36	3	24	96			
HYDRACARINA																					
Arrenurus sp.	NA	Predator	Swimmer										1								
Oxus sp.	NA	Predator	Swimmer										1								
CRUSTACEA																					
ISOPODA																					
Caecidotea sp.	8	Gatherer	Sprawler							1			15		8		3	1			
AMPHIPODA																					
Gammarus pseudolimnaeus	4	Gatherer	Swimmer								1		2		1						
Hyalella azteca	8	Gatherer	Swimmer		7	2			1		3	2	3		7			10			
TURBELLARIA																					
Girardia sp.	NA	Predator	Swimmer															1			
NEMATODA																					
Unid. Nematoda	5	Parasite	Sprawler		1				1		1		1		2		1				
ANNELIDA																					
OLIGOCHAETA																					
Enchytraeidae	10	Gatherer	Burrower		1																
Limnodrilus sp.	10	Gatherer	Burrower	1	19	3		1	6	1						1	1	6		1	1
Megadrili	6	Gatherer	Burrower			3				1					1			3	1	1	
Quistadrilus sp.	10	Gatherer	Burrower															1			
Tasserkidrilus sp.	10	Gatherer	Burrower					2	3												
Unid. Immature Tubificidae w/ Capilliform Chaetae	10	Gatherer	Burrower						1							2		3			
Unid. Immature Tubificidae w/o Capilliform Chaetae	10	Gatherer	Burrower	2	16	15		4	18	3	6	1			3		3	6			
HIRUDINEA																					
Helobdella fusca	8	Predator	Sprawler					1													
MOLLUSCA																					
GASTROPODA																					
Amnicola limosa	5	Scraper	Clinger		2	7	2	5	11									9			
Gyraulus sp.	8	Scraper	Clinger												2			1			
PELECYPODA																					
Sphaerium sp.	6	Filterer	Burrower			11	2	3	4									1	2		
Total Organisms				29	161	134	169	85	108	18	41	21	87	22	117	68	81	344	23	20	16
Biomass (mg)				17	136	237	104	116	227	148	54	38	123	56	376	213	289	407	262	622	239

Notes:

1. Locations are shown on Figure A-17.
2. Tolerance Value designations are from the *Quality Assurance Work Plan for Biological Stream Monitoring in New York State* (NYSDEC, June 2002) and/or *Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish* (USEPA, July 1999).
3. Feeding Guild and Organism Habit designations are from the *Quality Assurance Work Plan for Biological Stream Monitoring in New York State* (NYSDEC, June 2002), *An Introduction to the Aquatic Insects of North America* (Merritt and Cummins, 1996), *Ecology and Classification of North American Freshwater Invertebrates* (Thorp and Covich, 1991), and *Feeding of Freshwater Invertebrates* (Monakov, June 2003).

References:

Merritt, R.W. and K.W. Cummins, 1996. *An Introduction of the Aquatic Insects of North America*. Dubuque, Iowa: Kendall/Hunt Publishing Company.

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New York State Department of Environmental Conservation (NYSDEC), June 2002. *Quality Assurance Work Plan for Biological Stream Monitoring in New York State*. Stream Biomonitoring Unit, Division of Water.

Thorp, J.H. and A.P. Covich, 1991. *Ecology and Classification of North American Freshwater Invertebrates*. San Diego, California: Academic Press, Inc.

USEPA. July 1999. *Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. EPA 841-B-99-002.

NA = not available/applicable

mg = milligram (wet weight)

Table A-7
2005 Baseline Ecological Monitoring - Grain Size and TOC Results

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Area	Collection Date	Sample Location	Grain Size (percent by mass)							TOC (%)
			Gravel		Sand			Silt	Clay	
			Coarse	Fine	Coarse	Medium	Fine			
Northern Near Shore	5/11/05	NSNB-1	0	0.1	0.4	3.2	41.6	48.9	5.8	1.9
		NSNB-2	0	2	4.6	9.6	69.6	12.8	1.4	3.2
		NSNB-3	0	0.1	0.1	3.2	76.3	17.1	3.2	1.6
		NSNB-4	0	7.7	2.3	8.2	64	14.6	3.2	2.3
		NSNB-5	0	2.6	2.9	10.8	44.3	38.4	1	2.1
		NSNB-6	0	8.6	7.5	18.3	55.2	9	1.4	0.87
Southern Near Shore	5/11/05	NSSB-1	0	6.2	1.1	6.5	40.3	42.3	3.6	0.68
		NSSB-2	49.1	8.4	1.9	4.9	20.4	13	2.3	1.5
		NSSB-3	0	16.1	7.2	10.3	38.8	20.4	7.2	2.0
		NSSB-4	31.4	7.3	1.5	8.8	28.7	19.1	3.2	1.7
		NSSB-5	34.9	13	5.5	9.8	23.4	13.4	0	1.3
		NSSB-6	0	5.4	5	11.3	48	27.7	2.6	1.1
Upstream Control Northern Near Shore	5/11/05	NSCON-1	0	1.5	2.5	4.3	73.3	15.6	2.8	1.1
		NSCON-2	0	6.3	5	15.3	59.8	10	3.6	0.69
		NSCON-3	0	2.6	2.8	11.8	71.9	7.6	3.3	1.1
Upstream Control Southern Near Shore	5/11/05	NSCON-4	0	5	1.7	8	48.3	33.9	3.1	1.2
		NSCON-5	0	0.4	2.4	10.8	33.2	47.9	5.3	1.0
		NSCON-6	0	0.9	1.6	28.8	21.1	32.7	14.9	0.58

Note:
1. Locations are shown on Figure A-17.

TOC = total organic carbon
% = percent

Table A-8
2005 Baseline Ecological Monitoring - Water Quality Measurements

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Area	Collection Date	Sample Location	Water Depth (ft)	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Water Temperature (C)	Secchi Depth (ft)	Velocity (ft/s)
Northern Near Shore	5/11/05	NSNB-1	1.3	7.64	0.172	30.2	12.57	22.03	1.3	0.06
	5/11/05	NSNB-2	2.9	7.30	0.200	7.1	15.87	21.69	1.9	-0.08
	5/11/05	NSNB-3	1.8	7.63	0.181	25.5	14.43	21.33	1.8	0.08
	5/11/05	NSNB-4	1.7	7.66	0.162	28.4	14.31	21.44	1.7	0.11
	5/11/05	NSNB-5	2.3	7.47	0.179	13.6	14.05	21.46	2.3	0.13
	5/11/05	NSNB-6	1.8	7.68	0.172	17.6	14.42	21.59	1.8	0.15
Southern Near Shore	5/11/05	NSSB-1	1.9	6.97	0.151	70.7	14.37	20.08	1.9	0.14
	5/11/05	NSSB-2	2.5	6.74	0.146	68.1	13.80	20.45	2.2	0.03
	5/11/05	NSSB-3	2.6	6.74	0.140	37.5	13.83	20.51	2.3	0.11
	5/11/05	NSSB-4	3.5	6.78	0.165	42.7	13.81	20.27	2.1	0.06
	5/11/05	NSSB-5	3.0	6.46	0.170	11.2	12.80	20.35	2.4	0.21
	5/11/05	NSSB-6	4.0	6.35	0.134	7.2	13.76	20.22	3.0	0.17
Upstream Control Northern Near Shore	5/11/05	NSCON-1	2.1	7.57	0.132	10.7	14.12	21.54	2.1	0.07
	5/11/05	NSCON-2	3.8	7.30	0.135	20.7	14.57	21.86	3.1	0.05
	5/11/05	NSCON-3	2.4	7.82	0.138	30.4	14.98	21.78	2.4	0.24
Upstream Control Southern Near Shore	5/11/05	NSCON-4	1.7	6.75	0.138	20.4	14.61	21.30	1.7	0.07
	5/11/05	NSCON-5	1.9	7.35	0.136	24.7	14.74	21.37	1.8	0.26
	5/11/05	NSCON-6	2.1	7.20	0.135	17.3	14.47	21.43	2.1	0.13

Notes:
1. Locations are shown on Figure A-17.
2. Water quality measurements taken within one foot of river bottom.
3. Secchi depth is an alternate measure of turbidity (i.e., the greatest depth at which a Secchi disk can be seen).
4. Eddies (caused by shoreline shape and/or structure) resulted in a change in current direction (i.e., opposite to that of the positive reading) which results in a negative velocity reading on the flow meter; the magnitude of the velocity is accurate.

C = degrees Celsius
ft = feet
ft/s = feet per second
mg/L = milligrams per liter
NTU = Nephelometric Turbidity Unit
mS/cm = milliSiemens per centimeter

Table A-9
During-Construction Water Column Sample Summary[1]

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
5/25/2005	Main channel silt curtain installation	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Water was turbid near the shoreline due to wind. Additional turbidity measurements were obtained at ROPS-WCT5, ROPS-WCT14, and ROPS-WC131 throughout the day during main channel silt curtain installation.
5/26/2005	Main channel silt curtain installation	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
5/27/2005	Main channel silt curtain installation/dredging preparation	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
5/28/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - holiday weekend.
5/29/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - holiday weekend.
5/30/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - holiday weekend.
5/31/2005	Main channel silt curtain installation/dredging preparation	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
6/1/2005	Main channel silt curtain installation/dredging preparation	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
6/2/2005	Main channel silt curtain installation/dredging preparation	1	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131.
6/3/2005	Main channel silt curtain installation/dredging preparation	1	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131.
6/4/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - weekend.
6/5/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
6/6/2005	Dredging preparation; initial dredging activities in Work Zone 1	1	2	2	1	2	--	2	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14, ROPS-WC131, D2, and D4. Stratification was also present at D1 below 0.8 times the total water column depth sampling interval.
6/7/2005	Dredging preparation; silt curtain repair/repositioning (no active dredging)	1	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14 and ROPS-WC131.
6/8/2005	Initial dredging activities in Work Zone 2 (isolated instance)	1	2	2	--	1	2	2	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14, ROPS-WC131, D3, and, D4. Stratification was also present at D2 below 0.8 times the total water column depth sampling interval.
6/9/2005	Continued initial dredging in Work Zone 2	1	2	2	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14 and ROPS-WC131.
6/10/2005	Debris removal in Work Zone 1	1	2	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14 and ROPS-WC131. Additional turbidity measurements were obtained at ROPS-WCT5, ROPS-WCT14, ROPS-WC131, D1, D2, D3, and D4 throughout the day during debris removal activities.
6/11/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
6/12/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.

Table A-9
During-Construction Water Column Sample Summary[1]

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
6/13/2005	Debris removal in Work Zone 1 and limited dredging in Work Zone 2	1	2	2	1	1	1	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14 and ROPS-WC131. Stratification was also present at D4 below 0.8 times the total water column depth sampling interval. Additional turbidity measurements were obtained at ROPS-WCT5, ROPS-WCT14, ROPS-WC131, D1, D2, D3, and D4 throughout the day during debris removal activities.
6/14/2005	Debris removal and dredging in Work Zone 1	1	1	2	1	1	--	2	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131 and D4. Stratification was also present at D2 below 0.8 times the total water column depth sampling interval. Additional turbidity measurements were obtained at ROPS-WCT5, ROPS-WCT14, ROPS-WC131, D1, D2, D3, and D4 throughout the day during debris removal activities and scow transport.
6/15/2005	Debris removal and dredging in Work Zone 1	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131. Stratification was also present at D4 below 0.8 times the total water column depth sampling interval. Additional turbidity measurements were obtained at ROPS-WCT5, ROPS-WCT14, ROPS-WC131, D1, D2, D3, and D4 throughout the day during debris removal and dredging activities.
6/16/2005	Debris removal and dredging in Work Zone 1	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131. Stratification was also present at D4 below 0.8 times the total water column depth sampling interval. Additional turbidity measurements were obtained at D0 during scow transport.
6/17/2005	Dredging in Work Zone 1	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131. Additional volume of water collected at D2, D4, ROPS-WCT14, and ROPS-WC131 for filtered PCB analysis. Additional turbidity measurements were obtained at D0 during scow transport.
6/18/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No water column sampling - weekend.
6/19/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
6/20/2005	Dredging in Work Zone 1 and mechanical removal in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Additional volume of water collected at D2, D4, ROPS-WCT14, and ROPS-WC131 for filtered PCB analysis.
6/21/2005	Dredging in Work Zone 1 and mechanical removal in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Water was turbid near the shoreline due to wind.

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
6/22/2005	Dredging in Work Zone 1 and mechanical removal in northern near shore	1	1	1	1	1	--	1	--	--	--	1	1	1	--	--	--	--	Additional volume of water collected at D2, D4, D5, D6, D7, ROPS-WCT14, and ROPS-WC131 for filtered PCB analysis. Additional turbidity measurements were obtained at D0 during scow transport.
6/23/2005	Dredging in Work Zone 1 and mechanical removal in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Additional turbidity measurements were obtained at D0 during scow transport.
6/24/2005	Dredging in Work Zone 1 and mechanical removal in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
6/25/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - weekend.
6/26/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - weekend.
6/27/2005	Dredging activity in Work Zone 2 at time of sampling; dredging and debris removal in Work Zone 1	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	
6/28/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
6/29/2005	Dredging in Work Zone 1 and mechanical removal in northern near shore; some dredging in Work Zone 2 later in day (after sampling)	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131.
6/30/2005	Dredging in Work Zone 2 and mechanical removal in northern near shore	1	2	2	1	1	1	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14 and ROPS-WC131.
7/1/2005	Dredging in Work Zone 2	1	2	2	--	1	2	2	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14, ROPS-WC131, D3, and D4. Dredged Work Zone 2 overnight, no work performed since 0700 on 7/1/05.
7/2/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - holiday weekend.
7/3/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - holiday weekend.
7/4/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - holiday weekend.
7/5/2005	Dredging in Work Zone 1	1	2	2	1	2	--	2	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WCT14, ROPS-WC131, D2, and D4.
7/6/2005	Dredging in Work Zone 1	1	1	2	1	1	--	2	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131 and D4.
7/7/2005	Dredging and debris removal in Work Zone 1	1	1	2	1	1	--	1	--	--	--	1	1	1	--	--	--	--	Stratification present at ROPS-WC131. D5, D6, and D7 sampled to obtain data within and outside the silt curtain setup.
7/8/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131 below 0.8 times the total water column depth sampling interval.
7/9/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
7/10/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
7/11/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	

Table A-9
During-Construction Water Column Sample Summary[1]

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Grasse River Study Area, Massena, New York

Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
7/12/2005	Dredging and debris removal in Work Zone 1; dredging in Work Zone 2 later in day (after sampling)	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Divers working on the perimeter of the silt curtain.
7/13/2005	Anticipated dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	No work during the day on 7/13/05 due to severe weather.
7/14/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/15/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/16/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
7/17/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
7/18/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/19/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/20/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Divers working in the vicinity of D4.
7/21/2005	Dredging and debris removal in Work Zone 1 and dredging in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
7/22/2005	Dredging in Work Zone 2 and debris removal in Work Zone 1	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
7/23/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
7/24/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
7/25/2005	Dredging and debris removal in Work Zone 1	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131.
7/26/2005	Dredging and debris removal in Work Zone 1	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131.
7/27/2005	Dredging and debris removal in Work Zone 1 and mechanical removal in northern near shore	1	1	2	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Stratification present at ROPS-WC131.
7/28/2005	Mechanical removal in northern near shore and dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/29/2005	Mechanical removal in northern near shore and dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/30/2005	Equipment maintenance in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
7/31/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
8/1/2005	Debris removal and dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/2/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
8/3/2005	Debris removal and dredging in Work Zone 1 and dredging in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/4/2005	Debris removal in Work Zone 1 and dredging in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/5/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/6/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - weekend.
8/7/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
8/8/2005	Dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/9/2005	Dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/10/2005	Dredging in Work Zone 1 and dredging in Work Zone 2 later in day (after sampling)	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/11/2005	Debris removal and dredging in Work Zone 2 and limited dredging in Work Zone 1 at night (after sampling)	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/12/2005	Dredging in Work Zone 1 and Work Zone 2 later in the day (after sampling)	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/13/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
8/14/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
8/15/2005	Dredging and debris removal in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/16/2005	Dredging and debris removal in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Dredging stopped at 0530 due to mechanical problems and did not continue until after water column sampling was completed.
8/17/2005	Dredging in Work Zone 1 and mechanical removal in the northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/18/2005	Dredging in Work Zone 2, limited mechanical removal in northern near shore and dredging in Work Zone 1 later in day (after sampling)	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/19/2005	Dredging in Work Zone 1, dredging and removal in Work Zone 2, and mechanical removal in northern near shore	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/20/2005	Debris removal in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/21/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
8/22/2005	Dredging in Work Zone 1 and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/23/2005	Dredging in Work Zone 1 and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/24/2005	Dredging in Work Zone 1 and debris removal in Work Zone 2 (after sampling)	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
8/25/2005	Dredging in Work Zone 1 and dredging and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/26/2005	Dredging in Work Zone 1 and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/27/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
8/28/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - weekend.
8/29/2005	Dredging in Work Zone 1 and dredging and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/30/2005	Dredging in Work Zone 1 and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
8/31/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	In-river construction delayed due to wind gusts and heavy rain.
9/1/2005	Dredging in Work Zone 1 and dredging and debris removal in Work Zone 2	1	1	1	1	1	1	1	--	--	--	--	--	--	--	--	--	--	
9/2/2005	Overnight dredging in Work Zone 1 (from 9/1 to 9/2/05)	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	No debris removal or dredging during the day due to high river flows and damage to silt curtains.
9/3/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction due to high river flows and damage to silt curtains.
9/4/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction due to high river flows and damage to silt curtains.
9/5/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction as silt curtain damage was being repaired from high flow event.
9/6/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction as silt curtain damage was being repaired from high flow event.
9/7/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction as silt curtain damage was being repaired from high flow event.
9/8/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction as silt curtain damage was being repaired from high flow event during the day; initiation of dredging at night.
9/9/2005	Dredging and debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/10/2005	Debris removal in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
9/11/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
9/12/2005	Dredging and debris removal in Work Zone 1 and capping in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/13/2005	Dredging and debris removal in Work Zone 1 and capping in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/14/2005	Dredging in Work Zone 1 and capping in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/15/2005	Dredging in Work Zone 1 and capping in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/16/2005	Dredging in Work Zone 1 and capping in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/17/2005	Capping in northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
9/18/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
9/19/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction due to high river flows and damage to silt curtains.
9/20/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction due to high river flows and damage to silt curtains.
9/21/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction due to high river flows and damage to silt curtains.
9/22/2005	Divers repairing the silt curtain	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	No construction due to high river flows and damage to silt curtains.
9/23/2005	Capping in armored cap area	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	No dredging due to high river flows and damage to silt curtains.
9/24/2005	Capping in armored cap area	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	
9/25/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - Sunday.
9/26/2005	Capping in armored cap area and dredging in Work Zone 1 at night (after sampling)	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	
9/27/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
9/28/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
9/29/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	Capping began at 0740 and was shut down at 0810 due to rain.
9/30/2005	Capping in armored cap area	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	No dredging due to silt curtain repair.

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
10/1/2005	Capping in armored cap area	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	No dredging due to silt curtain repair.
10/2/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
10/3/2005	Capping in armored cap area and dredging in Work Zone 1 at night (after sampling)	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	
10/4/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	Both hydraulic and mechanical dredging were conducted in Work Zone 1.
10/5/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	Both hydraulic dredging and mechanical removal were conducted in Work Zone 1.
10/6/2005	Dredging in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	Both hydraulic dredging and mechanical removal were conducted in Work Zone 1.
10/7/2005	Dredging equipment maintenance in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	
10/8/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No in-river construction - weekend.
10/9/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - weekend.
10/10/2005	Dredging in Work Zone 1 and capping in armored cap area	1	2	2	1	1	--	1	--	1	1	--	--	--	--	--	--	--	Both hydraulic dredging and mechanical removal were conducted in Work Zone 1. Two water column rounds were conducted, the first round included ROPS-WCT5, ROPS-WCT14, ROPS-WC131, D1, D2, and D4 and was conducted approximately two hours after initiation of work in Work Zone 1; the second round included ROPS-WCT14, ROPS-WC131, C2, and C3 and was conducted after the initiation of capping in the armored cap area in the afternoon.
10/11/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	Both hydraulic dredging and mechanical removal were conducted in Work Zone 1.
10/12/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
10/13/2005	Dredging and debris removal in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
10/14/2005	Dredging and debris removal in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
10/15/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	Dredging discontinued at ~0800 due to torn curtains and inclement weather conditions.
10/16/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
10/17/2005	Capping in armored cap area	--	1	1	--	--	--	--	--	1	1	--	--	--	--	--	--	--	No dredging due to silt curtain repair.
10/18/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
10/19/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
10/20/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	--	--	--	--	
10/21/2005	Dredging in Work Zone 1 and capping in armored cap area	1	1	1	1	1	--	1	--	1	1	--	--	--	1	1	--	--	Location D8 and D9 monitored to assess conditions during dredging/capping.
10/22/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Additional turbidity measurements were obtained at ROPS-WCT5 and US-1 throughout the day during main channel capping activities with the air curtain installed per ECN 024.
10/23/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
10/24/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Additional turbidity measurements were obtained at ROPS-WCT5 and US-1 throughout the day during main channel capping activities with the air curtain installed per ECN 024.
10/25/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Additional turbidity measurements were obtained at ROPS-WCT5 and US-1 throughout the day during main channel capping activities with the air curtain installed per ECN 024.
10/26/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9, and D10 throughout the day during main channel capping activities with the air curtain installed.
10/27/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9, and D10 throughout the day during main channel capping activities with the air curtain installed.
10/28/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	1	1	1	--	Two water column rounds were conducted, the first round included ROPS-WCT5, ROPS-WCT14, ROPS-WC131, D2, D3, and D4; the second round included D8, D9, and D10 to monitor during capping with the air curtain in place. Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9, and D10 throughout the day during main channel capping activities with the air curtain installed.

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
10/29/2005	Capping in Work Zone 2	1	1	1	--	1	1	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9, and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
10/30/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
10/31/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/1/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/2/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/3/2005	Capping in Work Zone 1 and northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/4/2005	Capping in Work Zone 1 and northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/5/2005	Capping in Work Zone 1 and northern near shore	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/6/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.

Table A-9
During-Construction Water Column Sample Summary[1]

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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																	Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]							
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
11/7/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/8/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/9/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	--	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Locations D8, D9, and D10 monitored during capping with the air curtain in place.
11/10/2005	Capping in Work Zone 1	1	1	1	1	1	--	1	--	--	--	--	--	--	1	1	1	1	Additional turbidity measurements were obtained at ROPS-WCT5, US-1, D8, D9 and D10 throughout the day during main channel capping activities with the air curtain installed. Samples collected per ECN 035 to assess water column conditions prior to silt curtain removal.
11/11/2005	Demobilization of dredging-related equipment in Work Zones 1 and 2	1	--	--	--	--	--	--	--	--	--	--	--	--	1	1	1	1	Samples collected per ECN 035 to assess water column conditions prior to silt curtain removal.
11/12/2005	No construction activities	2	1	1	--	--	--	--	--	--	--	--	--	--	1	1	1	1	Two water column rounds were conducted, the first round included ROPS-WCT5, D8, D9, D10, and D11; the second round included ROPS-WCT5, ROPS-WCT14, and ROPS-WC131 to assess water quality for removal of silt curtain per ECN 035. The second round of samples were not analyzed because results of the 11/11/05 samples were acceptable for silt curtain removal.
11/13/2005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No construction - Sunday.
11/14/2005	Main channel silt curtain removal	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
11/15/2005	Capping southern near shore	1	1	1	--	--	--	--	1	--	--	--	--	--	--	--	--	--	
11/16/2005	Capping southern near shore	1	1	1	--	--	--	--	1	--	--	--	--	--	--	--	--	--	

Table A-9
During-Construction Water Column Sample Summary[1]

Remedial Options Pilot Study Documentation Report
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Date	Construction Activity[2] at the Time of Sampling	Number of Samples Collected at Each Water Column Sampling Location[3,4,8,9]																Comments
		Transect[5,6]			Perimeter Local[6,7]							Interior Local[6,7]						
		ROPS-WCT5	ROPS-WCT14	ROPS-WC131	D1	D2	D3	D4	C1	C2	C3	D5	D6	D7	D8	D9	D10	D11	
11/17/2005	Capping southern near shore and initiate pulling main channel silt curtain system anchors	1	1	1	--	--	--	--	1	--	--	--	--	--	--	--	--	--	
11/18/2005	Removal of remaining main channel silt curtain system anchors	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	

Notes:
1. Table provides all water column sampling conducted during ROPS construction activities (i.e., does not include baseline and post-construction events). Monitoring conducted per the protocol described in Appendix VI of the Operations Plan (Sevenson, May 2005).
2. Field crews determined water column sampling locations based on construction activities at the time of sampling (typically late morning). The construction activity description provided herein includes the description provided by field crews during sampling supplemented with information from Daily Construction Reports (Form 10; Appendix H) and Daily Field and Quality Control Reports (Appendix F.06).
3. All samples submitted to the Alcoa Massena ChemLab for TSS and PCB (Aroclor) analyses unless otherwise indicated.
4. Sample locations provided on Figure A-14. Locations D0 and US-1 were only monitored for turbidity.
5. Samples collected at transects were composite samples composed of 9 grab samples obtained from 3 locations (north shore, center channel, south shore) at 3 depths (0.2, 0.5, and 0.8 times the total water column depth). Stratification was checked at the center sampling station (as described in note 6). Turbidity, dissolved oxygen, temperature, pH, and conductivity measurements were obtained at each sampling depth at the center channel location.
6. If stratification was present based on measurement of temperature and conductivity every 2 feet in the water column, sampling was altered such that grab samples from above and below the demarcation of stratification were composited separately (i.e., total of 2 samples) and analyzed.
7. Samples at the local locations (perimeter and interior) were composite samples of 3 grab samples (0.2, 0.5, and 0.8 times the total water column depth). Stratification was checked at each location (as described in note 6). Turbidity, dissolved oxygen, temperature, pH and conductivity measurements were obtained at each sampling depth at each location. Samples were collected at each local location based on the construction activity being performed.
8. Sample results are provided on the Daily Water Column Summary (Form 8A) in Appendix H.
9. Number of samples presented on the table does not include field or laboratory quality assurance/quality control samples.

Reference:
Sevenson. May 2005. *Remedial Options Pilot Study Operations Plan*.

ECN = Engineering Change Notice
PCB = polychlorinated biphenyl
ROPS = Remedial Options Pilot Study
TSS = total suspended solids

Table A-10
During-Construction Air Monitoring Sample Summary[1]

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Date		Air Monitoring Station [2,3]							Comments [4,5]
(Set)	(Retrieved)	#1	#2	#3	#4	#5	#6	SLF	
6/6/05	6/7/05	--	--	--	--	--	--	--	DustTrak data obtained.
6/7/05	6/8/05	--	--	--	--	--	--	--	DustTrak data obtained.
6/8/05	6/9/05	--	--	--	--	--	--	--	DustTrak data obtained.
6/9/05	6/10/05	--	--	--	--	--	--	--	DustTrak data obtained.
6/10/05	6/11/05	--	--	--	--	--	--	--	DustTrak data obtained.
6/11/05	6/12/05	--	--	--	--	--	--	--	No air monitoring.
6/12/05	6/13/05	--	--	--	--	--	--	--	No air monitoring.
6/13/05	6/14/05	--	--	--	--	--	--	--	DustTrak data obtained.
6/14/05	6/15/05	X	X	--	--	X	--	---	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/15/05	6/16/05	--	--	X	X	X	--	---	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/16/05	6/17/05	--	--	X	X	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/17/05	6/18/05	X	X	--	--	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/18/05	6/19/05	--	--	--	--	--	--	--	No air monitoring.
6/19/05	6/20/05	--	--	--	--	--	--	--	No air monitoring.
6/20/05	6/21/05	--	--	X	X	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/21/05	6/22/05	--	--	X	X	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/22/05	6/23/05	X	X	X	X	X	X	--	Samples submitted for PCB, PAH, VOC, PM_{10} analysis. DustTrak and PID data obtained. Samples set/retrieved at #1-#6.
6/23/05	6/24/05	--	--	X	X	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/24/05	6/25/05	--	--	X	X	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/25/05	6/26/05	--	--	--	--	--	--	--	No air monitoring.
6/26/05	6/27/05	--	--	--	--	--	--	--	No air monitoring.
6/27/05	6/28/05	--	--	X	X	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/28/05	6/29/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/29/05	6/30/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #1-#6.
6/30/05	7/1/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #1-#6.
7/1/05	7/2/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #1-#6.
7/2/05	7/3/05	--	--	--	--	--	--	--	No air monitoring.
7/3/05	7/4/05	--	--	--	--	--	--	--	No air monitoring.
7/4/05	7/5/05	--	--	--	--	--	--	--	No air monitoring.
7/5/05	7/6/05	--	--	--	--	X	--	--	Sample submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
7/6/05	7/7/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/7/05	7/8/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/8/05	7/9/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/9/05	7/10/05	--	--	--	--	--	--	--	No air monitoring.
7/10/05	7/11/05	--	--	--	--	--	--	--	No air monitoring.
7/11/05	7/12/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/12/05	7/13/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/13/05	7/14/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/14/05	7/15/05	X	X	X	X	X	X	--	Samples submitted for PCB, PAH, VOC, PM_{10} analysis. DustTrak and PID data obtained. Samples set/retrieved at #1-#6.

Table A-10
During-Construction Air Monitoring Sample Summary[1]

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Date		Air Monitoring Station [2,3]							Comments [4,5]
(Set)	(Retrieved)	#1	#2	#3	#4	#5	#6	SLF	
7/15/05	7/16/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/16/05	7/17/05	--	--	--	--	--	--	--	No air monitoring.
7/17/05	7/18/05	--	--	--	--	--	--	--	No air monitoring.
7/18/05	7/19/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/19/05	7/20/05	--	--	--	X	--	--	--	Sample submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
7/20/05	7/21/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/21/05	7/22/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/22/05	7/23/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/23/05	7/24/05	--	--	--	--	--	--	--	No air monitoring.
7/24/05	7/25/05	--	--	--	--	--	--	--	No air monitoring.
7/25/05	7/26/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/26/05	7/27/05	--	--	--	X	--	--	--	Samples submitted for PCB (#4 only) and VOC (all locations) analysis. DustTrak and PID data obtained.
7/27/05	7/28/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/28/05	7/29/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/29/05	7/30/05	--	--	--	--	--	--	--	DustTrak data obtained.
7/30/05	7/31/05	--	--	--	--	--	--	--	No air monitoring.
7/31/05	8/1/05	--	--	--	--	--	--	--	No air monitoring.
8/1/05	8/2/05	--	--	--	--	--	--	--	DustTrak data obtained.
8/2/05	8/3/05	--	--	--	--	--	--	--	DustTrak data obtained.
8/3/05	8/4/05	--	--	--	--	--	--	--	DustTrak data obtained.
8/4/05	8/5/05	--	--	--	X	--	--	--	Sample submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
8/5/05	8/6/05	--	--	--	--	--	--	--	DustTrak data obtained.
8/6/05	8/7/05	--	--	--	--	--	--	--	No air monitoring.
8/7/05	8/8/05	--	--	--	--	--	--	--	No air monitoring.
8/8/05	8/9/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/9/05	8/10/05	--	--	X	X	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
8/10/05	8/11/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/11/05	8/12/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/12/05	8/13/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1, #3, and SLF.
8/13/05	8/14/05	--	--	--	--	--	--	X	Sample submitted for PCB analysis. Location #3 not submitted due to malfunction with high volume sampler equipment. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/14/05	8/15/05	--	--	--	--	--	--	--	No air monitoring.
8/15/05	8/16/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/16/05	8/17/05	--	--	X	X	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
8/17/05	8/18/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/18/05	8/19/05	--	--	--	--	--	--	X	Sample submitted for PCB analysis. Location #3 not submitted due to malfunction with high volume sampling equipment. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/19/05	8/20/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #1, #3, and SLF.
8/20/05	8/21/05	--	--	--	--	--	--	--	DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/21/05	8/22/05	--	--	--	--	--	--	--	No air monitoring.

Table A-10
During-Construction Air Monitoring Sample Summary[1]

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Date		Air Monitoring Station [2,3]							Comments [4,5]
(Set)	(Retrieved)	#1	#2	#3	#4	#5	#6	SLF	
8/22/05	8/23/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/23/05	8/24/05	--	--	X	X	--	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
8/24/05	8/25/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/25/05	8/26/05	--	--	--	--	--	--	--	Samples held for potential PCB analysis based on evaluation of initial 2-weeks of data. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
8/26/05	8/27/05	--	--	--	--	--	--	--	DustTrak data obtained.
8/27/05	8/28/05	--	--	--	--	--	--	--	No air monitoring.
8/28/05	8/29/05	--	--	--	--	--	--	--	No air monitoring.
8/29/05	8/30/05	--	--	--	--	--	--	--	DustTrak data obtained.
8/30/05	8/31/05	X	--	X	--	X	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
8/31/05	9/1/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/1/05	9/2/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/2/05	9/3/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/3/05	9/4/05	--	--	--	--	--	--	--	No air monitoring.
9/4/05	9/5/05	--	--	--	--	--	--	--	No air monitoring.
9/5/05	9/6/05	--	--	--	--	--	--	--	No air monitoring.
9/6/05	9/7/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/7/05	9/8/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/8/05	9/9/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/9/05	9/10/05	--	--	X	X	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
9/10/05	9/11/05	--	--	--	--	--	--	--	
9/11/05	9/12/05	--	--	--	--	--	--	--	No air monitoring.
9/12/05	9/13/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/13/05	9/14/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
9/14/05	9/15/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/15/05	9/16/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/16/05	9/17/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/17/05	9/18/05	--	--	--	--	--	--	--	No air monitoring.
9/18/05	9/19/05	--	--	--	--	--	--	--	No air monitoring.
9/19/05	9/20/05	--	--	--	--	--	--	--	No air monitoring.
9/20/05	9/21/05	--	--	--	--	--	--	--	No air monitoring.
9/21/05	9/22/05	--	--	--	--	--	--	--	No air monitoring.
9/22/05	9/23/05	--	--	--	--	--	--	--	No air monitoring.
9/23/05	9/24/05	--	--	--	--	--	--	--	No air monitoring.
9/24/05	9/25/05	--	--	--	--	--	--	--	No air monitoring.
9/25/05	9/26/05	--	--	--	--	--	--	--	No air monitoring.
9/26/05	9/27/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/27/05	9/28/05	--	--	--	X	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
9/28/05	9/29/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/29/05	9/30/05	--	--	--	--	--	--	--	DustTrak data obtained.
9/30/05	10/1/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/1/05	10/2/05	--	--	--	--	--	--	--	No air monitoring.
10/2/05	10/3/05	--	--	--	--	--	--	--	No air monitoring.
10/3/05	10/4/05	--	--	--	--	--	--	--	DustTrak data obtained.

Table A-10
During-Construction Air Monitoring Sample Summary[1]

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Date		Air Monitoring Station [2,3]							Comments [4,5]
(Set)	(Retrieved)	#1	#2	#3	#4	#5	#6	SLF	
10/4/05	10/5/05	--	--	--	X	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
10/5/05	10/6/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/6/05	10/7/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/7/05	10/8/05	--	--	--	--	--	--	--	No air monitoring.
10/8/05	10/9/05	--	--	--	--	--	--	--	No air monitoring.
10/9/05	10/10/05	--	--	--	--	--	--	--	No air monitoring.
10/10/05	10/11/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/11/05	10/12/05	X	--	--	--	X	--	--	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
10/12/05	10/13/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/13/05	10/14/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/14/05	10/15/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/15/05	10/16/05	--	--	--	--	--	--	--	No air monitoring.
10/16/05	10/17/05	--	--	--	--	--	--	--	No air monitoring.
10/17/05	10/18/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/18/05	10/19/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/19/05	10/20/05	--	--	--	X	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #1-#6.
10/20/05	10/21/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/21/05	10/22/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/22/05	10/23/05	--	--	--	--	--	--	--	No air monitoring.
10/23/05	10/24/05	--	--	--	--	--	--	--	No air monitoring.
10/24/05	10/25/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/25/05	10/26/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/26/05	10/27/05	--	--	X	--	--	--	--	Sample submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
10/27/05	10/28/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/28/05	10/29/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/29/05	10/30/05	--	--	--	--	--	--	--	DustTrak data obtained.
10/30/05	10/31/05	--	--	--	--	--	--	--	No air monitoring.
10/31/05	11/1/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/1/05	11/2/05	--	--	X	--	--	--	X	Samples submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
11/2/05	11/3/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/3/05	11/4/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/4/05	11/5/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/5/05	11/6/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/6/05	11/7/05	--	--	--	--	--	--	--	No air monitoring.
11/7/05	11/8/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/8/05	11/9/05	--	--	--	X	--	--	--	Sample submitted for PCB analysis. DustTrak data obtained. Samples set/retrieved at #3 and SLF.
11/9/05	11/10/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/10/05	11/11/05	--	--	--	--	--	--	--	DustTrak data obtained.
11/11/05	11/12/05	--	--	--	--	--	--	--	DustTrak data obtained.

Notes:
1. Table provides all air montioring conducted during ROPS construction activities (i.e., does not include baseline and post-construction events). Monitoring conducted per the protocol described in Appendix VI of the *Operations Plan* (Sevenson, May 2005), *Community Health and Safety Plan* (Alcoa, April 2005), and *Additional Air Monitoring Activities Associated with the Operation of Secure Landfill Cell* (Alcoa, June 2005).
2. Sample locations provided on Figure A-15.
3. "X" indicates sample submitted for analysis.
4. All samples submitted for PCB analysis unless otherwise indicated. All analyses conducted by Con-Test Analytical Laboratories.
5. Sample results are provided on the Air Monitoring Data Summary - Expanded Sampling Event and Continuous Air Monitoring Data Summary (Form 8B and 8C, respectively) in Appendix H.

References:

Alcoa. April 2005. *Remedial Options Pilot Study Community Health and Safety Plan*.
Alcoa. June 2005. *Additional Air Monitoring Activities Associated with the Operation of Secure Landfill Cell 3*.
Sevenson. May 2005. *Remedial Options Pilot Study Operations Plan*.

DustTrak = DuskTrak meter
PAH = polyc polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PID = photoionization detector
PM_{10} = particulate matter less than 10 microns
ROPS = Remedial Options Pilot Study
SLF = Alcoa's Secure Landfill
VOC = volatile organic compound

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Table A-11
2005 Resident Fish Trend Monitoring Study
Adult Resident Fish Collection Field and Laboratory Data - Smallmouth Bass and Brown Bullhead

Sample Area	Species	Sample ID	Date Collected	Length (cm)	Weight (g)	Lipid (%)	PCB (ppm wet)	PCB (ppm lipid)
Background Stretch	Smallmouth bass	FS1-147-SB	9/1	34.1	561	1.84	0.11	6
		FS1-148-SB	9/1	27.2	266	1.47	0.11	7
		FS1-149-SB	9/1	25.5	244	0.89	ND	11
		FS1-150-SB	9/1	29.7	363	2.19	0.12	5
		FS1-151-SB	9/1	37.6	871	2.23	ND	4
	Brown bullhead	FS1-142-BB	9/1	26.7	276	0.63	0.36	57
		FS1-143-BB	9/1	23.4	158	0.71	0.06	9
		FS1-144-BB	9/1	25.0	227	0.87	0.12	13
		FS1-145-BB	9/1	24.8	219	0.91	0.06	6
		FS1-146-BB	9/1	20.9	130	0.09	ND	---
Upper Stretch	Smallmouth bass	FS2-245-SB	8/30	32.1	433	0.81	0.93	115
		FS2-246-SB	8/30	30.9	411	0.60	1.12	188
		FS2-247-SB	8/30	35.1	539	0.99	8.36	841
		FS2-248-SB	8/30	28.2	310	0.81	0.72	89
		FS2-249-SB	8/30	29.0	351	0.83	0.98	118
		FS2-250-SB	8/30	41.5	1032	1.77	7.47	422
		FS2-251-SB	8/30	29.7	395	0.83	1.93	232
		FS2-252-SB	8/30	33.2	531	0.85	4.60	542
		FS2-253-SB	8/30	27.2	308	0.53	2.62	495
		FS2-254-SB	8/30	33.9	597	0.77	4.86	628
		FS2-255-SB	8/30	29.4	355	0.56	5.87	1052
		FS2-256-SB	8/30	25.2	218	0.22	4.61	2105
		FS2-257-SB	8/30	26.2	217	0.45	1.01	222
		FS2-258-SB	8/30	30.0	348	0.65	7.11	1096
		FS2-259-SB	8/30	32.4	557	0.51	2.19	434
		FS2-260-SB	8/30	39.3	782	0.46	1.99	434
		FS2-261-SB	8/30	40.7	999	0.96	12.00	1253
	Brown bullhead	FS2-248-BB	8/30	31.4	487	1.49	6.37	428
		FS2-249-BB	8/30	25.8	251	1.45	8.18	564
		FS2-250-BB	8/30	31.9	455	1.16	23.60	2034
		FS2-251-BB	8/30	31.8	435	1.47	7.26	494
		FS2-252-BB	8/30	35.0	651	2.72	2.48	91
		FS2-253-BB	8/30	32.7	499	2.50	21.10	844
		FS2-254-BB	8/30	31.6	405	2.11	22.00	1043
		FS2-255-BB	8/30	32.4	423	2.09	15.10	722
		FS2-256-BB	8/30	28.1	280	1.39	9.72	699
		FS2-257-BB	8/30	32.6	482	1.73	12.60	728
		FS2-258-BB	8/30	30.0	450	3.94	25.50	647
		FS2-259-BB	8/30	29.3	392	2.49	21.10	847
		FS2-260-BB	8/30	31.2	427	1.87	18.80	1005
		FS2-261-BB	8/30	30.0	441	3.05	23.80	780
		FS2-262-BB	8/30	31.0	396	1.66	9.90	596
		FS2-263-BB	8/30	33.3	554	4.04	13.80	342
		FS2-264-BB	8/30	30.7	407	3.15	19.30	613
		FS2-265-BB	8/30	31.5	389	1.36	11.70	860

notes provided on page 3 of 3

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Table A-11
2005 Resident Fish Trend Monitoring Study
Adult Resident Fish Collection Field and Laboratory Data - Smallmouth Bass and Brown Bullhead

Sample Area	Species	Sample ID	Date Collected	Length (cm)	Weight (g)	Lipid (%)	PCB (ppm wet)	PCB (ppm lipid)
Middle Stretch (Cont'd)	Smallmouth bass (Cont'd)	FS3-249-SB	8/29	27.7	294	0.93	8.81	943
		FS3-250-SB	8/29	29.2	338	1.11	5.43	489
		FS3-251-SB	8/29	29.0	364	0.37	3.27	886
		FS3-252-SB	8/29	25.0	204	0.95	5.48	577
		FS3-253-SB	8/29	26.0	255	1.02	6.17	605
		FS3-254-SB	8/29	31.2	461	0.95	2.99	315
		FS3-255-SB	8/29	32.5	457	0.84	3.21	382
		FS3-256-SB	8/29	31.6	507	1.07	7.35	687
		FS3-257-SB	8/29	30.5	415	0.82	3.75	458
		FS3-258-SB	8/29	32.1	493	0.93	4.33	468
		FS3-259-SB	8/29	41.8	1028	0.99	5.03	508
		FS3-260-SB	8/29	38.0	857	1.27	7.77	612
		FS3-261-SB	8/30	34.2	652	0.91	4.64	509
		FS3-262-SB	8/30	28.5	331	0.81	3.84	473
		FS3-263-SB	8/30	32.4	506	1.28	7.62	595
		FS3-264-SB	8/30	28.2	306	0.60	3.36	562
		FS3-265-SB	8/30	34.1	561	0.95	5.22	547
	Brown bullhead	FS3-249-BB	8/29	31.1	464	3.54	12.10	342
		FS3-250-BB	8/29	30.1	332	0.82	2.76	336
		FS3-251-BB	8/29	29.2	361	2.73	13.60	498
		FS3-252-BB	8/29	28.9	328	2.88	14.60	507
		FS3-253-BB	8/29	28.2	332	2.08	9.06	436
		FS3-254-BB	8/29	35.3	652	1.93	14.10	731
		FS3-255-BB	8/29	30.9	419	1.92	7.69	401
		FS3-256-BB	8/29	32.8	552	3.69	15.10	409
		FS3-257-BB	8/29	29.5	363	2.38	13.90	584
		FS3-258-BB	8/29	30.1	381	1.21	5.36	443
		FS3-259-BB	8/29	32.4	605	2.52	10.90	433
		FS3-260-BB	8/29	31.0	451	2.71	13.40	494
		FS3-261-BB	8/29	31.6	456	0.99	6.03	610
		FS3-262-BB	8/29	30.8	414	2.14	12.30	575
		FS3-263-BB	8/29	30.3	425	2.46	14.30	581
		FS3-264-BB	8/29	25.7	268	1.42	6.34	446
		FS3-265-BB	8/29	29.2	382	1.16	11.60	1000
		FS3-266-BB	8/29	27.5	272	1.21	5.56	460
Lower Stretch	Smallmouth bass	FS4-200-SB	8/29	35.0	552	1.22	4.90	402
		FS4-201-SB	8/29	28.1	290	1.35	7.82	579
		FS4-202-SB	8/29	26.4	290	0.89	4.08	457
		FS4-203-SB	8/29	26.2	254	0.77	3.31	428
		FS4-204-SB	8/29	26.6	298	0.78	2.46	317
		FS4-205-SB	8/29	30.3	391	0.87	3.70	423
		FS4-206-SB	8/29	32.2	487	0.57	2.88	506
		FS4-207-SB	8/29	40.5	1050	1.55	7.03	454
		FS4-208-SB	8/29	41.6	1075	0.88	3.38	385
		FS4-209-SB	8/29	39.5	1037	1.19	4.60	387
		FS4-210-SB	8/29	46.0	1502	2.60	12.40	477
		FS4-211-SB	8/30	40.7	992	1.06	3.85	363

notes provided on page 3 of 3

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Table A-11
2005 Resident Fish Trend Monitoring Study
Adult Resident Fish Collection Field and Laboratory Data - Smallmouth Bass and Brown Bullhead

Sample Area	Species	Sample ID	Date Collected	Length (cm)	Weight (g)	Lipid (%)	PCB (ppm wet)	PCB (ppm lipid)
Lower Stretch (Cont'd)	Smallmouth bass (Cont'd)	FS4-212-SB	8/30	36.2	676	0.77	4.99	651
		FS4-213-SB	8/30	32.9	523	0.92	5.50	597
		FS4-214-SB	8/30	25.0	200	0.51	3.20	631
		FS4-215-SB	8/30	25.5	251	0.59	3.55	599
		FS4-216-SB	8/30	28.2	303	0.76	4.88	641
	Brown bullhead	FS4-220-BB	8/29	29.5	358	1.18	4.74	402
		FS4-221-BB	8/29	28.6	298	2.15	8.81	410
		FS4-222-BB	8/29	30.8	432	1.58	5.11	323
		FS4-223-BB	8/29	30.6	419	0.95	5.42	573
		FS4-224-BB	8/29	28.5	353	1.36	3.90	287
		FS4-225-BB	8/29	31.5	528	3.41	16.00	469
		FS4-226-BB	8/29	28.6	354	2.46	9.19	374
		FS4-227-BB	8/29	28.3	387	2.42	7.05	291
		FS4-228-BB	8/29	29.1	413	1.80	4.90	272
		FS4-229-BB	8/29	30.2	412	3.84	12.90	336
		FS4-230-BB	8/29	28.8	439	1.39	5.15	371
		FS4-231-BB	8/29	30.3	388	2.13	6.76	317
		FS4-232-BB	8/29	31.5	474	3.19	13.20	414
		FS4-233-BB	8/29	27.8	383	3.18	13.60	428
		FS4-234-BB	8/29	30.1	480	4.56	14.30	314
		FS4-235-BB	8/29	28.9	329	2.85	10.10	354
		FS4-236-BB	8/29	27.4	286	0.73	3.36	459
		FS4-237-BB	8/29	30.3	406	2.12	9.95	469
Power Canal	Smallmouth bass	FS6-35-SB	9/20	41.6	795	0.19	1.19	613
		FS6-36-SB	9/20	36.1	617	0.47	0.40	86
		FS6-37-SB	9/20	39.3	825	0.12	0.26	223
		FS6-38-SB	9/20	29.3	294	0.24	0.17	72
		FS6-39-SB	9/20	27.2	243	0.05	ND	---
		FS6-40-SB	9/20	28.5	285	0.30	ND	34
		FS6-41-SB	9/20	43.1	1212	0.94	0.44	46
		FS6-42-SB	9/20	34.0	622	0.53	0.25	47
		FS6-43-SB	9/20	33.0	462	0.79	0.35	44
		FS6-44-SB[7]	9/20	41.8	962	0.75	0.49	65
		FS6-45-SB[7]	9/20	42.9	967	0.92	0.92	100
		FS6-46-SB[7]	9/20	41.1	1012	0.73	0.71	97
		FS6-47-SB[7]	9/21	40.8	792	0.35	0.61	173
		FS6-48-SB[7]	9/21	41.4	722	0.30	0.97	325
		FS6-49-SB[7]	9/21	44.3	941	0.20	1.61	817
		FS6-50-SB[7]	9/21	45.0	1339	0.74	0.68	92
		FS6-51-SB[7]	9/21	41.2	871	0.653	0.47	72

Notes:
1. Units: cm = centimeters, g = grams, ppm = parts per million
2. ND = not detected; Detection limits range from 0.2 to 0.71ppm for non-detected samples.
3. '---' = PCB lipid concentration not computed due to unreasonably low lipid content of the sample (<0.1%).
4. PCB concentrations quantified on an Aroclor basis.
5. If PCB concentration was not detected, PCB concentration on a wet weight basis was set to half the detection limit prior to computing PCB concentration on a lipid basis.
6. Smallmouth bass fillets - skin-on, scales-off; brown bullhead fillets - skin-off
7. Collected with a gill net; all other fish collected with a boat-mounted electrofishing unit.
8. Sampling locations shown on Figure A-66.

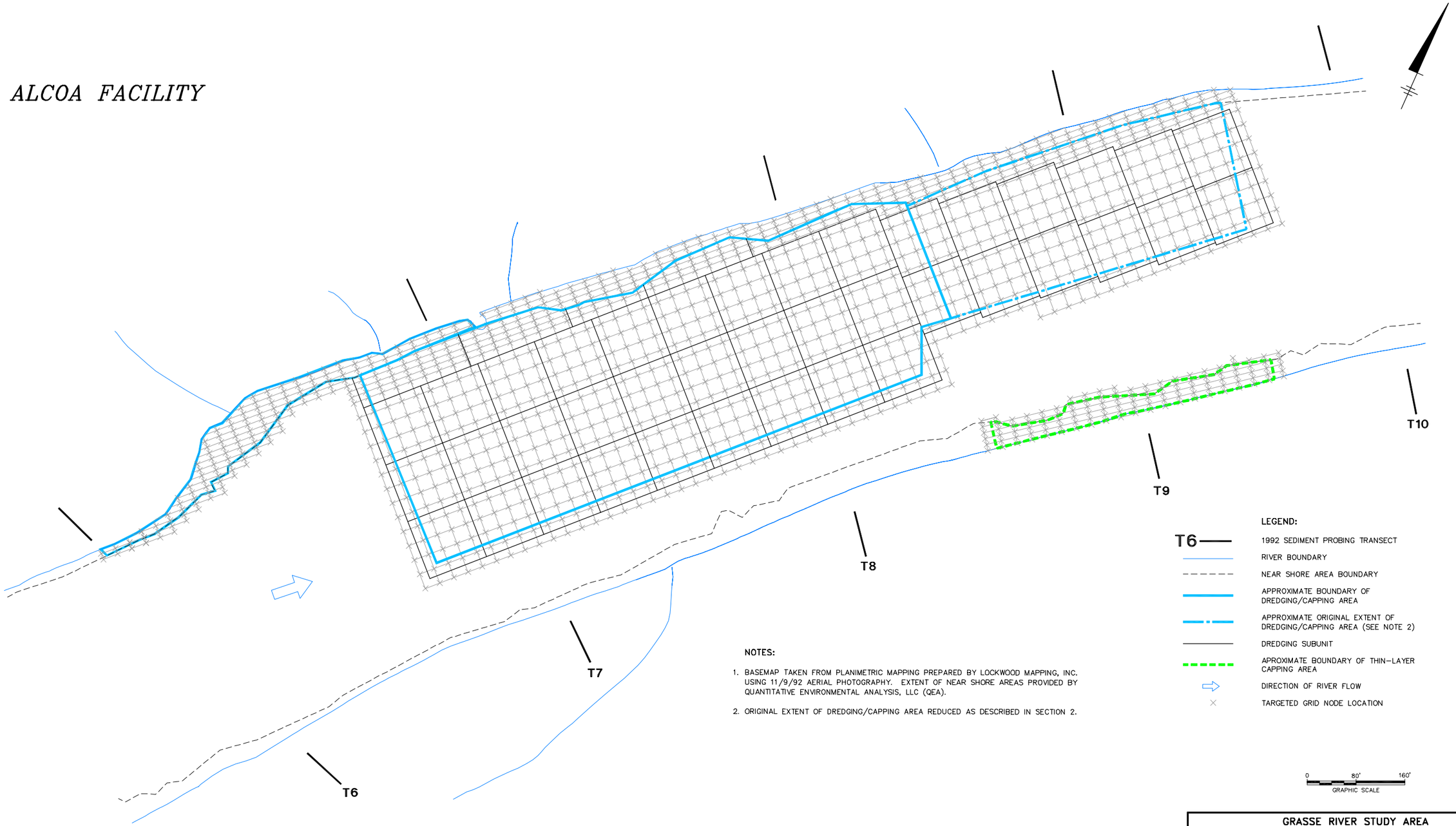
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Table A-12
2005 Resident Fish Trend Monitoring Study
Resident Fish Collection Field and Laboratory Data - Young-of-Year Spottail Shiner

Species	Sample Area	Sample ID	Date Collected	Fish per Sample	Length Range (cm)	Weight (g)	Lipid (%)	PCB (ppm wet)	PCB (ppm lipid)
Spottail Shiner	Background Stretch	FS1-34-SS	9/1	25	5.1 - 6.1	34	5.68	0.17	3.0
		FS1-35-SS	9/1	25	5.5 - 6.4	41	4.89	0.13	2.7
		FS1-36-SS	9/1	25	4.9 - 5.8	34	5.21	0.14	2.7
	Near Outfall 001	FS2-49-SS	9/20	20	4.2 - 5.7	20	3.27	7.84	239.8
		FS2-50-SS	9/20	20	4.4 - 6.2	20	4.27	7.71	180.6
		FS2-51-SS	9/20	40	3.4 - 4.2	16	3.4	5.54	162.9
	Near Unnamed Tributary	FS3-37-SS	9/20	19	3.7 - 5.7	23	4.61	19.70	427.3
		FS3-38-SS	9/20	19	4.6 - 5.9	23	4.64	18.60	400.9
		FS3-39-SS	9/20	19	3.9 - 6.0	22	4.65	20.30	436.6
	Near Grasse River Mouth	FS5-34-SS	9/21	16	3.0 - 5.7	16	3.96	8.87	224.0
		FS5-35-SS	9/21	17	3.1 - 5.8	16	3.34	9.48	283.8
		FS5-36-SS	9/21	17	3.1 - 6.0	17	3.73	9.07	243.2

Notes:
1. Units: cm = centimeters, g = grams, ppm = parts per million
2. PCB concentrations quantified on an Aroclor basis.
3. Spottail shiner - whole-body composites
4. Sampling locations shown on Figure A-66.

Figures



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

2. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.

LEGEND:

- T6 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
- DREDGING SUBUNIT
- APROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
- DIRECTION OF RIVER FLOW
- TARGETED GRID NODE LOCATION

0 80' 160'
GRAPHIC SCALE

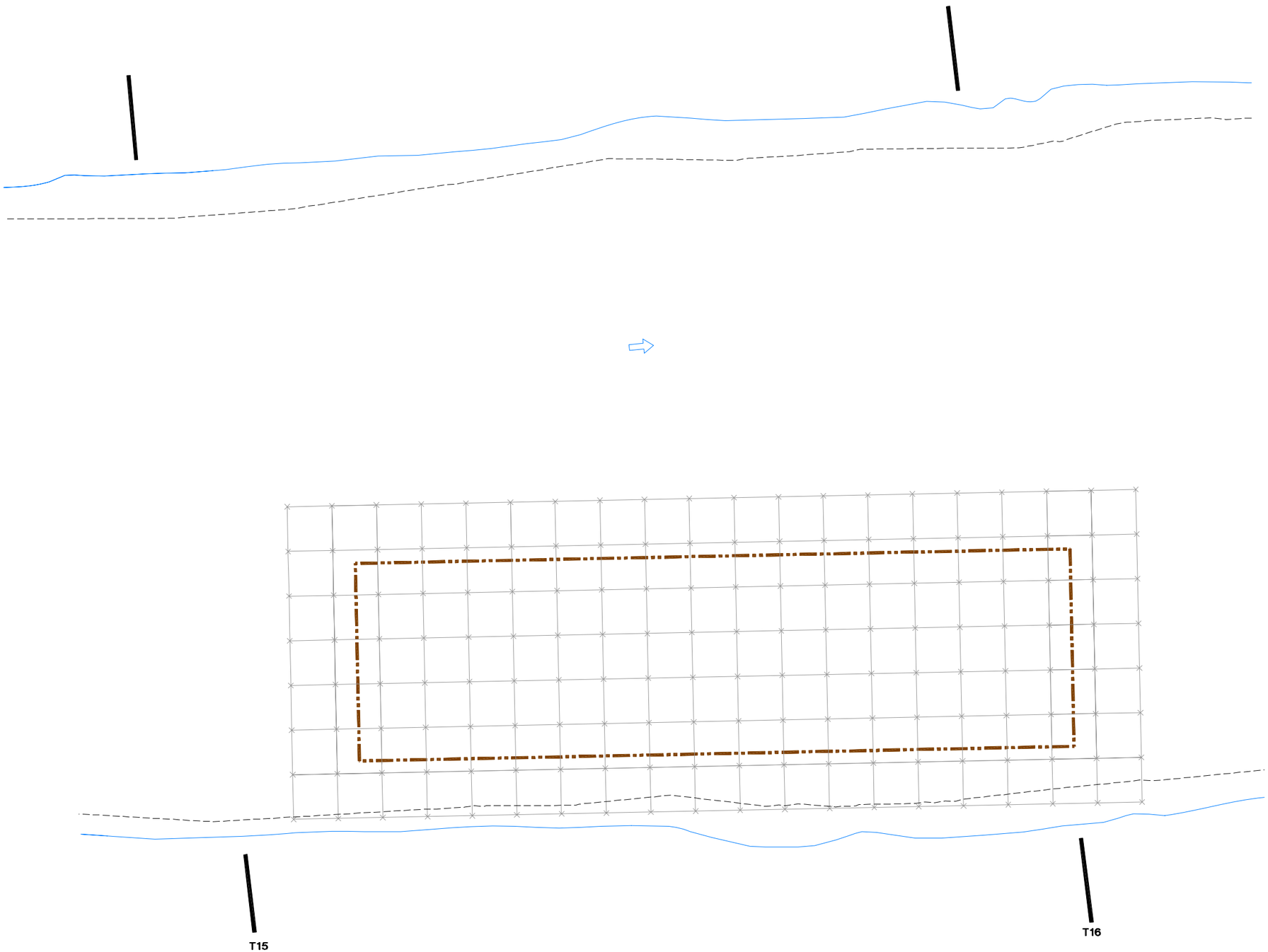
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

GRID NODE LOCATIONS FOR ELEVATION/PROBING MEASUREMENTS IN DREDGING/CAPPING AND THIN-LAYER CAPPING AREAS

ALCOA

FIGURE
A-1

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/19/06 SYR-85-NES TJR BGP
10809001/10809G48.DWG



LEGEND:

- T15 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
- TARGETED GRID NODE LOCATION
- DIRECTION OF RIVER FLOW

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

GRID NODE LOCATIONS FOR ELEVATION MEASUREMENTS IN ARMORED CAPPING AREA

ALCOA

FIGURE
A-2

X: 10809X01.DWG, X02.DWG, X01.TIF
L: ON=*, OFF=REF*
P: PAGESET/SYR-DL2B1
5/18/06 SYR-85-NES TJR BGP
10809001/10809G35.DWG

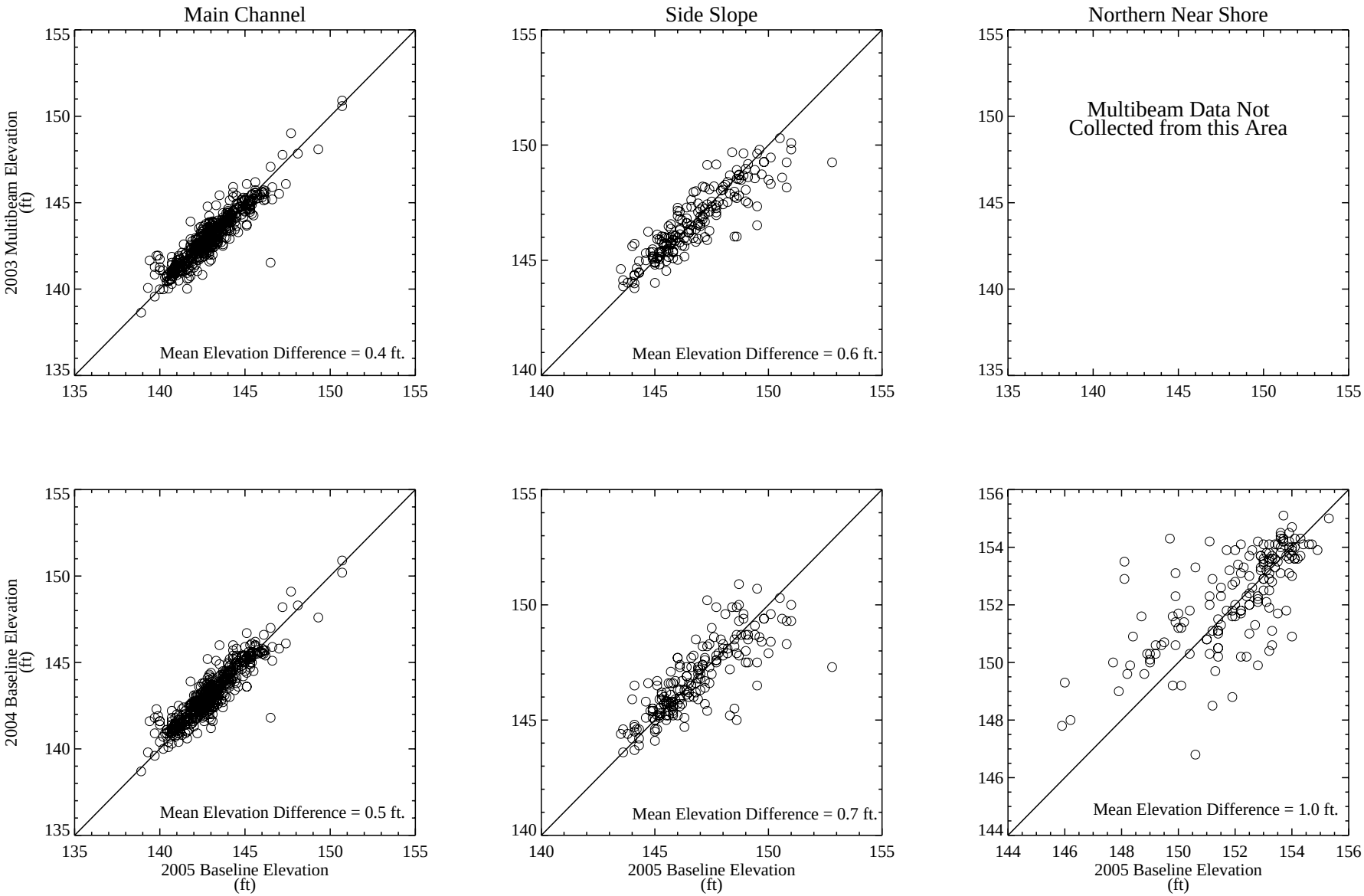


Figure A-3. Comparison of Sediment Elevations from 2003 Multibeam, 2004 Baseline and 2005 Baseline Surveys.
Elevation comparisons only performed for paired elevation measurements (i.e., those collected within 10 ft of each other).
Elevations based on USLS 1935 Datum.
Data tables: sed_probe_ROPS

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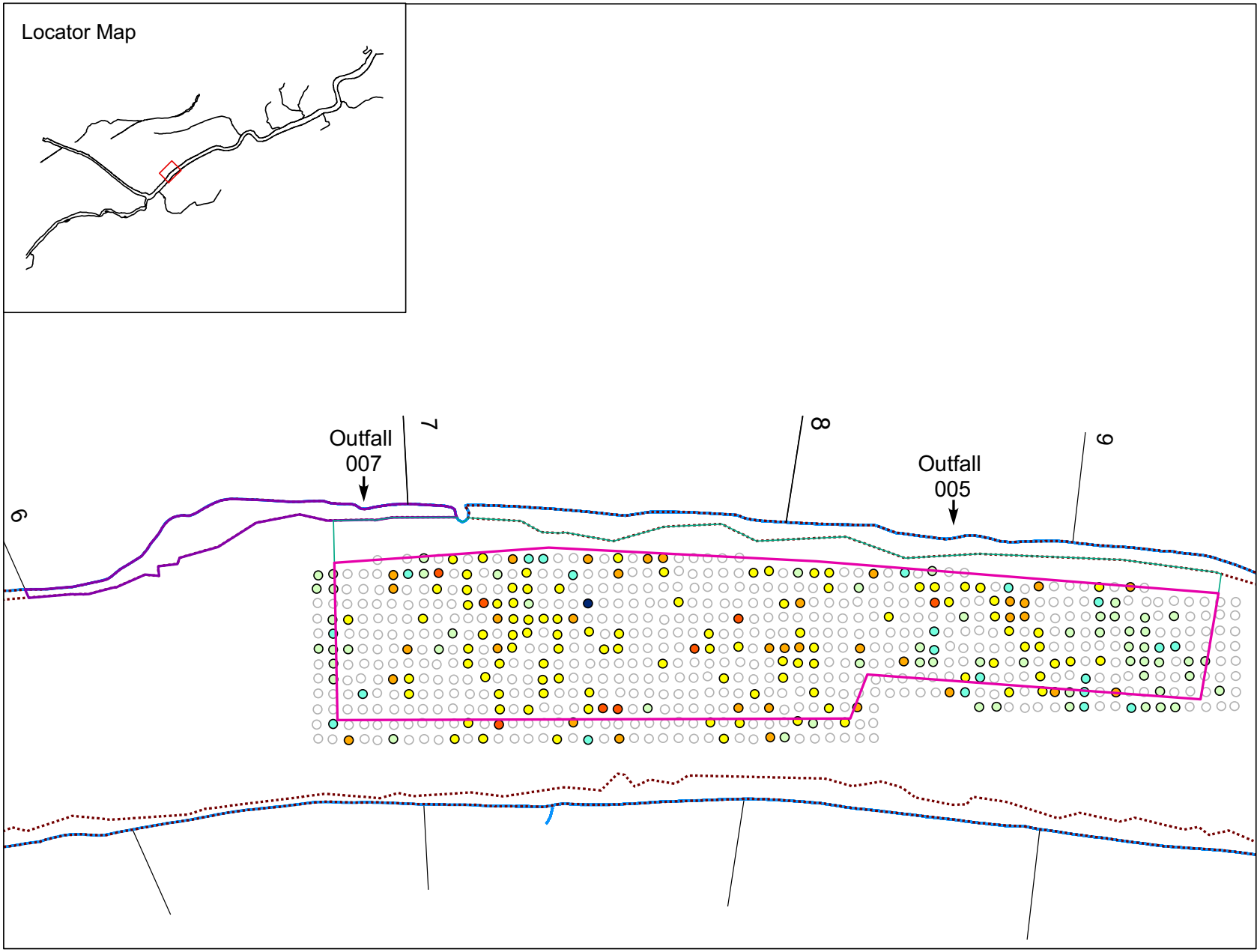
Fri May 19 17:37:55 2006



GRAPHIC SCALE
Feet
0 50 100 200

LEGEND

Main Channel Baseline Probing
Elevation Difference (ft)

- -2.50 - -2.00
- -1.99 - -1.01
- -1.00 - -0.51
- -0.50 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 4.70
- Main Channel Target Area
- Side Slope Target Area
- Near Shore Target Area
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-4.
Sediment Elevation Differences in the Main Channel from 2004 to 2005 Based on ROPS Baseline Monitoring Data

ALCOA

April 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060329.mxd

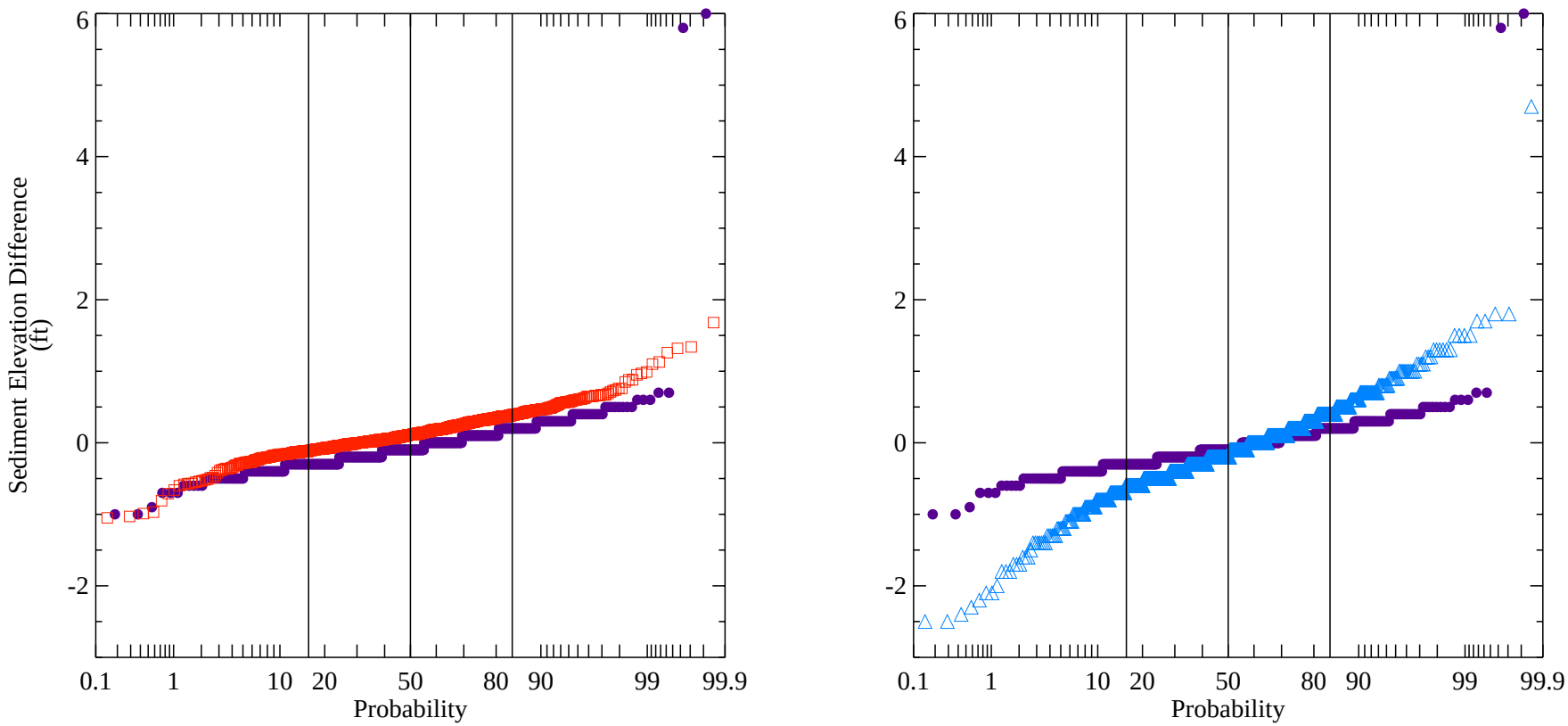


Figure A-5. Comparison of Sediment Elevation Differences in the Main Channel of the ROPS Area
2004 and 2005 measurements collected via manual probing.
Positive elevation differences indicate deposition, while negative differences indicate scour.

Data tables: sed_probe_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\ROPS_sedelev_MBvsProbing.pro
Mon May 22 12:08:40 2006

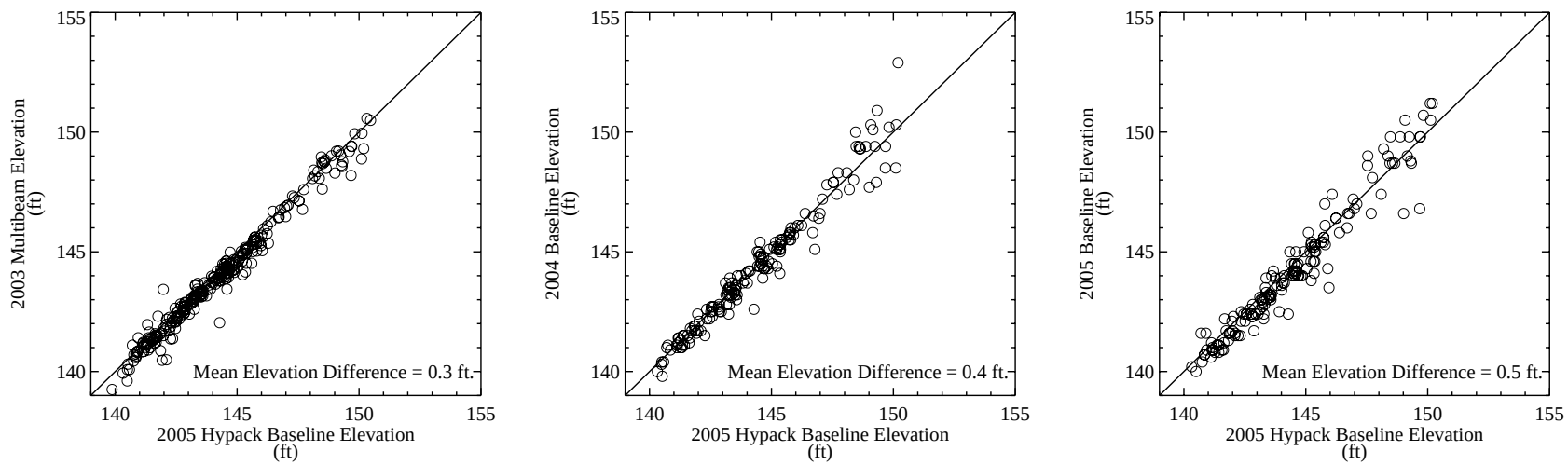
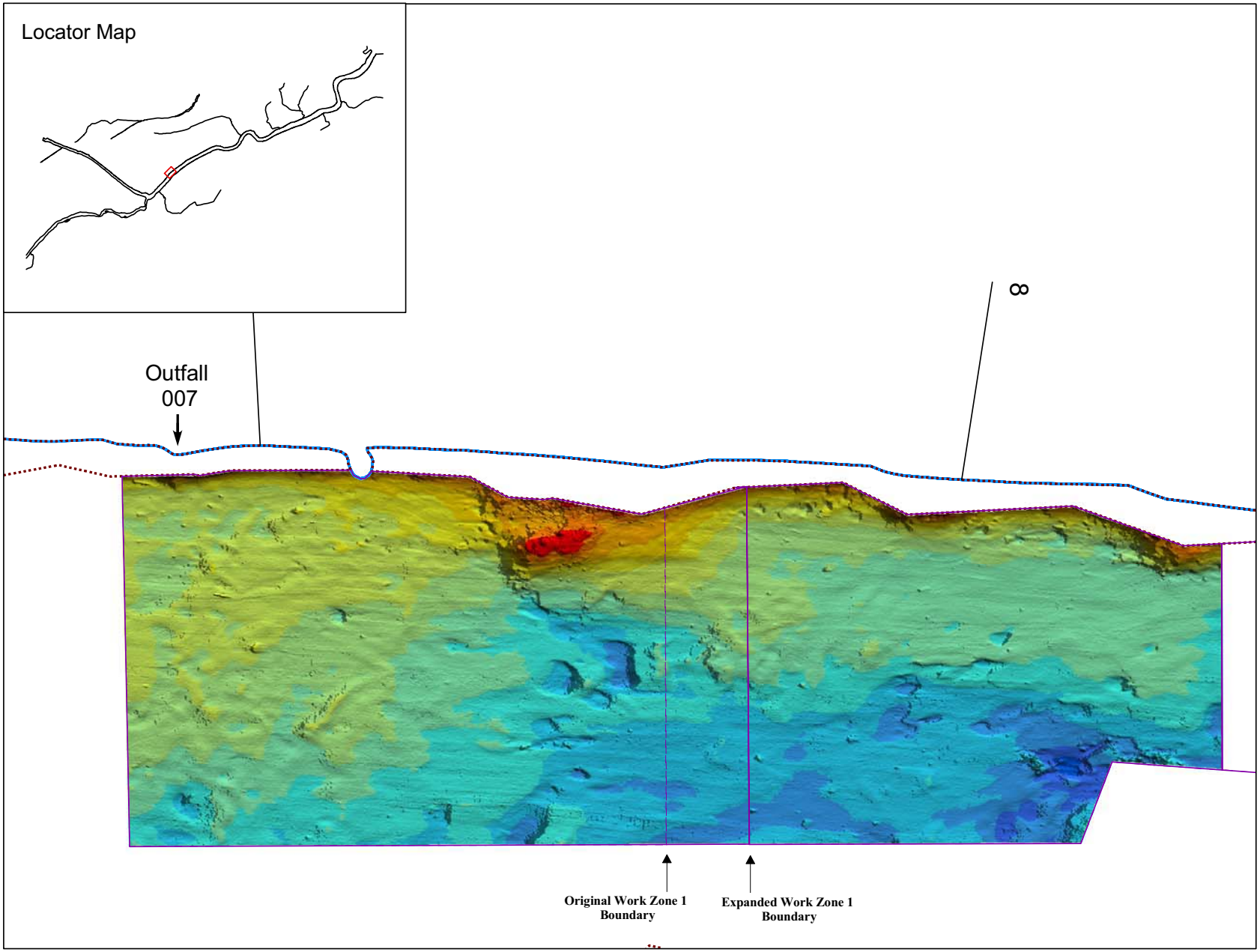


Figure A-6. Comparison of Main Channel Sediment Elevations from 2003 Multibeam, 2004 Baseline, 2005 Baseline, and 2005 Hypack Surveys.

Elevation comparisons only performed for paired elevation measurements (i.e., those collected within 10 ft of each other). Elevations based on USLS 1935 Datum.

Data tables: sed_probe_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\ROPS_sedelev_MBvsProbing.pro
Thu Feb 09 09:31:35 2006



GRAPHIC SCALE
Feet
0 25 50 100

LEGEND

Elevation (ft)
- 151 - 152
- 150 - 151
- 149 - 150
- 148 - 149
- 147 - 148
- 146 - 147
- 145 - 146
- 144 - 145
- 143 - 144
- 142 - 143
- 141 - 142
- 140 - 141
- 139 - 140
- 138 - 139
- 137 - 138
- 136 - 137

- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

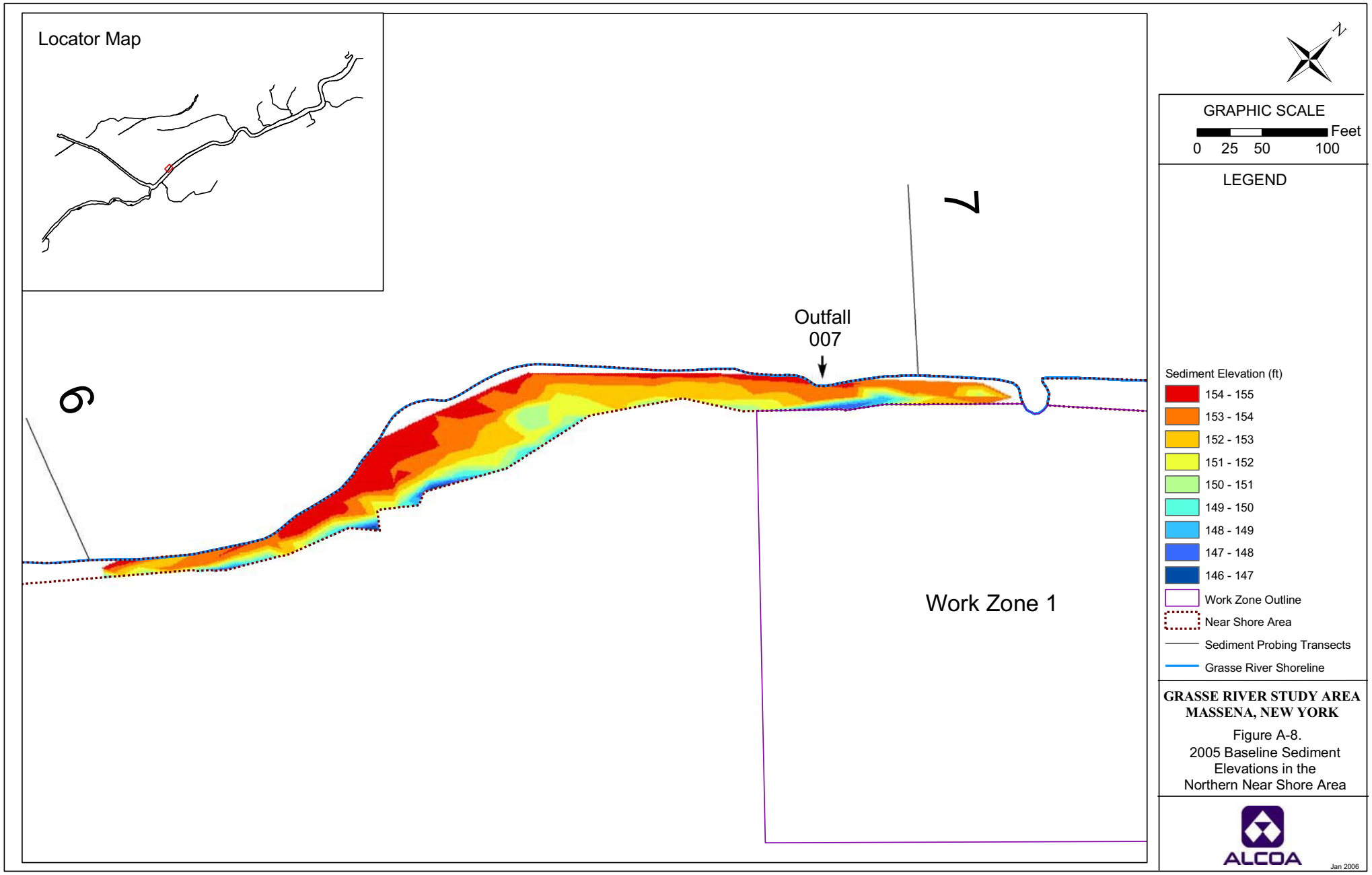
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-7.
Main Channel Sediment Elevations Measured During the 2003 Multibeam Survey

ALCOA

Feb 2006

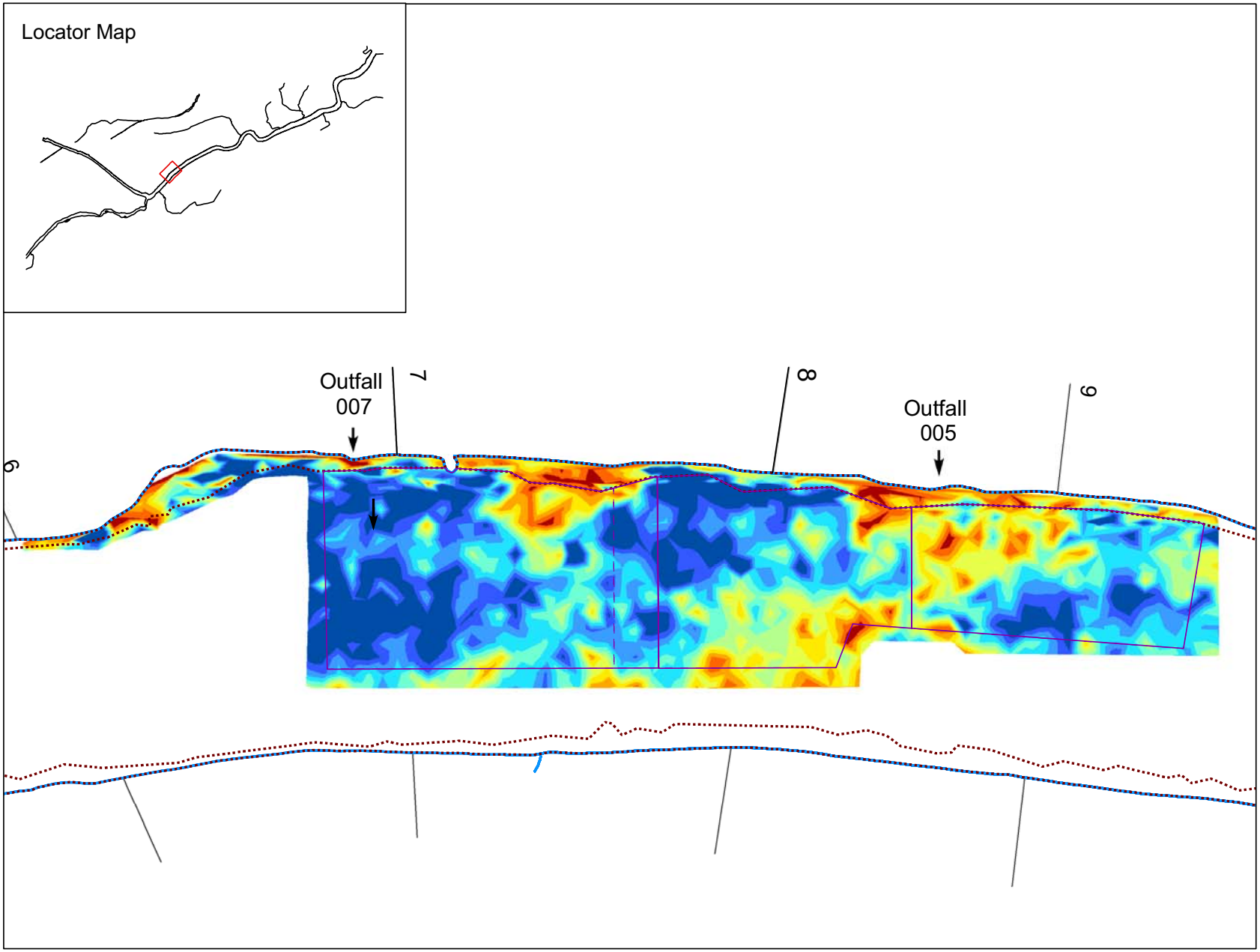
ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-8.
2005 Baseline Sediment Elevations in the Northern Near Shore Area

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



GRAPHIC SCALE
Feet
0 50 100 200

LEGEND

Probing Depth (ft)
- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- > 5.0
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

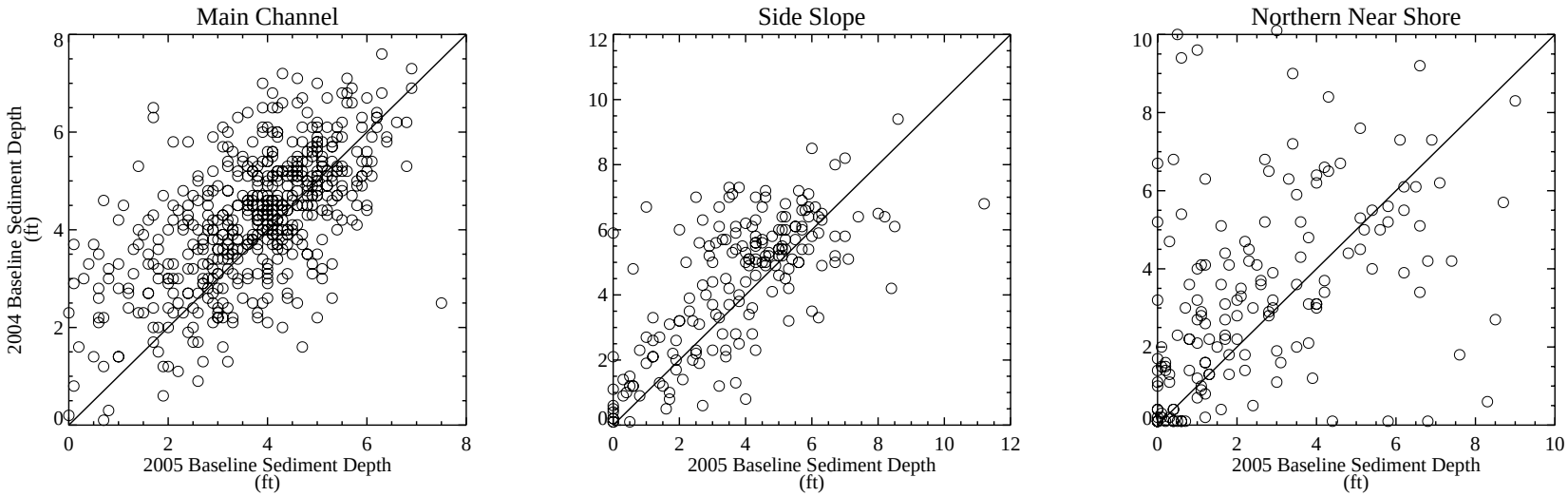
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-9.
Sediment Depths
Measured During the
2005 ROPS Baseline Survey

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



Mean Sediment Depth Difference = 1.0 ft.

Mean Sediment Depth Difference = 1.3 ft.

Mean Sediment Depth Difference = 1.8 ft.

Figure A-10. Comparison of Sediment Probing Depths from 2004 Baseline and 2005 Baseline Surveys.
Probing depth comparisons only performed for paired measurements (i.e., those collected within 10 ft of each other).

Data tables: sed_probe_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\ROPS_sedelev_MBvsProbing.pro
Thu Feb 09 09:31:35 2006

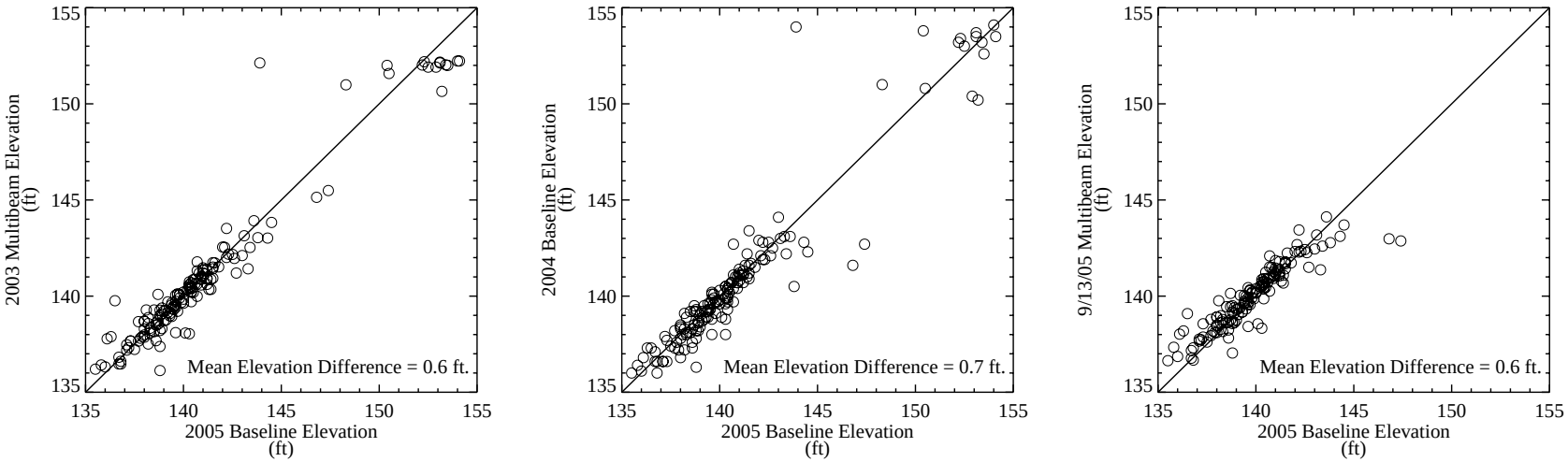
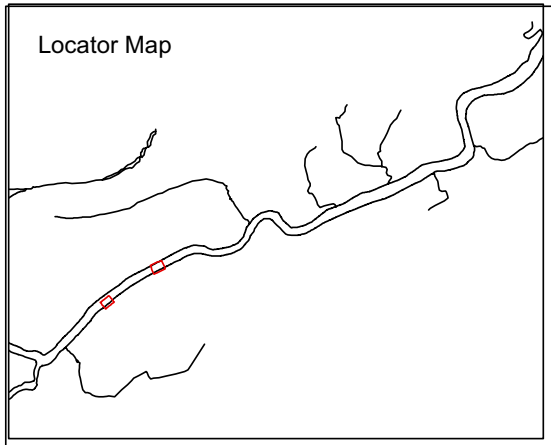


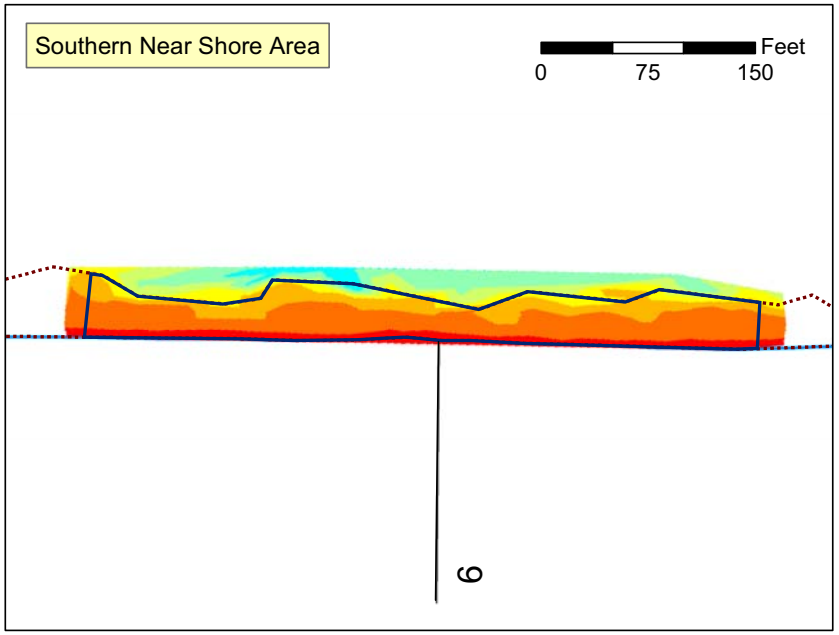
Figure A-11. Comparison of Sediment Elevations in the Armored Cap Area During 2003 Multibeam, 2004 Baseline, 2005 Baseline and September 12-13, 2005 Multibeam Surveys

Elevation comparisons only performed for paired elevation measurements (i.e., those collected within 10 ft of each other). Elevations based on USLS 1935 Datum.

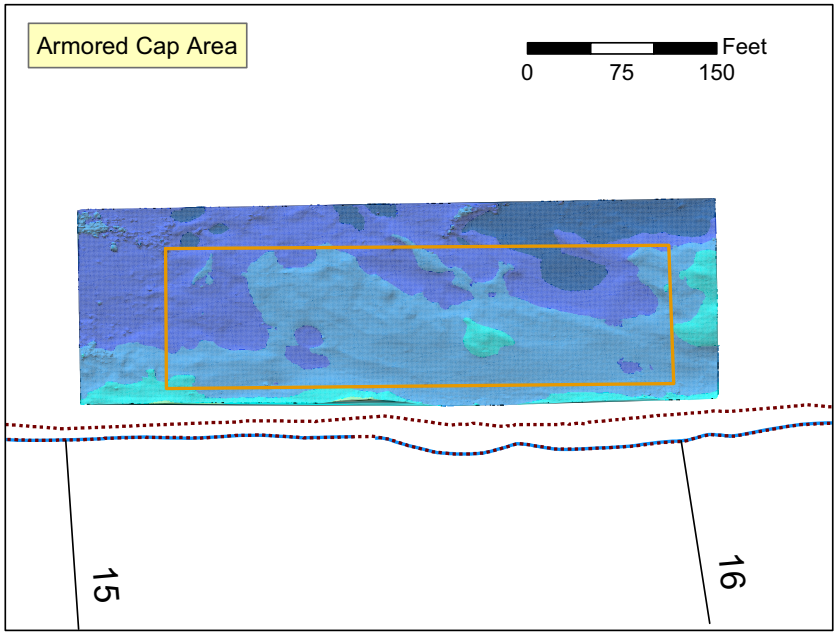
Data tables: sed_probe_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\ROPS_sedelev_MBvsProbing.pro
Thu Feb 09 09:31:35 2006





Elevations Measured During 2005 Baseline Survey



Elevations Measured During September 12-13, 2005 Multibeam Survey

LEGEND

Sediment Elevation (ft)

- 154 - 156
- 152 - 154
- 150 - 152
- 148 - 150
- 146 - 148
- 144 - 146
- 142 - 144
- 140 - 142
- 138 - 140
- 136 - 138
- Armored Cap Area
- Southern Near Shore
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-12.
Baseline Sediment Elevations for the Southern Near Shore and Armored Capping Areas

ALCOA

May 2006

ARC:\\Adrianne\D_Drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_ArmCapTLC_arc_060329.mxd

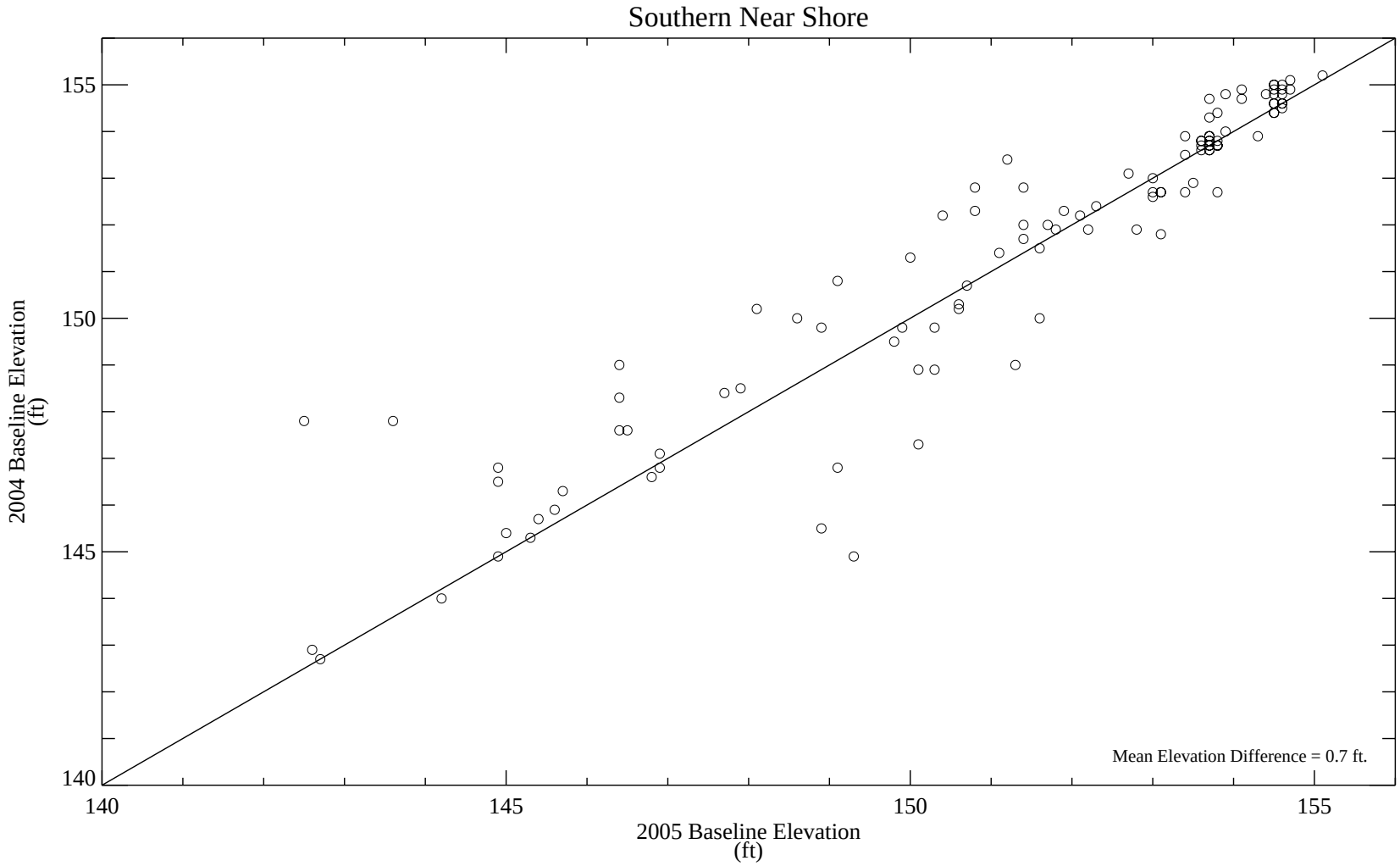
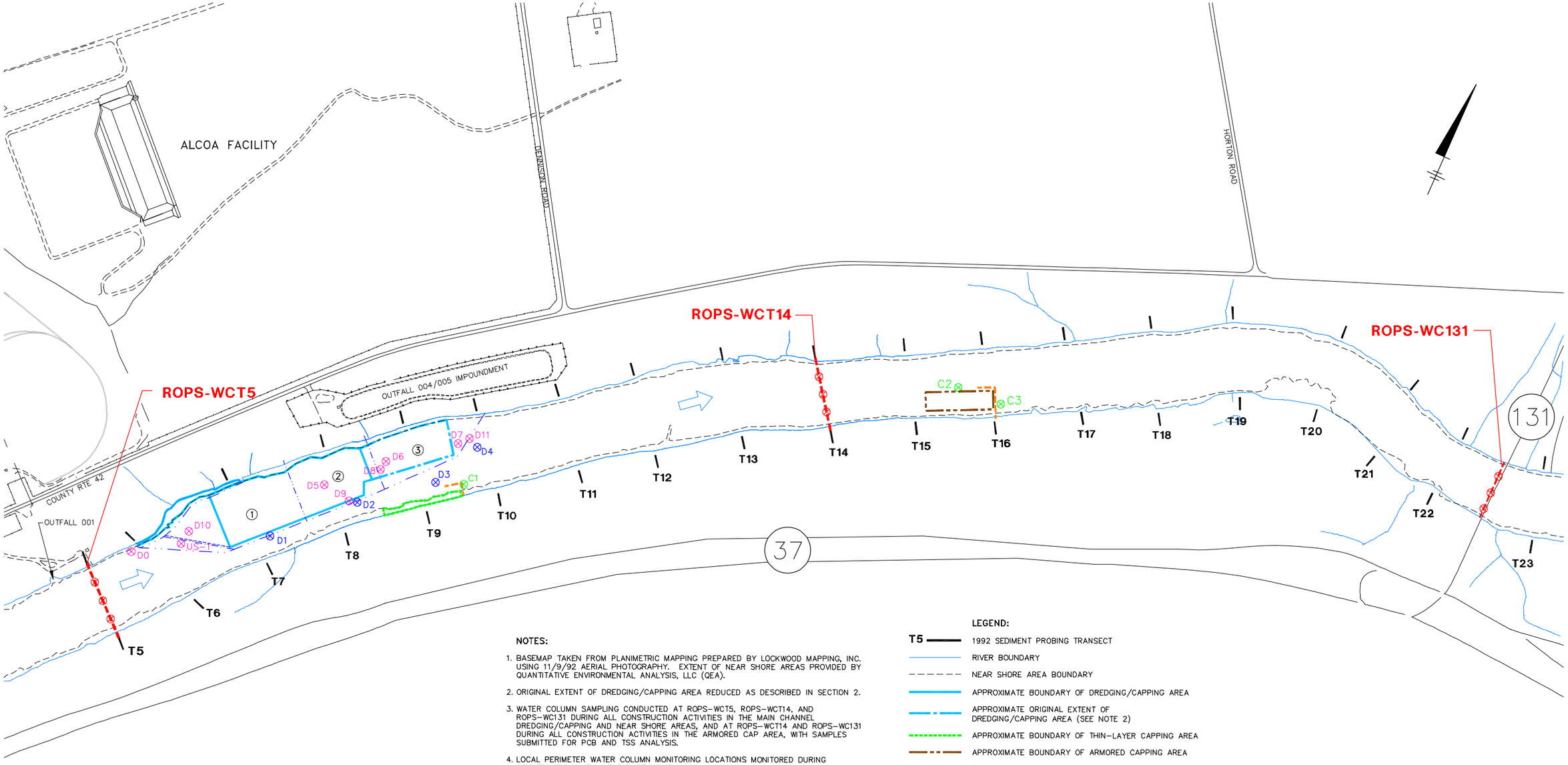


Figure A-13. Comparison of Sediment Elevations in the Southern Near Shore Area from 2004 Baseline and 2005 Baseline Surveys

Elevation comparisons only performed for paired elevation measurements (i.e., those collected within 10 ft of each other). Elevations based on USLS 1935 Datum.

Data tables: sed_probe_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\probing\bathymetry\ROPS_sedelev_MBvsProbing.pro
Thu Feb 09 09:31:35 2006



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.
3. WATER COLUMN SAMPLING CONDUCTED AT ROPS-WCT5, ROPS-WCT14, AND ROPS-WC131 DURING ALL CONSTRUCTION ACTIVITIES IN THE MAIN CHANNEL DREDGING/CAPPING AND NEAR SHORE AREAS, AND AT ROPS-WCT14 AND ROPS-WC131 DURING ALL CONSTRUCTION ACTIVITIES IN THE ARMORED CAP AREA, WITH SAMPLES SUBMITTED FOR PCB AND TSS ANALYSIS.
4. LOCAL PERIMETER WATER COLUMN MONITORING LOCATIONS MONITORED DURING CONSTRUCTION WITHIN THE PARTICULAR AREAS THEY SURROUND, WITH SAMPLES SUBMITTED FOR PCB AND TSS ANALYSIS DAILY. NOTE THAT LOCATIONS C2 AND C3 ARE APPROXIMATE.
5. LOCAL INTERIOR WATER COLUMN MONITORING STATIONS MONITORED AS PART OF SUPPLEMENTAL MONITORING ACTIVITIES TO ASSESS WATER QUALITY WITHIN SILT CURTAIN SETUP DURING DREDGING AND CAPPING.
6. DETAILS REGARDING ACTUAL SILT CURTAIN SETUP AND CONFIGURATION ARE PRESENTED IN APPENDIX I.
7. DURING CONSTRUCTION, THE LOCATION OF THE SILT CURTAINS SHIFTED FROM THAT SHOWN ON THIS FIGURE DUE TO RIVER FLOWS. THE ACTUAL WATER COLUMN MONITORING LOCATIONS ARE SHOWN ON THIS FIGURE AND WERE LOCATED IN THE FIELD AT THE TIME OF SAMPLING BASED ON THE SILT CURTAIN POSITION. THE LOCAL WATER COLUMN LOCATIONS WERE PLACED AS FOLLOWS: D0 LOCATED WITHIN OPENING OF UPSTREAM SILT CURTAIN DURING SCOW TRANSPORT; D1-D4 LOCATED IMMEDIATELY ADJACENT TO THE OUTSIDE PERIMETER OF THE SILT CURTAIN; D5-D6 LOCATED ALONG THE UPSTREAM SIDE OF THE INTERMEDIATE SILT CURTAINS BETWEEN THE WORK ZONES; D7 AND D11 LOCATED UPSTREAM OF THE DOWNSTREAM PORTION OF THE PERIMETER SILT CURTAIN; D8 LOCATED UPSTREAM OF THE INTERMEDIATE CURTAIN BETWEEN WORK ZONES 2 AND 3; D9 LOCATED INSIDE THE SILT CURTAIN ADJACENT TO D2; D10 LOCATED DOWNSTREAM OF THE AIR CURTAIN; US-1 LOCATED UPSTREAM OF THE AIR CURTAIN; C1 LOCATED DOWNSTREAM OF THE SILT CURTAIN RUNNING PERPENDICULAR TO SHORE DOWNSTREAM OF THE SOUTHERN NEAR SHORE AREA; C2 LOCATED NEAR THE CENTER OF THE RIVER AT THE MID POINT OF THE ARMORED CAP AREA; AND C3 LOCATION DOWNSTREAM OF THE SILT CURTAIN RUNNING PERPENDICULAR TO SHORE DOWNSTREAM OF THE ARMORED CAP AREA.

LEGEND:

- T5 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
- APPROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
- APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
- ROPS WATER COLUMN SAMPLING TRANSECT WITH WATER COLUMN MONITORING STATION (SEE NOTE 3)
- LOCAL PERIMETER WATER COLUMN MONITORING LOCATION FOR DREDGING/CAPPING (SEE NOTES 4 AND 7)
- LOCAL PERIMETER WATER COLUMN MONITORING LOCATION FOR CAPPING (SEE NOTES 4 AND 7)
- LOCAL INTERIOR WATER COLUMN MONITORING LOCATION FOR DREDGING/CAPPING (SEE NOTES 5 AND 7)
- ① MAIN CHANNEL DREDGE WORK ZONE
- APPROXIMATE PERIMETER SILT CURTAIN LOCATION (SEE NOTES 6 AND 7)
- APPROXIMATE INTERMEDIATE SILT CURTAIN LOCATION (SEE NOTES 6 AND 7)
- APPROXIMATE CAPPING AREA SILT CURTAIN LOCATION (SEE NOTES 6 AND 7)
- APPROXIMATE AIR CURTAIN LOCATION (SEE NOTES 6 AND 7)
- DIRECTION OF RIVER FLOW

0 300' 600'
GRAPHIC SCALE

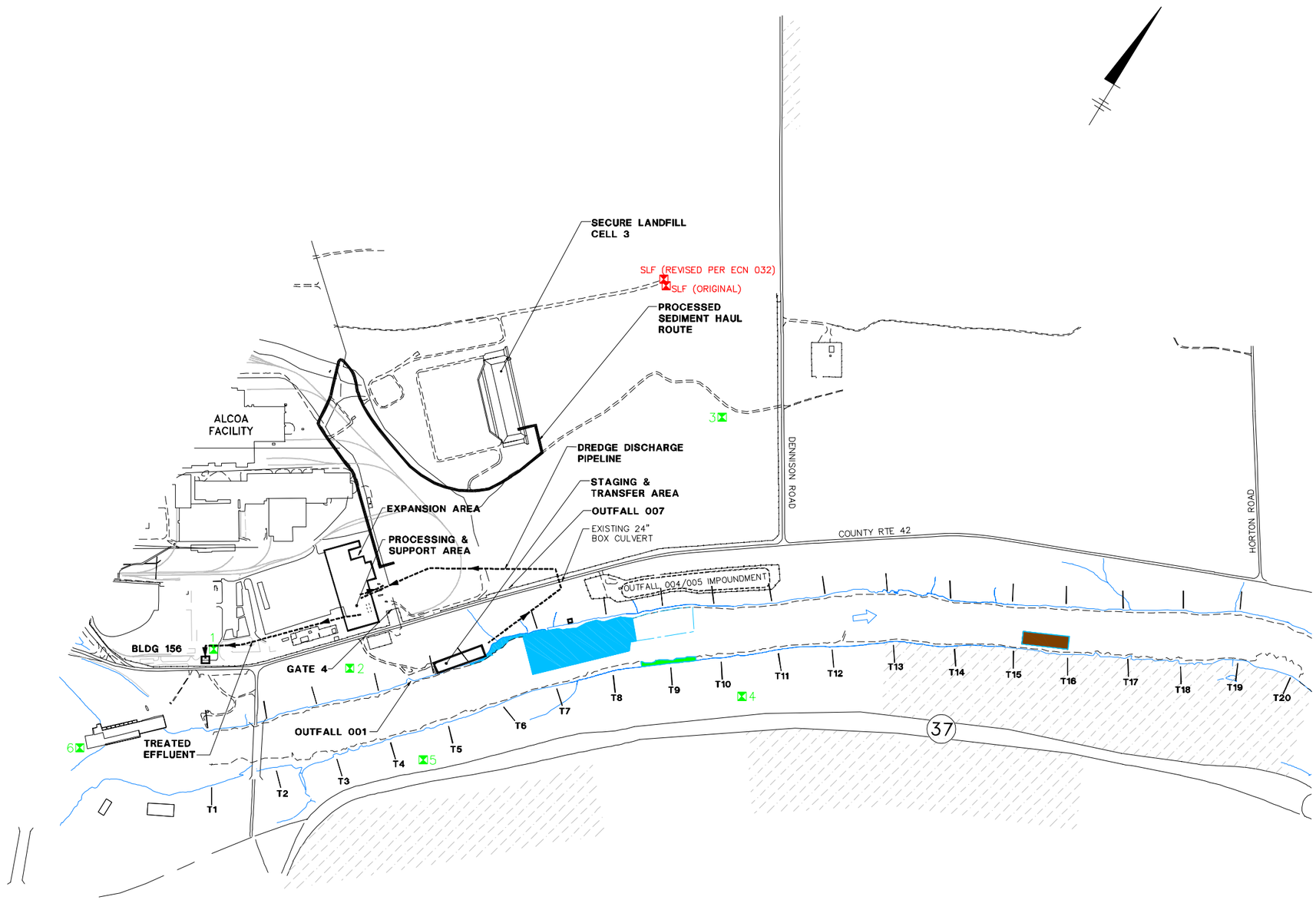
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

WATER COLUMN MONITORING LOCATIONS

ALCOA

FIGURE
A-14

X: 10809X01.DWG, X02.DWG, X01.TIF
L: ON=*, OFF=REF*
P: PAGESET/PLT-DL2B1
5/19/06 SYR-85-KMD DJP BGP
10809001/10809B04.DWG



LEGEND:

- T5 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE EXTENT OF COMMERCIAL/ RESIDENTIAL PROPERTY (SEE NOTE 2)
- APPROXIMATE DREDGING/CAPPING AREA
- APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 3)
- APPROXIMATE ARMORED CAPPING AREA
- APPROXIMATE THIN-LAYER CAPPING AREA
- DIRECTION OF RIVER FLOW
- 2 — COMMUNITY AIR MONITORING LOCATION (HIGH VOLUME)
- SLF — SLF AIR MONITORING LOCATION (HIGH VOLUME; SEE NOTE 4)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. LAND-BASED FEATURES PROVIDED BY CAMP, DRESSER, & McKEE. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. APPROXIMATE EXTENT OF COMMERCIAL/RESIDENTIAL PROPERTIES WERE DIGITIZED BASED ON LOCATIONS OF BUILDINGS/HOUSES SHOWN ON 11/9/92 AERIAL PHOTOGRAPHY REFERENCED IN NOTE 1 AND FIELD RECONNAISSANCE EFFORTS CONDUCTED IN FEBRUARY 2005. APPROXIMATE EXTENT OF COMMERCIAL/RESIDENTIAL PROPERTIES ALONG DENNISON ROAD WERE BASED ON AERIAL PHOTOGRAPHS TAKEN ON 5/2/97 BY THE UNITED STATES GEOLOGICAL SURVEY INCLUDED ON TERRASERVER USA.
3. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.
4. THE SLF AIR MONITORING LOCATION WAS MODIFIED ON OCTOBER 8, 2005 DUE TO INCLEMENT WEATHER CONDITIONS RESULTING IN STANDING WATER AT THE ORIGINAL LOCATION (DETAILS PROVIDED IN ECN 032). THE SLF LOCATION WAS NOT MONITORED DURING THE BASELINE EVENT AS IT WAS NOT ESTABLISHED UNTIL AUGUST 2005.

0 500' 1000'
GRAPHIC SCALE

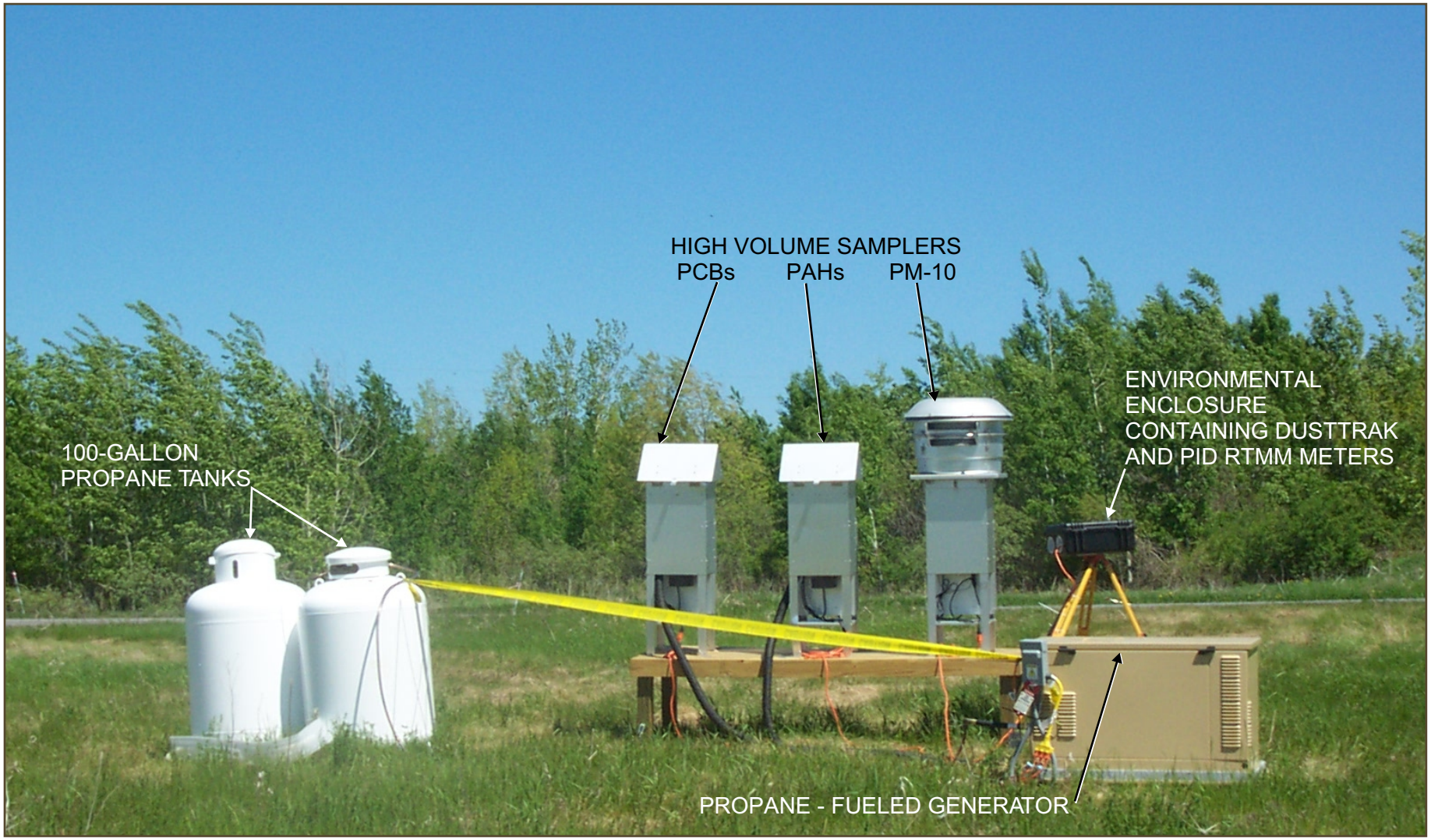
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

AIR MONITORING LOCATIONS

ALCOA

FIGURE
A-15

X: 10809X02.DWG, 10809X01.TIF
L: ON=*, OFF=REF*
P: PAGESET/PLT-BL
5/19/06 SYR-85-KMD BGP BGP
10809001/10809B05.DWG



NOTE:

1. Laboratory-supplied summa canister for VOC analysis per USEPA method TO-15 not shown.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY DOCUMENTATION REPORT

TYPICAL AIR MONITORING STATION SETUP

ALCOA

FIGURE A-16

05/17/06 SYR-D85-KLS
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ALCOA FACILITY

NORTHERN NEAR SHORE DREDGING/CAPPING AREA

COUNTY RTE 42

OUTFALL 004/005 IMPOUNDMENT

NSNB-1
NSNB-2
NSNB-3
NSNB-4
NSNB-5
NSNB-6

NSSB-1
NSSB-2
NSSB-3
NSSB-4
NSSB-5
NSSB-6

NSCON-1
NSCON-2
NSCON-3
NSCON-4
NSCON-5
NSCON-6

T4
T5
T6
T7
T8
T9
T10

37

SOUTHERN NEAR SHORE THIN-LAYER CAPPING AREA

UPSTREAM CONTROL AREAS

LEGEND:

T5	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA BOUNDARY
	APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
	APPROXIMATE ORIGINAL EXTENT OF DREDGING/CAPPING AREA (SEE NOTE 2)
	APPROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
	UPSTREAM INVERTEBRATE COMMUNITY AND AQUATIC HABITAT SURVEY CONTROL AREAS
	DIRECTION OF RIVER FLOW
	INVERTEBRATE COMMUNITY MONITORING LOCATIONS
NSSB-5	SAMPLE ID

0 150' 300'
GRAPHIC SCALE

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ORIGINAL EXTENT OF DREDGING/CAPPING AREA REDUCED AS DESCRIBED IN SECTION 2.
3. AQUATIC HABITAT WAS SURVEYED ALONG THE ENTIRE SHORELINE OF EACH NEAR SHORE DREDGING/CAPPING AREA AND EACH UPSTREAM CONTROL AREA.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

NEAR SHORE DREDGING/CAPPING
INVERTEBRATE COMMUNITY AND AQUATIC
HABITAT MONITORING LOCATIONS

ALCOA

FIGURE
A-17

X: 10809X01.DWG, X02.DWG, X04.DWG, 10809X01.TIF
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P: PAGESET/SYR-DL2B1
5/19/06 SYR-85-NES BGP BGP
10809001/10809B03.DWG

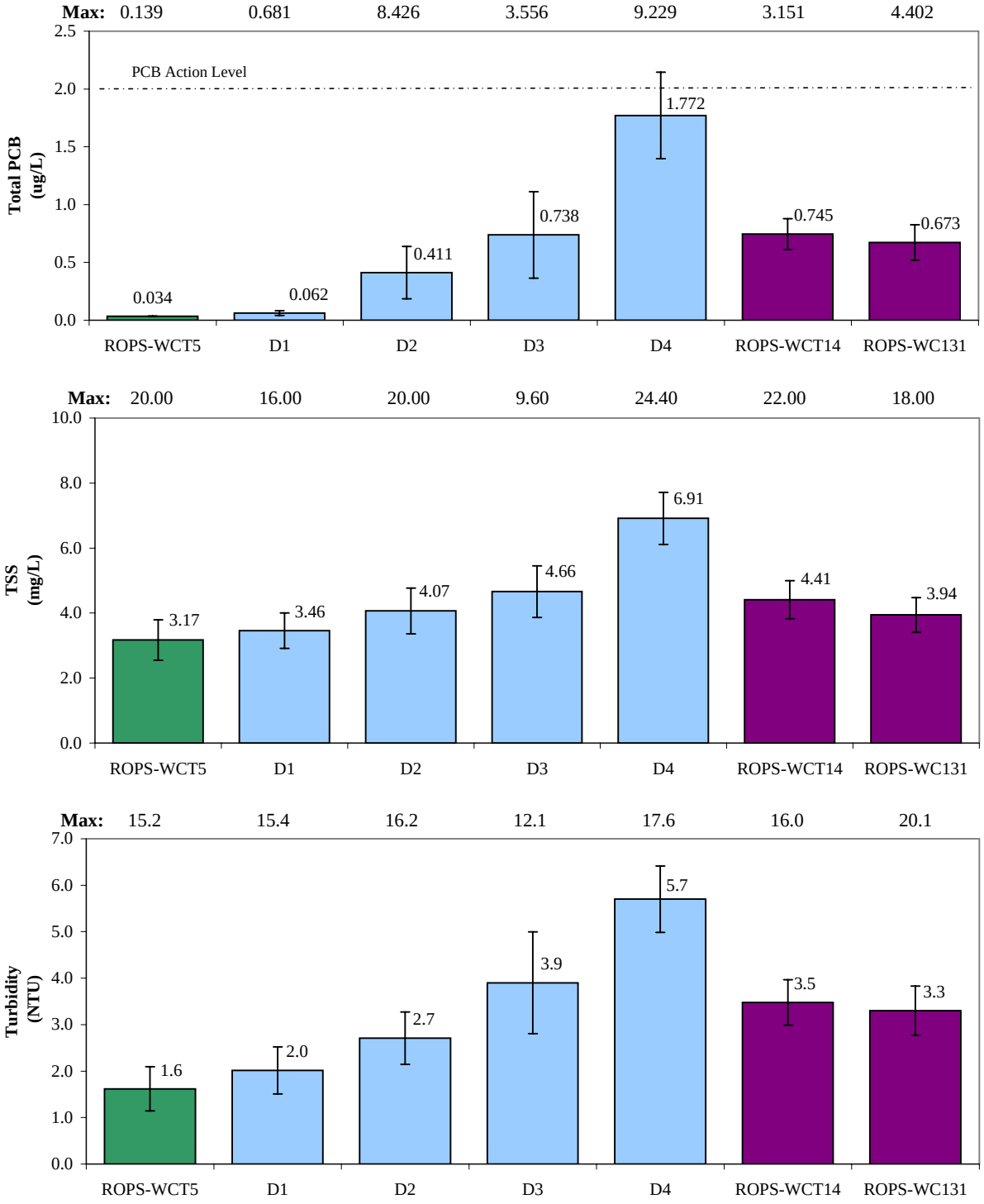

Figure A-18. Average Water Column Levels During Main Channel and Northern Near Shore Debris and Sediment Removal Activities

Values below the detection were set to half the detection limit prior to calculations.
On days were stratification occurred, samples below the stratification level were excluded.
Error bars represent 95% confidence intervals.
Maximum levels displayed along the top of each panel for each location.
PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

Date tables: water_aro_ROPS, water_field_ROPS

- Upstream
- Local
- Downstream

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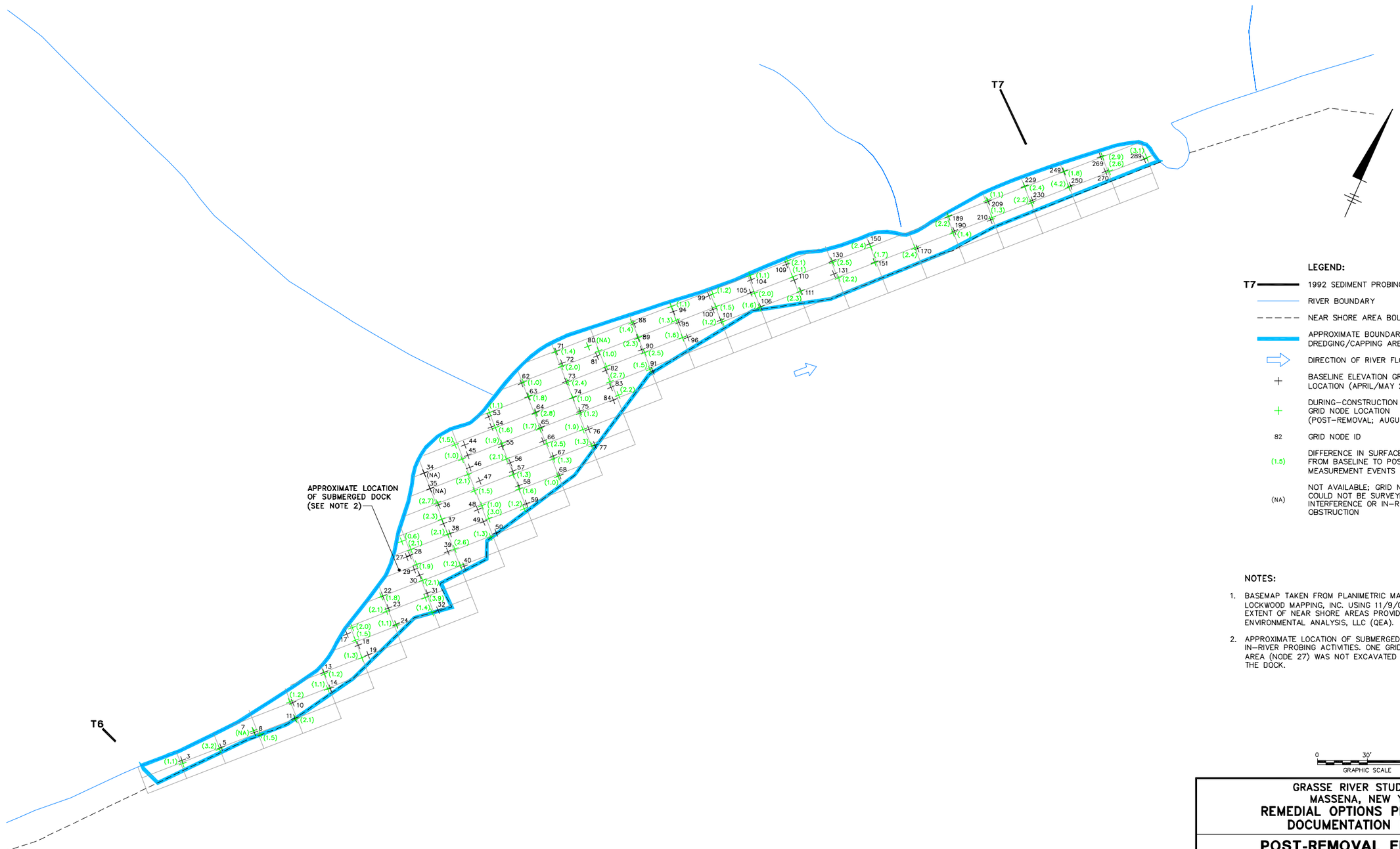

LEGEND:

T7	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA BOUNDARY
	APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
	DIRECTION OF RIVER FLOW
+	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
+	DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-REMOVAL; AUGUST 2005)
82	GRID NODE ID
(1.5)	DIFFERENCE IN SURFACE ELEVATION FROM BASELINE TO POST-REMOVAL MEASUREMENT EVENTS (FT)
(NA)	NOT AVAILABLE; GRID NODE LOCATION COULD NOT BE SURVEYED DUE TO INTERFERENCE OR IN-RIVER OBSTRUCTION

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. APPROXIMATE LOCATION OF SUBMERGED DOCK DEFINED THROUGH IN-RIVER PROBING ACTIVITIES. ONE GRID NODE IN SUBMERGED DOCK AREA (NODE 27) WAS NOT EXCAVATED TO DESIRED DEPTH DUE TO THE DOCK.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-REMOVAL ELEVATION MEASUREMENT RESULTS FOR THE NORTHERN NEAR SHORE AREA

ALCOA

FIGURE
A-19

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P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES PGL BGP
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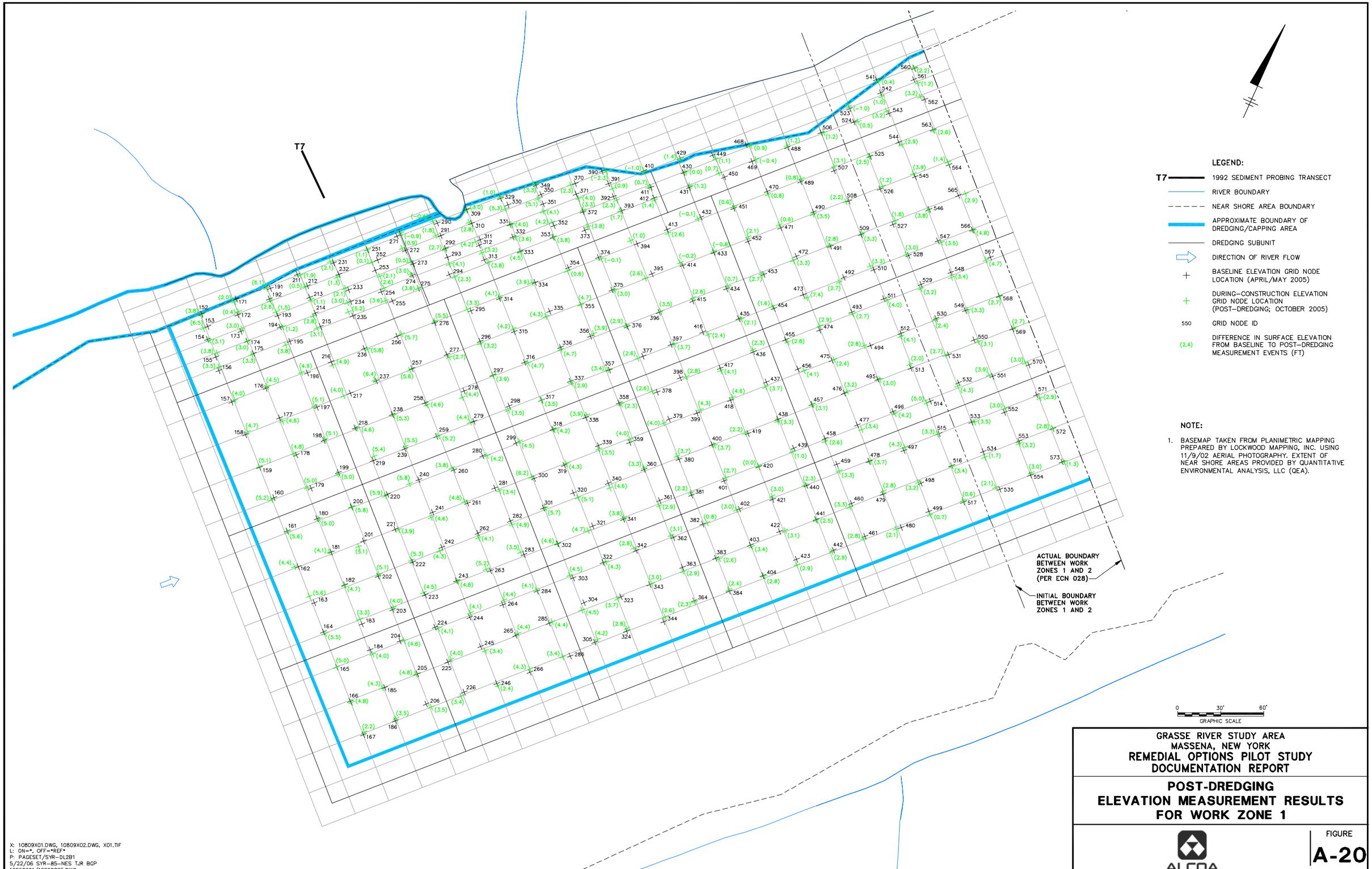

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-DREDGING ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 1

ALCOA

FIGURE
A-20

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
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P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES TJR BGP
10809001/10809G05.DWG

LEGEND:

- T8 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- + BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
- + DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-DREDGING; OCTOBER 2005)
- 819 GRID NODE ID
- (1.5) DIFFERENCE IN SURFACE ELEVATION FROM BASELINE TO POST-DREDGING MEASUREMENT EVENTS (FT)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. WORK ZONE 2 WAS NOT DREDGED TO ITS ORIGINAL EXTENT AS DESCRIBED IN SECTION 2.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-DREDGING ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 2

ALCOA

FIGURE
A-21

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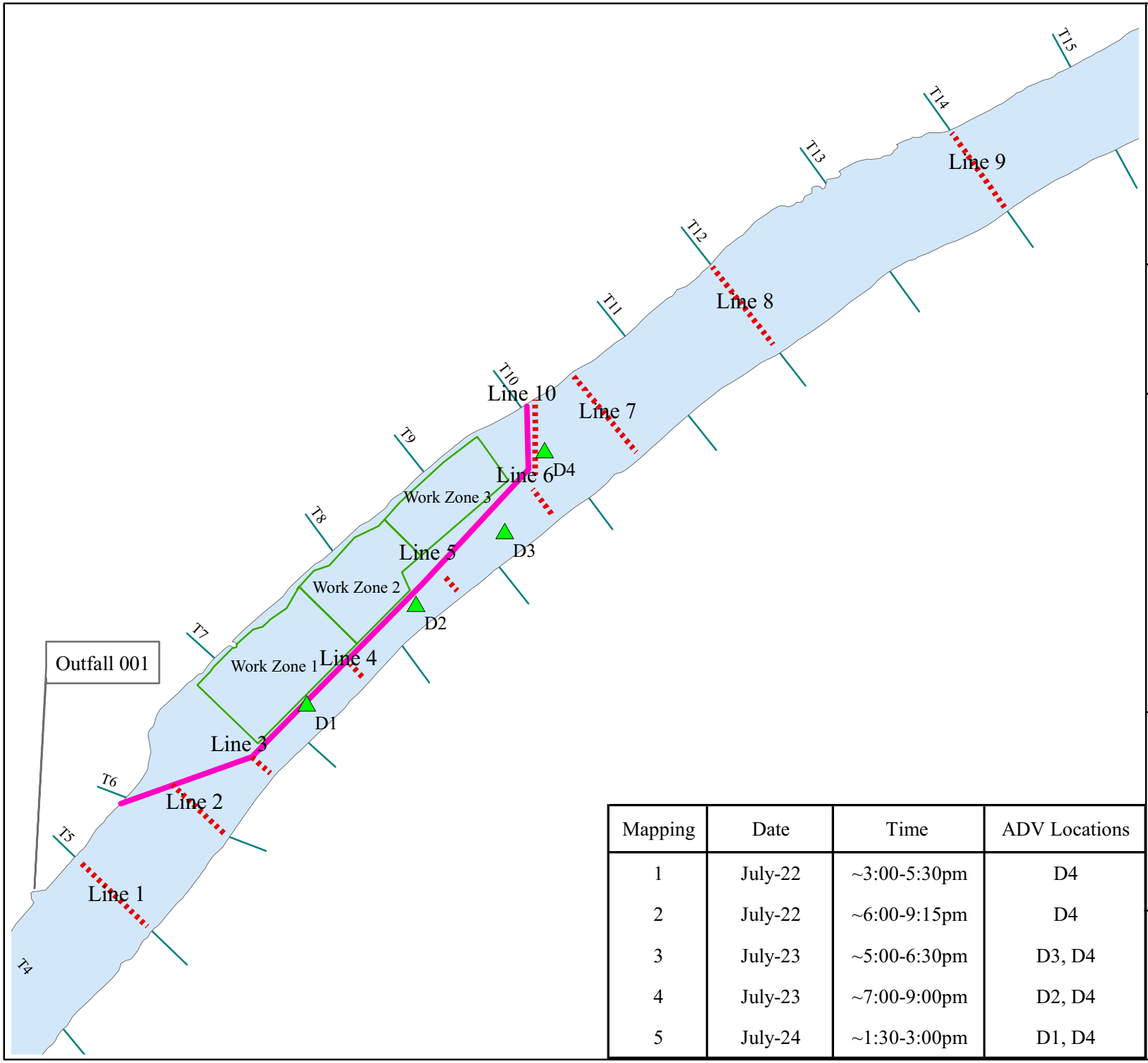
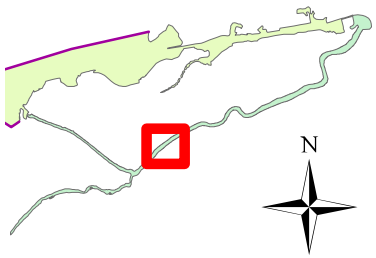


LOCATOR MAP



GRAPHIC SCALE

400 200 0 400 Feet

LEGEND

- ADV Locations
- ADCP Transects
- Silt Curtain
- Sediment Transects
- Work Zones
- River

Mapping	Date	Time	ADV Locations
1	July-22	~3:00-5:30pm	D4
2	July-22	~6:00-9:15pm	D4
3	July-23	~5:00-6:30pm	D3, D4
4	July-23	~7:00-9:00pm	D2, D4
5	July-24	~1:30-3:00pm	D1, D4

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-22.

ADCP and ADV Mesurement Locations for July 2005 Velocity Study

ALCOA

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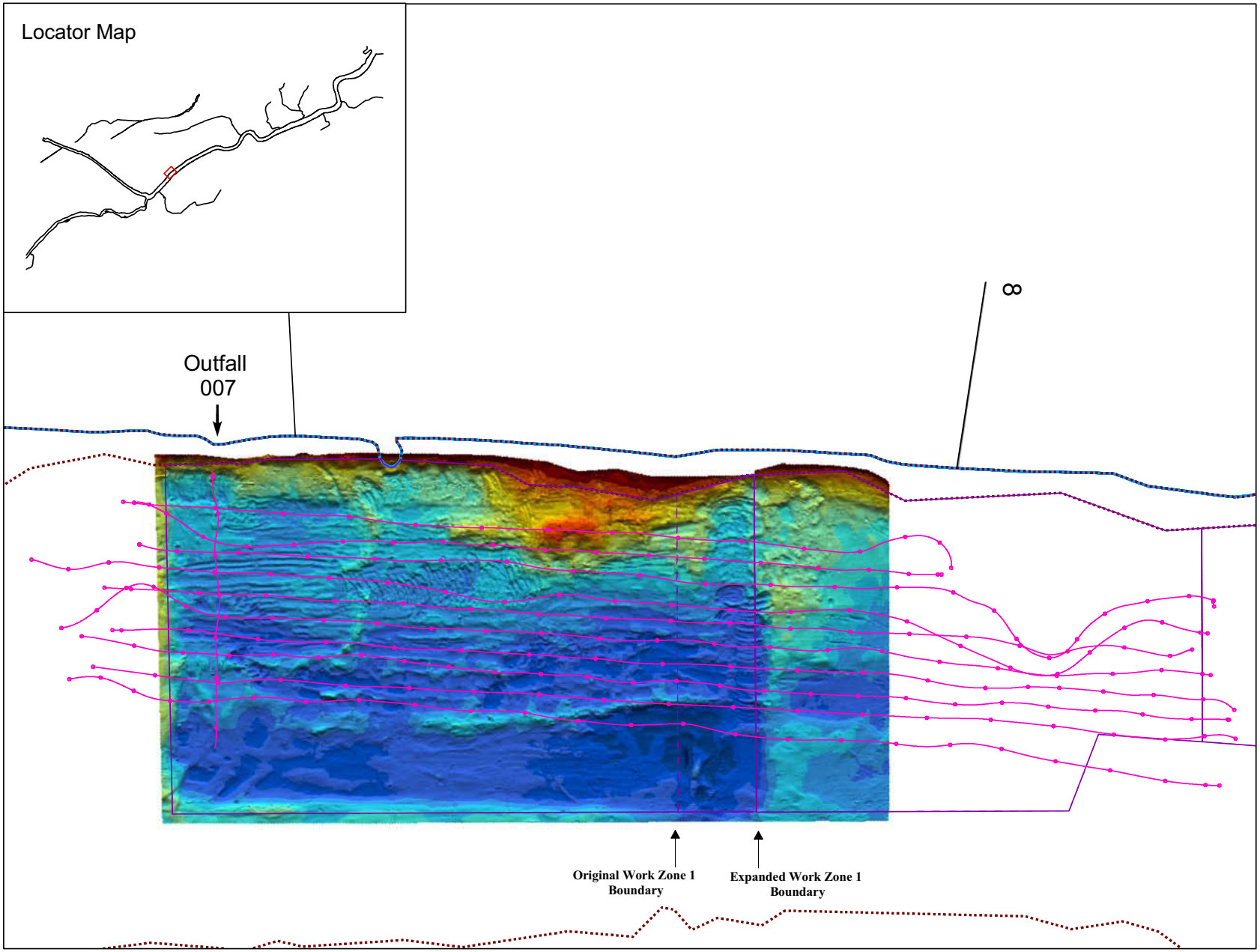

GRAPHIC SCALE
Feet
0 25 50 100

LEGEND
Elevation (ft)

- 151 - 152
- 150 - 151
- 149 - 150
- 148 - 149
- 147 - 148
- 146 - 147
- 145 - 146
- 144 - 145
- 143 - 144
- 142 - 143
- 141 - 142
- 140 - 141
- 139 - 140
- 138 - 139
- 137 - 138
- 136 - 137
- Sub-Bottom Profiling Transects
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-23.
Transects Surveyed
During October 22
Sub-Bottom Profiling Survey

ALCOA

Feb 2006

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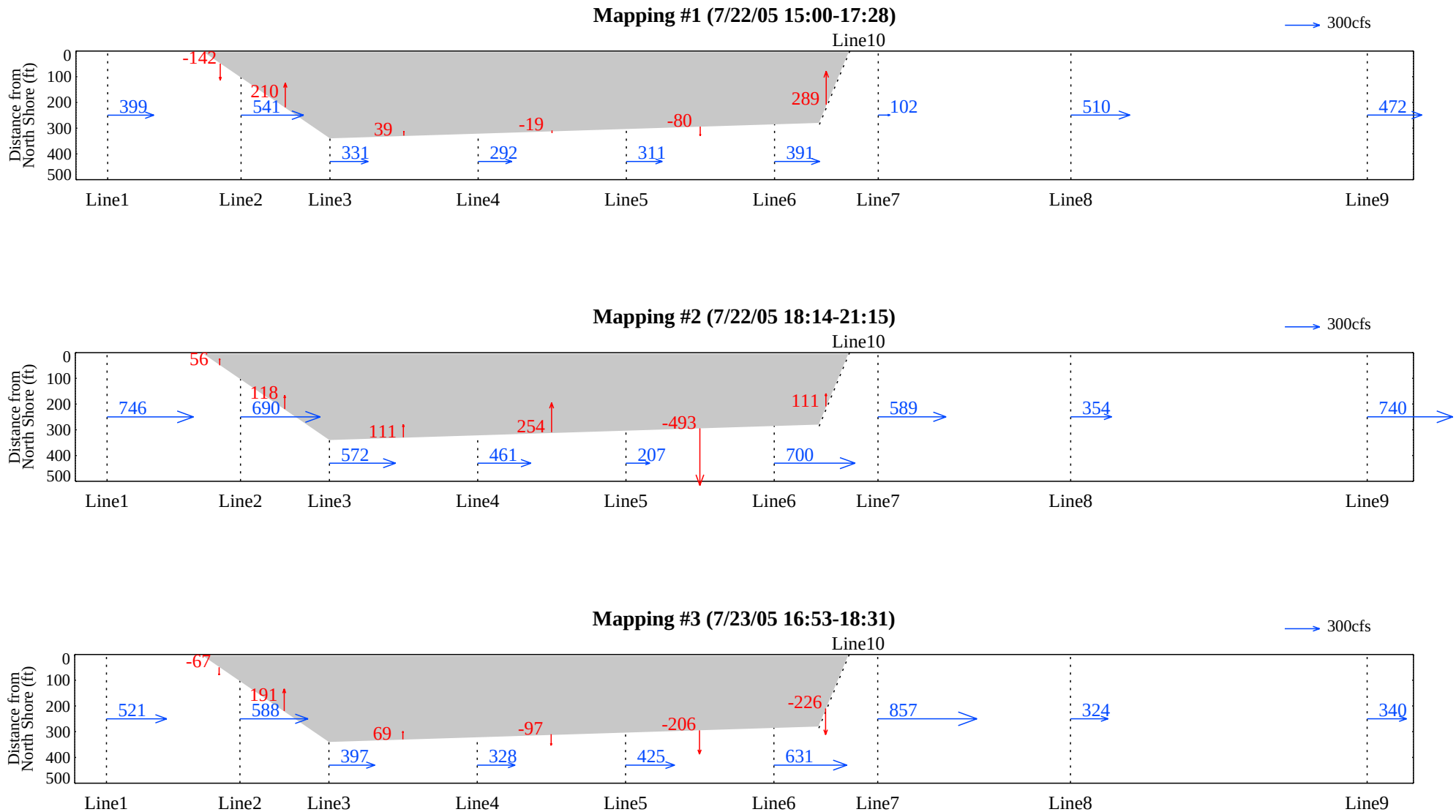

Figure A-24. ROPS Work Area Flow Balance for Mappings 1, 2, and 3

Flows computed using velocity data and 2003 multibeam bathymetry data.

Positive longitudinal flow represents flow downstream; positive lateral flow represents flow into the silt curtain (calculated by a horizontal flow balance).

Shaded area represents portion of river enclosed by containment system.

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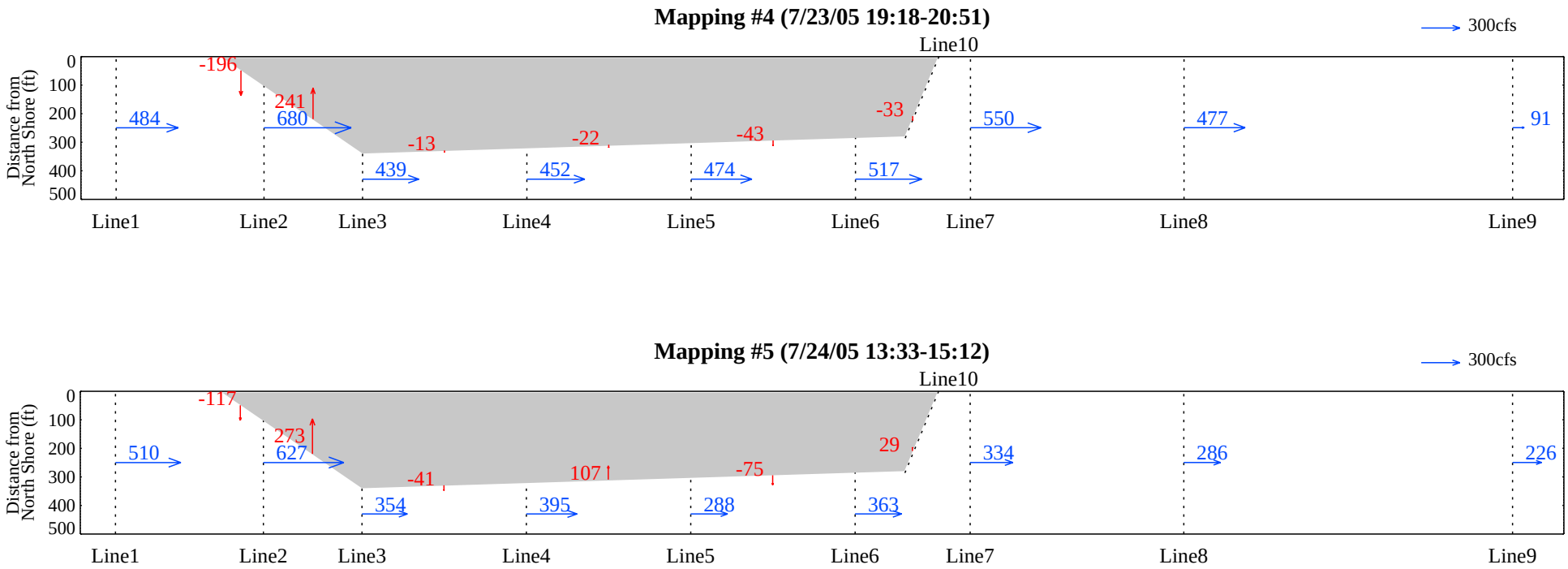
Wed Feb 08 08:52:34 2006



Longitudinal Flow
Lateral Flow

Figure A-25. ROPS Work Area Flow Balance for Mappings 4 and 5

Flows computed using velocity data and 2003 multibeam bathymetry data.

Positive longitudinal flow represents flow downstream; positive lateral flow represents flow into the silt curtain (calculated by a horizontal flow balance). Shaded area represents portion of river enclosed by containment system.

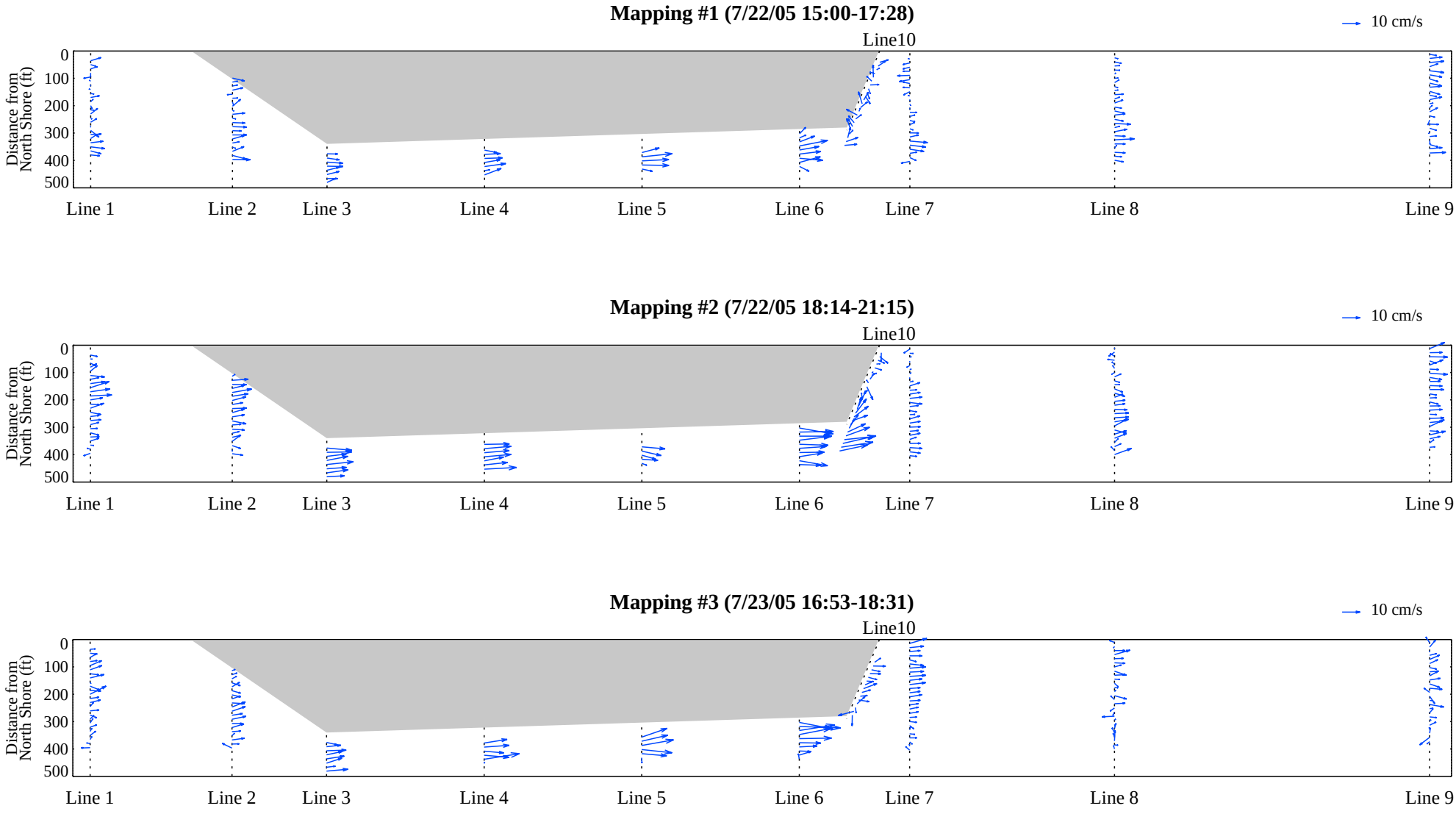


Figure A-26. Vertically-averaged Velocity Fields for Mappings 1, 2, and 3

Shaded area represents portion of river enclosed by containment system.

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Wed Feb 08 08:56:49 2006

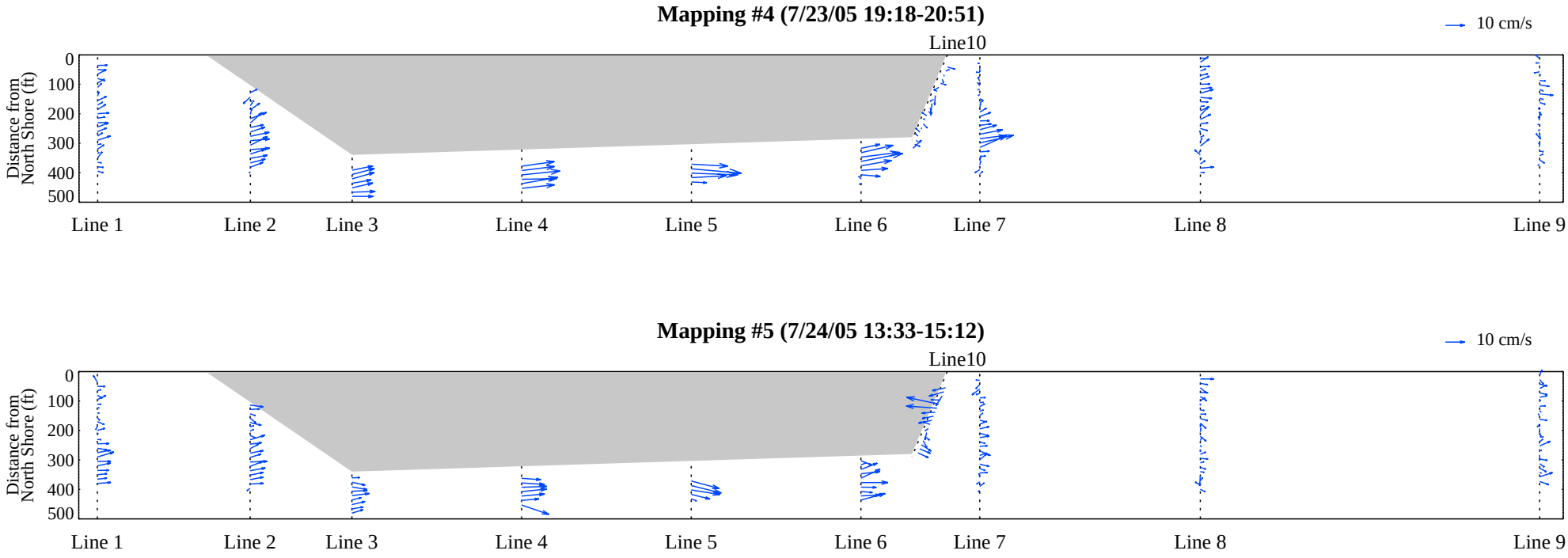

Figure A-27. Vertically-averaged Velocity Fields for Mappings 4 and 5

Shaded area represents portion of river enclosed by containment system.

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Wed Feb 08 08:56:49 2006

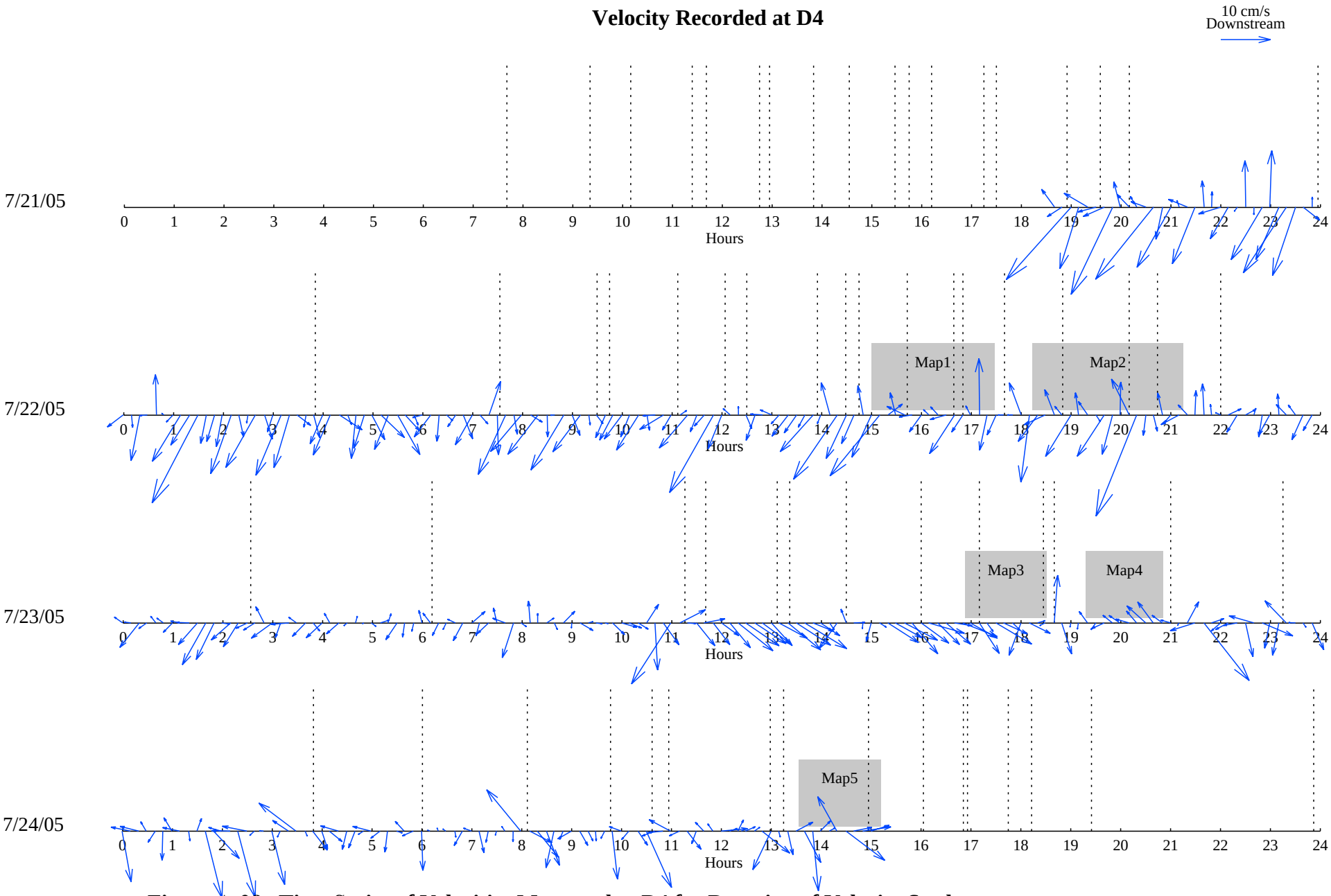

Figure A-28. Time Series of Velocities Measured at D4 for Duration of Velocity Study

Velocities measured approximately 1 foot from the river bottom.

Positive X direction towards downstream; positive Y direction towards northern shore. Dashed lines represent estimated times of water release from Snell Lock.

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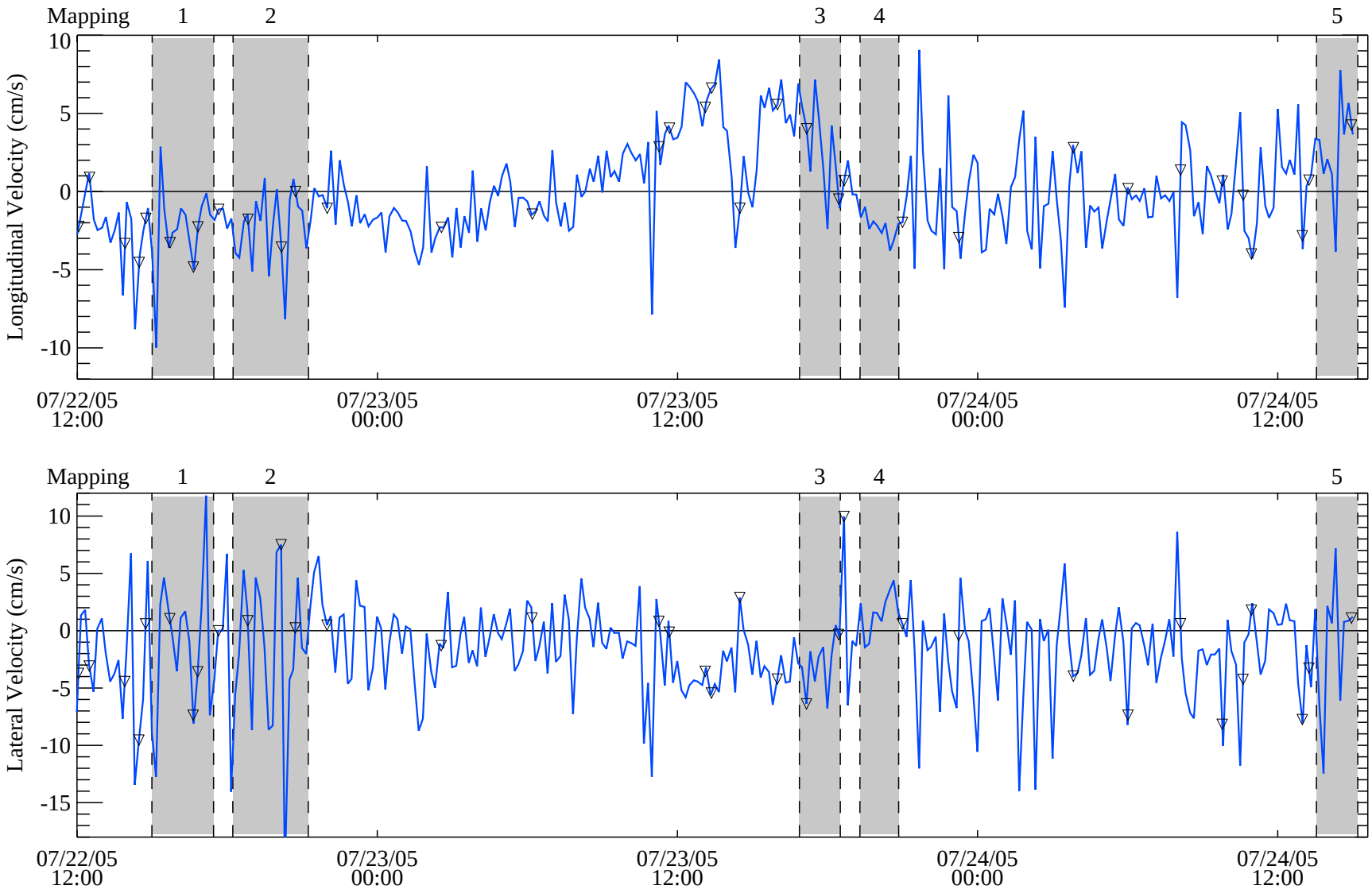

Figure A-29. Comparison of Measured Current Velocities at D4 (ADV) with Estimated Release Times for Snell Lock

Velocities Measured by ADV at D4 During July 22-24, 2005.

Positive longitudinal velocity indicates movement downstream; positive lateral velocity indicates movement towards the southern shore.

▽ Est. Release Time for Snell Lock

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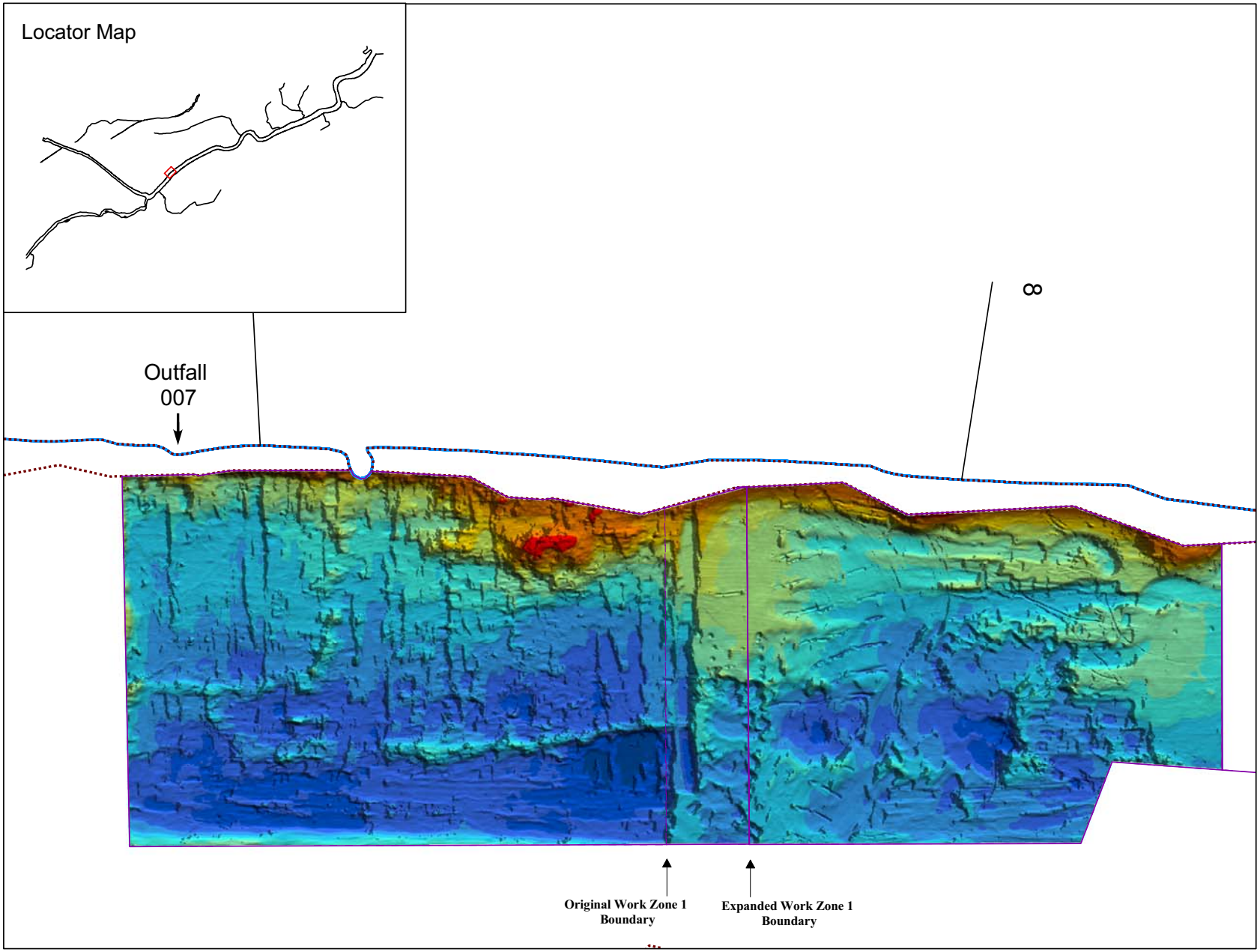

GRAPHIC SCALE
Feet
0 25 50 100

LEGEND

Elevation (ft)
151 - 152
150 - 151
149 - 150
148 - 149
147 - 148
146 - 147
145 - 146
144 - 145
143 - 144
142 - 143
141 - 142
140 - 141
139 - 140
138 - 139
137 - 138
136 - 137
Work Zone Outline
Original Work Zone Boundary
Near Shore Area
Grasse River Shoreline
Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-30.
Sediment Elevations Measured
During September 12-13
Multibeam Survey

ALCOA

Feb 2006

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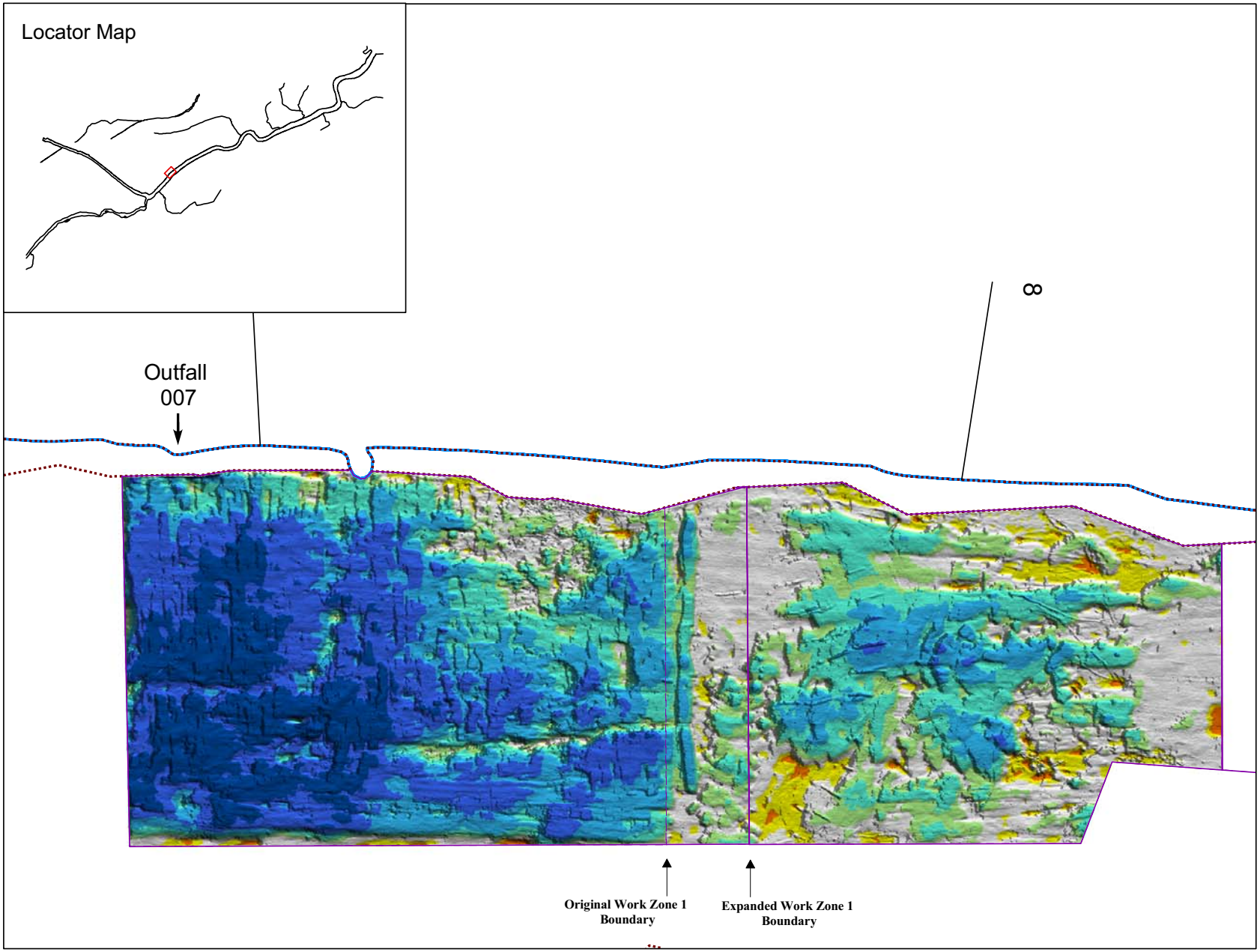


GRAPHIC SCALE

Feet

0 25 50 100

LEGEND

Sediment Removed (ft)

- < -2
- -2 - -1
- -1 - -0.5
- -0.5 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

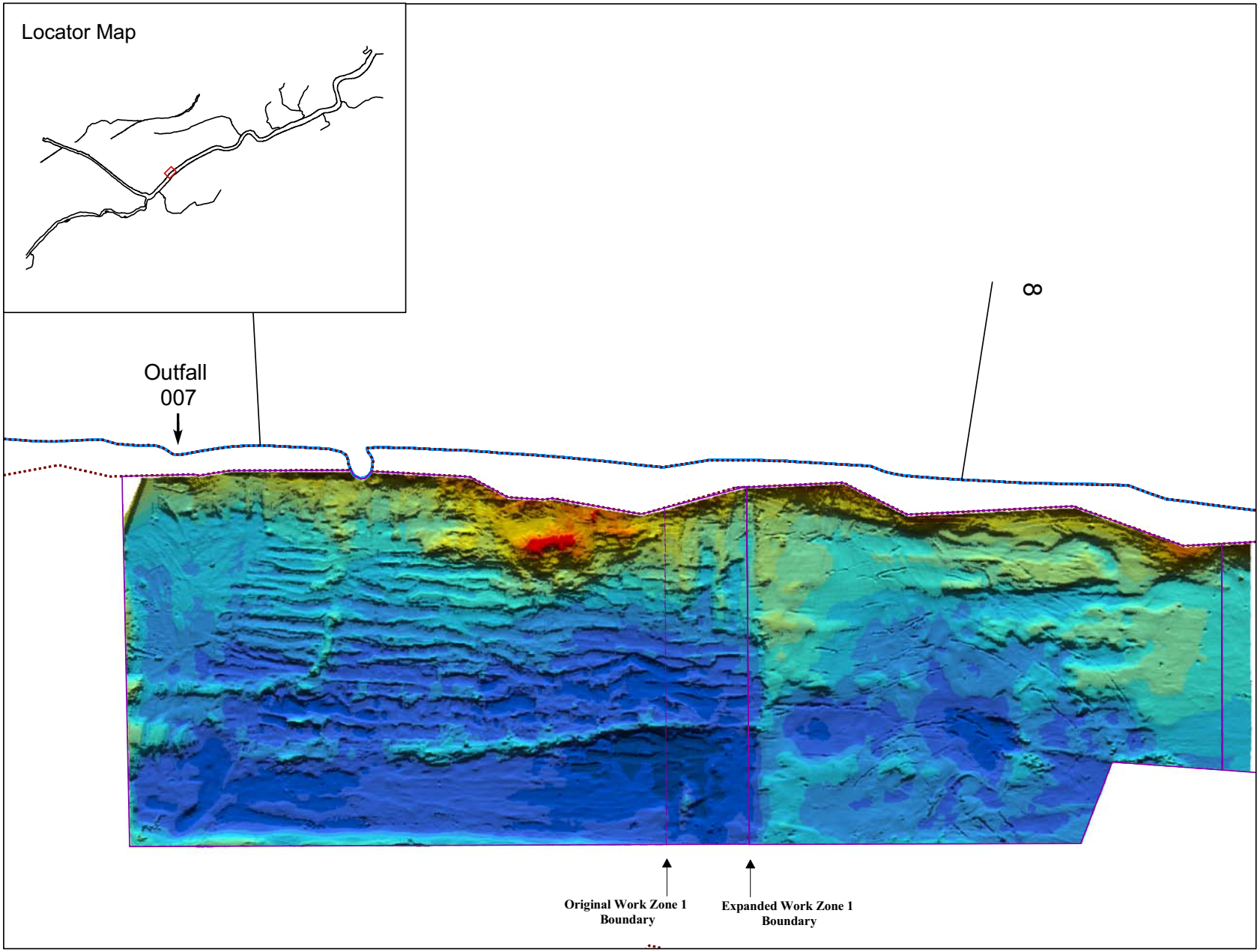
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-31.
Sediment Elevation Differences Between Pre-ROPS (2003) and September 12, 2005 Multibeam Bathymetry Surveys

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



GRAPHIC SCALE

Feet

0 25 50 100

LEGEND

Elevation (ft)

- 151 - 152
- 150 - 151
- 149 - 150
- 148 - 149
- 147 - 148
- 146 - 147
- 145 - 146
- 144 - 145
- 143 - 144
- 142 - 143
- 141 - 142
- 140 - 141
- 139 - 140
- 138 - 139
- 137 - 138
- 136 - 137
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

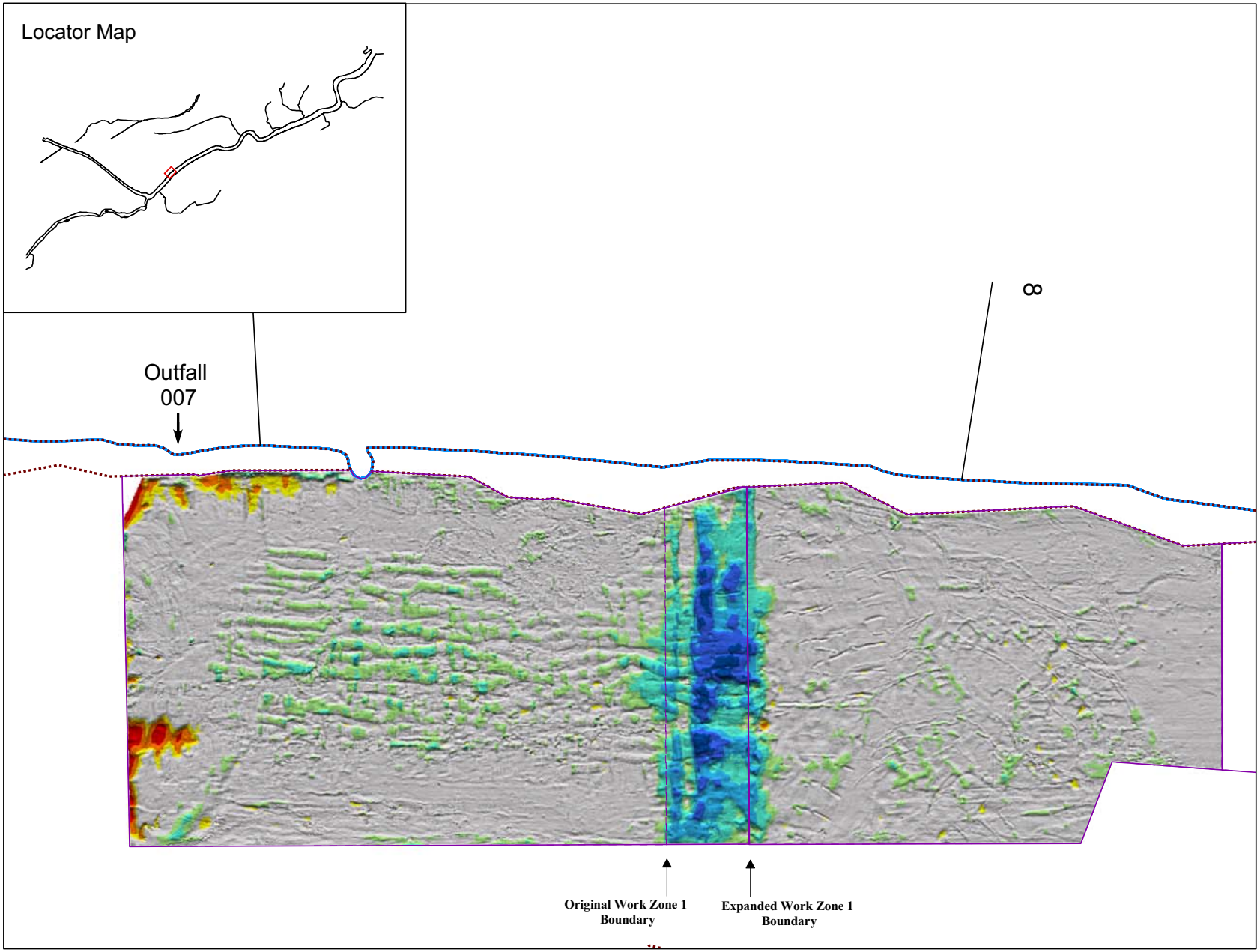
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-32.
Sediment Elevations Measured
During September 30
Multibeam Bathymetry Survey

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



GRAPHIC SCALE

Feet

0 25 50 100

LEGEND

Sediment Removed (ft)

- < -2
- -2 - -1
- -1 - -0.5
- -0.5 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

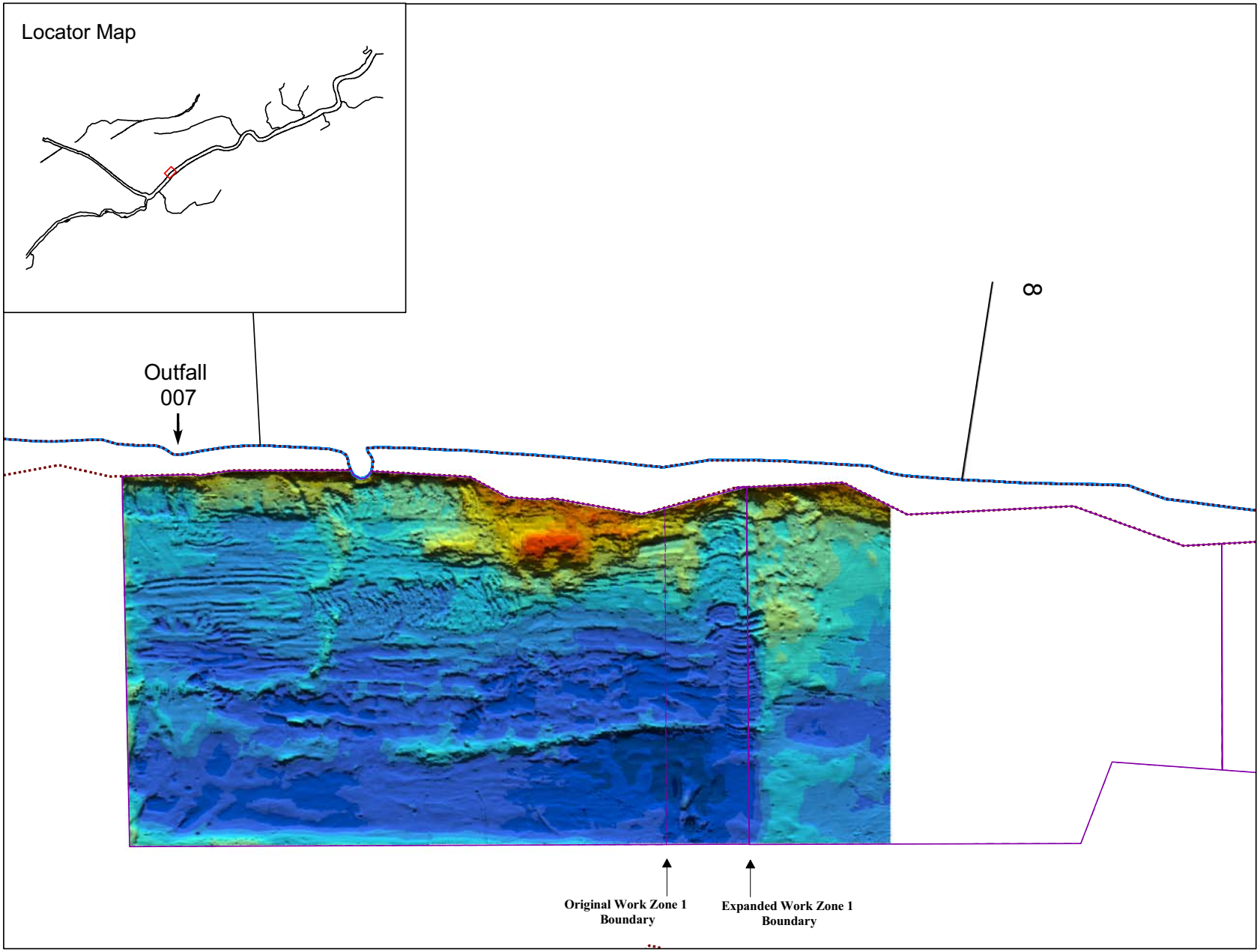
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-33.
Sediment Elevation
Differences Between
September 13 & September 30
Multibeam Bathymetry Surveys

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



GRAPHIC SCALE

Feet

0 25 50 100

LEGEND

Elevation (ft)

- 151 - 152
- 150 - 151
- 149 - 150
- 148 - 149
- 147 - 148
- 146 - 147
- 145 - 146
- 144 - 145
- 143 - 144
- 142 - 143
- 141 - 142
- 140 - 141
- 139 - 140
- 138 - 139
- 137 - 138
- 136 - 137
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

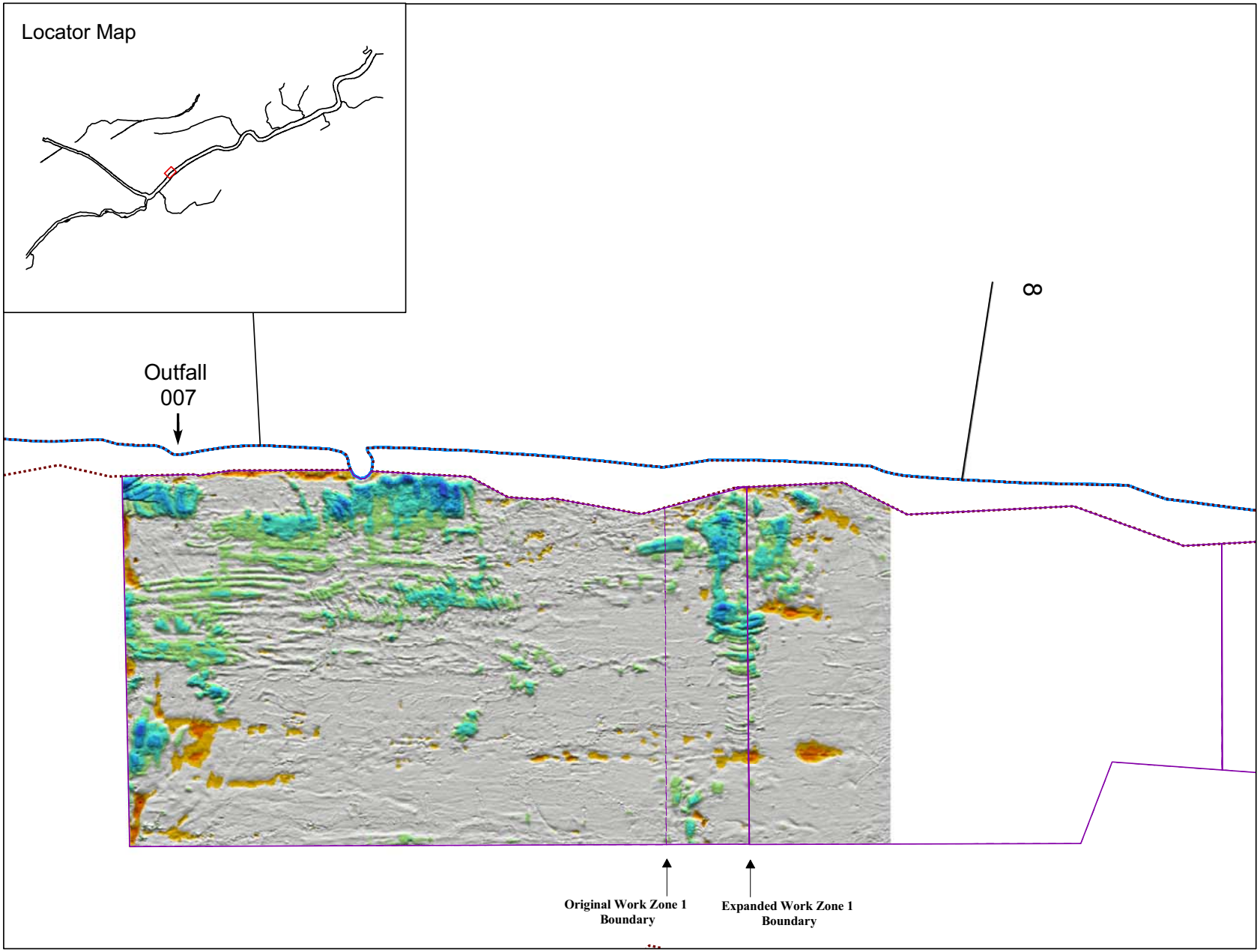
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-34.
Sediment Elevations Measured
During October 22
Multibeam Bathymetry Survey

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



N

GRAPHIC SCALE

Feet

0 25 50 100

LEGEND

Sediment Removed (ft)

- < -2
- -2 - -1
- -1 - -0.5
- -0.5 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4
- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-35.
Sediment Elevation
Differences Between
September 30 & October 22
Multibeam Bathymetry Surveys

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DIRECTION OF RIVER FLOW
- NNS-4 — SAMPLE ID
- AUGUST 3-4, 2005 SAMPLE LOCATION
- AUGUST 19, 2005 SAMPLE LOCATION

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-REMOVAL
SEDIMENT CORE COLLECTION LOCATIONS - NORTHERN NEAR SHORE

ALCOA

FIGURE
A-36

X: 10809X01, ...X02.DWG, ...X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES TJR BGP
10809001/10809G37.DWG

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- AUGUST 24–25, 2005 MANUAL COLLECTION LOCATION
- AUGUST 30, 2005 VIBRACORE COLLECTION LOCATION
- SEPTEMBER 12–13, 2005 VIBRACORE COLLECTION LOCATION
- SEPTEMBER 22–23, 2005 MANUAL CORE COLLECTION LOCATION
- OCTOBER 10–12, 2005 VIBRACORE COLLECTION LOCATION
- OCTOBER 22, 2005 VIBRACORE COLLECTION LOCATION
- 572 — GRID NODE ID (SEE NOTE 2)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. GRID NODE IDs ARE PROVIDED FOR IDENTIFICATION PURPOSES.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

DURING-CONSTRUCTION MONITORING SEDIMENT CORE COLLECTION LOCATIONS - WORK ZONE 1

ALCOA

FIGURE
A-37

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES TJR BGP
10809001/10809G38.DWG

LEGEND:

- T8 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- APPROXIMATE BOUNDARY OF AREA PROPOSED FOR THIN-LAYER CAPPING
- DIRECTION OF RIVER FLOW
- AUGUST 30, 2005 VIBRACORE COLLECTION LOCATION
- SEPTEMBER 30, 2005 VIBRACORE COLLECTION LOCATION
- 750 — GRID NODE ID (SEE NOTE 3)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. WORK ZONE 2 WAS NOT DREDGED TO ITS ORIGINAL EXTENT AS DESCRIBED IN SECTION 2.
3. GRID NODE IDs ARE PROVIDED ONLY NEAR VIBRACORE LOCATIONS FOR IDENTIFICATION PURPOSES.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

DURING-CONSTRUCTION MONITORING SEDIMENT CORE COLLECTION LOCATIONS - WORK ZONE 2

ALCOA

FIGURE
A-38

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/23/06 SYR-85-NES TJR BGP
10809001/10809G39.DWG

CORE 492 (AUGUST 30, 2005)

Visual Characterization	Total PCB Concentration
Dark brown silt, little fine sand, trace organics (twigs), odor	322 ppm
Brown very fine to fine sand, trace shells, odor	25.2 ppm
Dark brown to gray fine sand, little medium to coarse sand, trace fine to medium gravel	7.2 ppm
Brown fine sand, trace very fine sand, trace silt, trace medium sand	Non-detect
	Non-detect
Gray very fine sand and silt, trace clay, trace rock fragments	Non-detect
	Non-detect

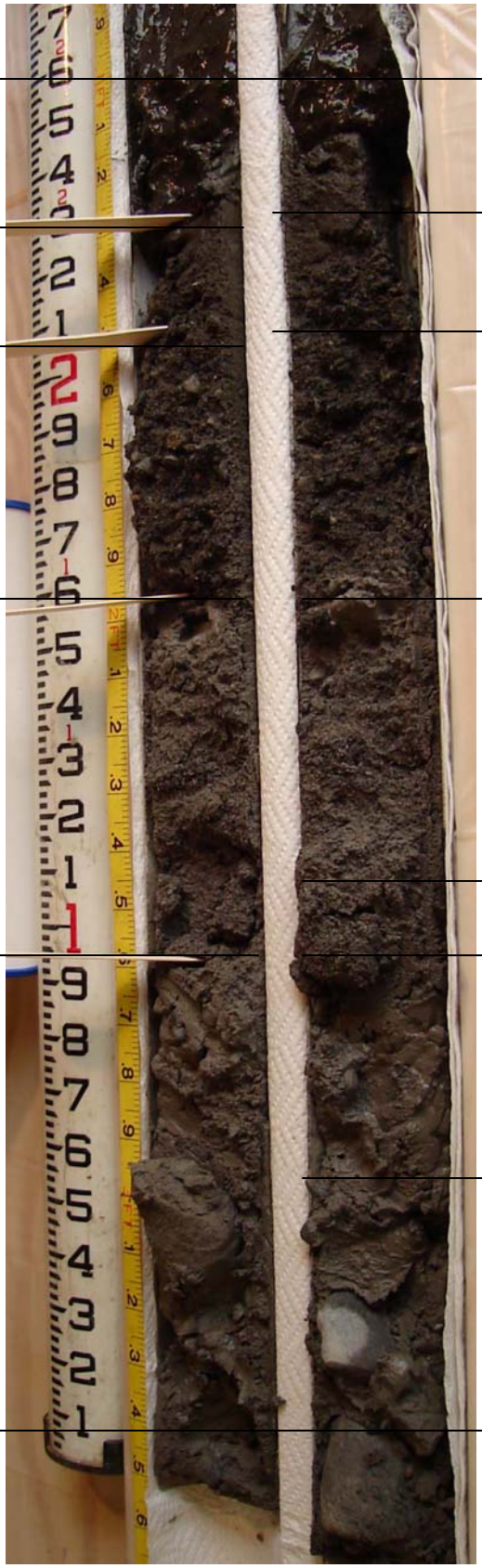


Figure A-39. Example of Physical and Chemical Differences Between Contaminated Sediment Layer and Native Sediments.

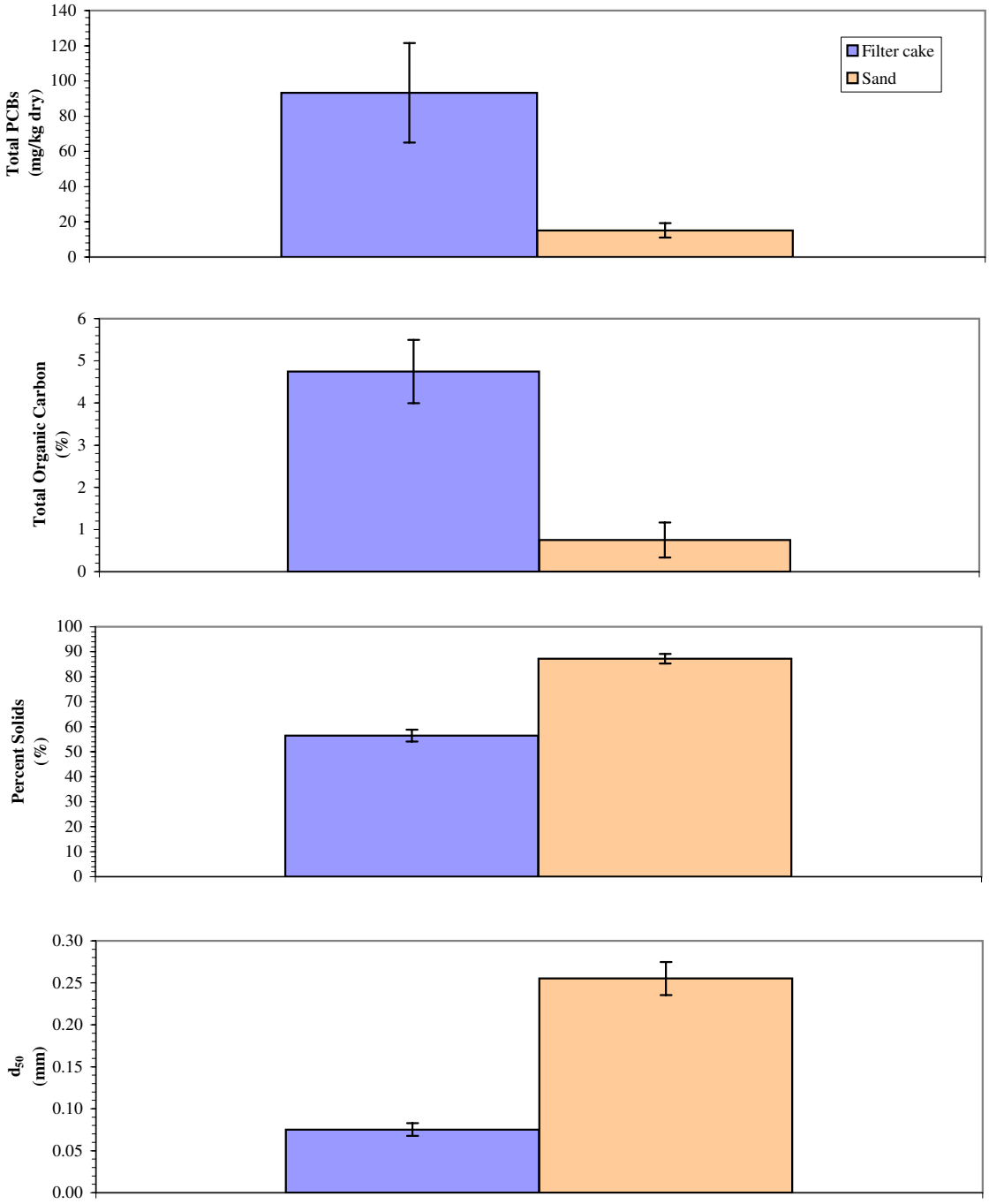


Figure A-40. Average PCB, TOC, Percent Solids, and Grain Size in Filter Cake and Sand Samples of Ex-Situ Dredge Material

Error bars represent +/- two standard errors of the mean. Non-detects replaced with half the detection limit. Results for samples re-extracted and re-analyzed (Aug 9 and Sept 28) were averaged.

Grain size results for 7/7and 7/14 were excluded from d50 calculation for filter cake because original sample from 7/21 was found to be able to be broken down further in the laboratory. Samples from 7/7 and 7/14 were no longer available for re-analysis.

Data table: dredge_material_ROPS

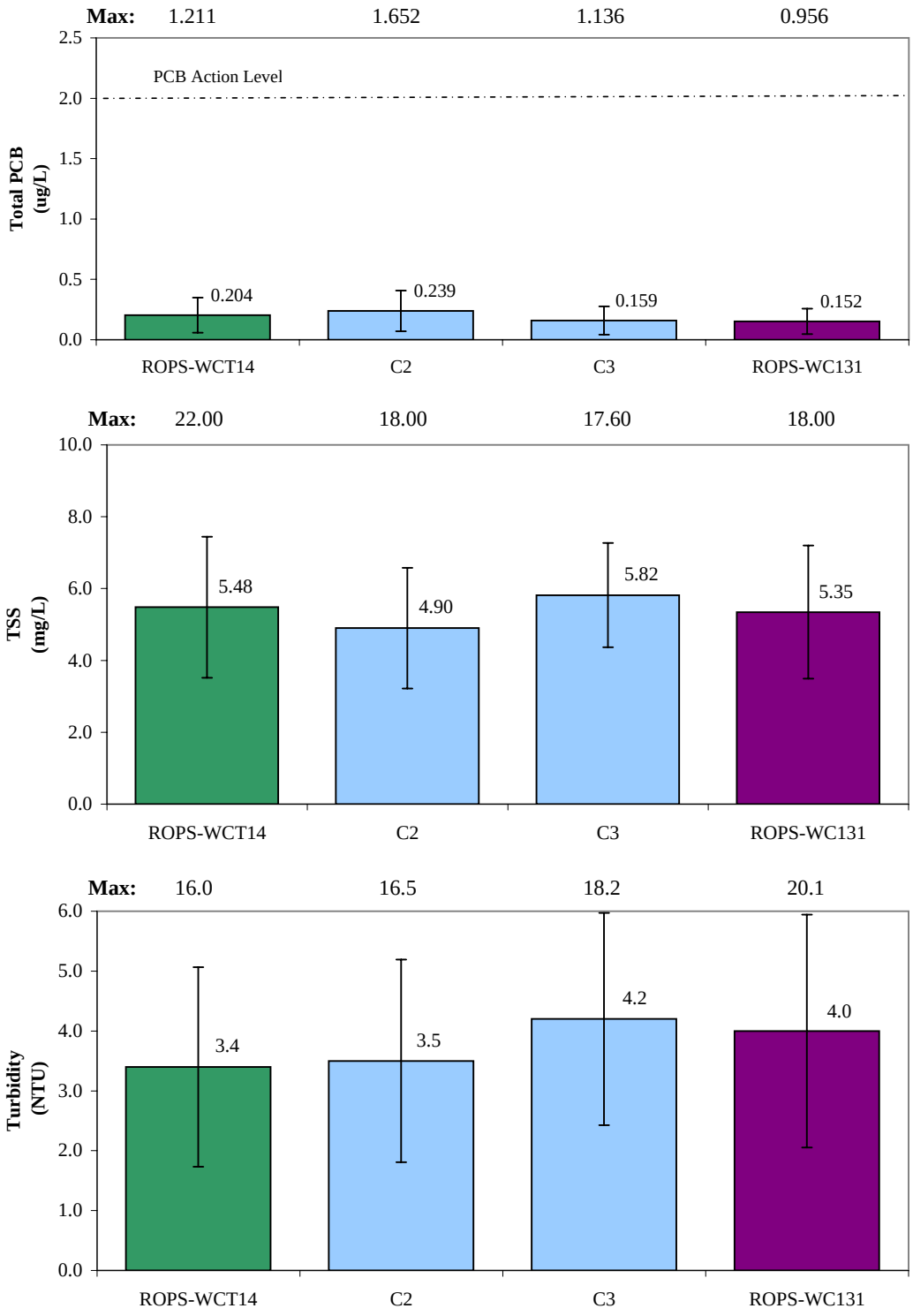
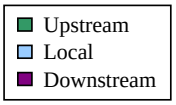
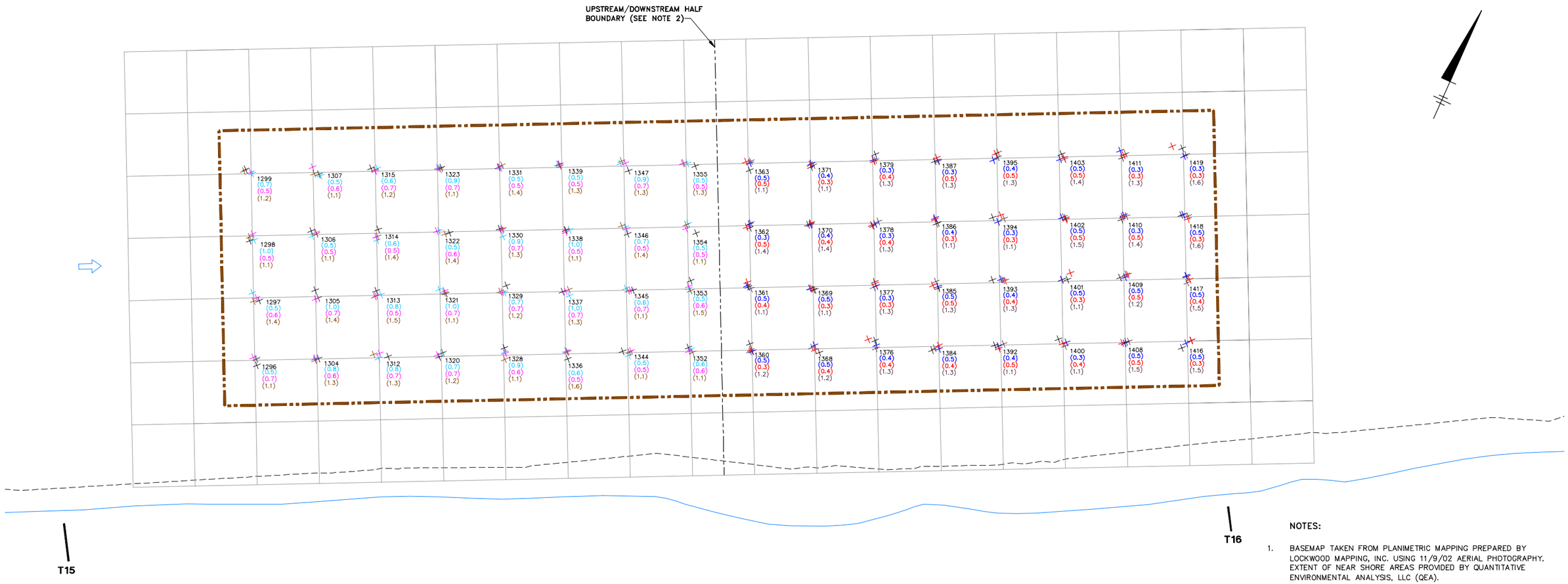


Figure A-41. Average Water Column Levels During Armored Capping
Values below the detection were set to half the detection limit prior to calculations.
Error bars represent 95% confidence intervals.
Maximum levels displayed along the top of each panel for each location.
PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.



Date tables: water_aro_ROPS, water_field_ROPS

ARC- D:\ALCgra\Analysis\ROPS\IDL\water\watercolumn_spatialavg_barplots.xls
5/22/2006 11:49 AM



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. THE ARMORED CAP AREA WAS DIVIDED INTO AN UPSTREAM AND DOWNSTREAM HALF AS DIFFERENT LAYERS WERE PLACED IN THESE AREAS. THREE LAYERS WERE PLACED IN THE UPSTREAM HALF INCLUDING A 6–INCH BASE LAYER, 6–INCH FILTER LAYER, AND 13–INCH ARMOR LAYER. THREE LAYERS WERE ALSO PLACED IN THE DOWNSTREAM HALF INCLUDING TWO 3–INCH FILTER LAYERS AND A 13–INCH ARMOR LAYER. THE THICKNESSES PROVIDED HERE ARE ACTUAL; THICKNESS TOLERANCES ARE DESCRIBED IN ECN 027 REVISION 1.
3. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE 2005 BASELINE OR PREVIOUS CAPPING LAYER SURFACE ELEVATION AND THE NEXT POST–CAPPING ELEVATION (i.e., ARMORED LAYER THICKNESS DETERMINED USING THE FILTER SURFACE ELEVATION AND THE POST–ARMOR LAYER ELEVATION).

LEGEND:

T16	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
	DIRECTION OF RIVER FLOW
×	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
1352	GRID NODE ID

UPSTREAM HALF OF ARMORED CAP AREA

×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – BASE LAYER (POST–CAPPING; SEPTEMBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – FILTER LAYER (POST–CAPPING; SEPTEMBER/OCTOBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – ARMOR LAYER (POST–CAPPING; OCTOBER 2005)
(0.6)	BASE LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(0.5)	FILTER LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(1.2)	ARMOR LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)

DOWNSTREAM HALF OF ARMORED CAP AREA

×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – FILTER LAYER 2 (POST–CAPPING; SEPTEMBER/OCTOBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – FILTER LAYER 1 (POST–CAPPING; OCTOBER 2005)
×	DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION – ARMOR LAYER (POST–CAPPING; OCTOBER 2005)
(0.6)	FILTER LAYER 2 CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(0.5)	FILTER LAYER 1 CAP MATERIAL THICKNESS (FT; SEE NOTE 3)
(1.2)	ARMOR LAYER CAP MATERIAL THICKNESS (FT; SEE NOTE 3)

0 20' 40'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR THE ARMORED CAPPING AREA

ALCOA

FIGURE
A-42

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G40.DWG

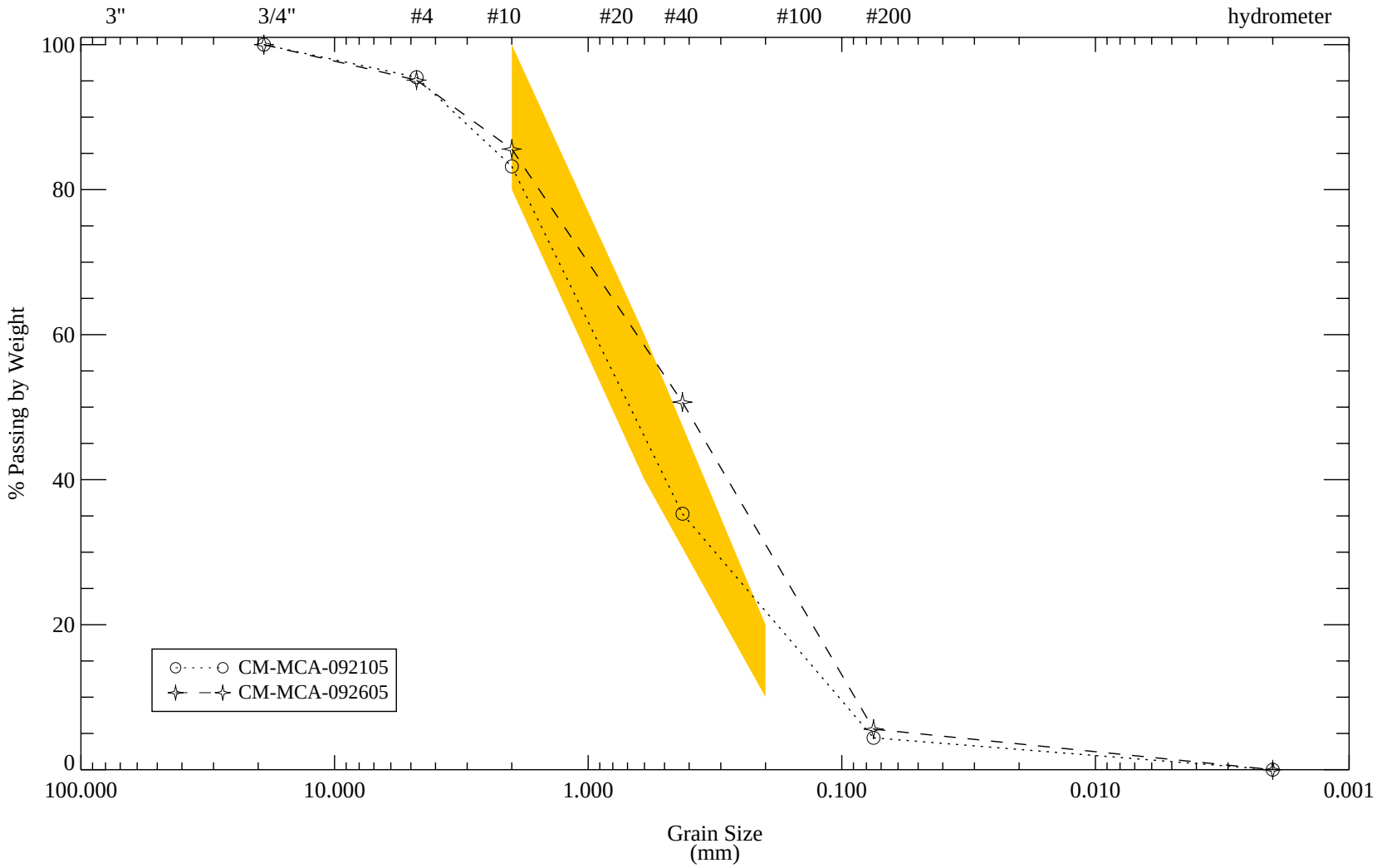


Figure A-43. Grain Size Distributions of Cap Material Used During Armored Capping
Two samples collected from cap material prior to placement.
The orange polygon represents an envelope of cap material based on armored capping specifications for the base layer.

Data table: cap_material_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\capping\actualcap_grainsize_distrib.pro
Tue Jan 10 18:46:14 2006

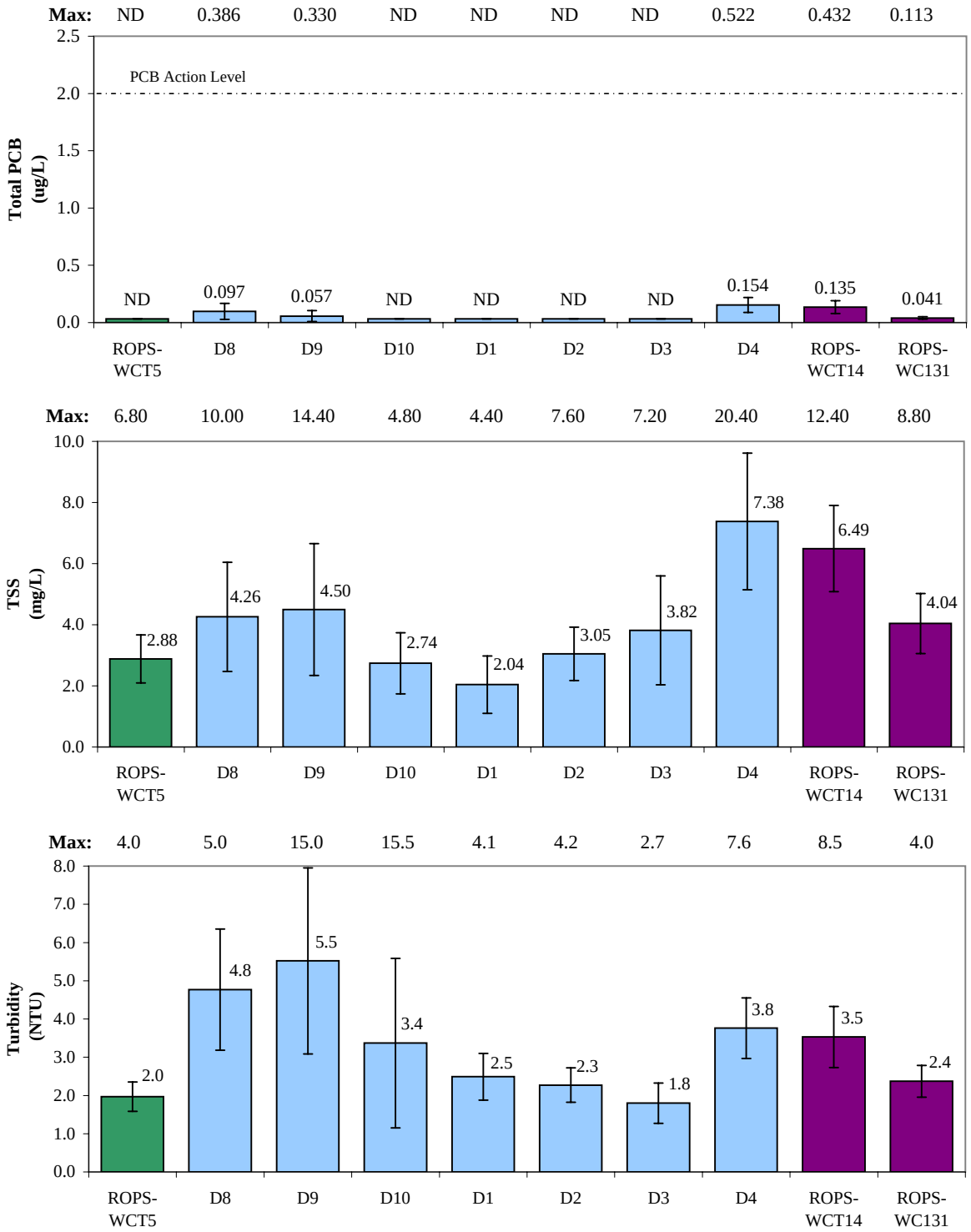


Figure A-44. Average Water Column Levels During Post-Dredge Capping in Work Zones 1 and 2

Values below the detection were set to half the detection limit prior to calculations.

Locations where all PCB levels were below the detection limit (0.065 ug/L) are labled as 'ND'.

Error bars represent 95% confidence intervals.

Maximum levels displayed along the top of each panel for each location.

PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

- Upstream
- Local
- Downstream

Date tables: water_aro_ROPS, water_field_ROPS

ARC- D:\ALCgra\Analysis\ROPS\IDL\water\watercolumn_spatialavg_barplots.xls
5/22/2006 11:50 AM

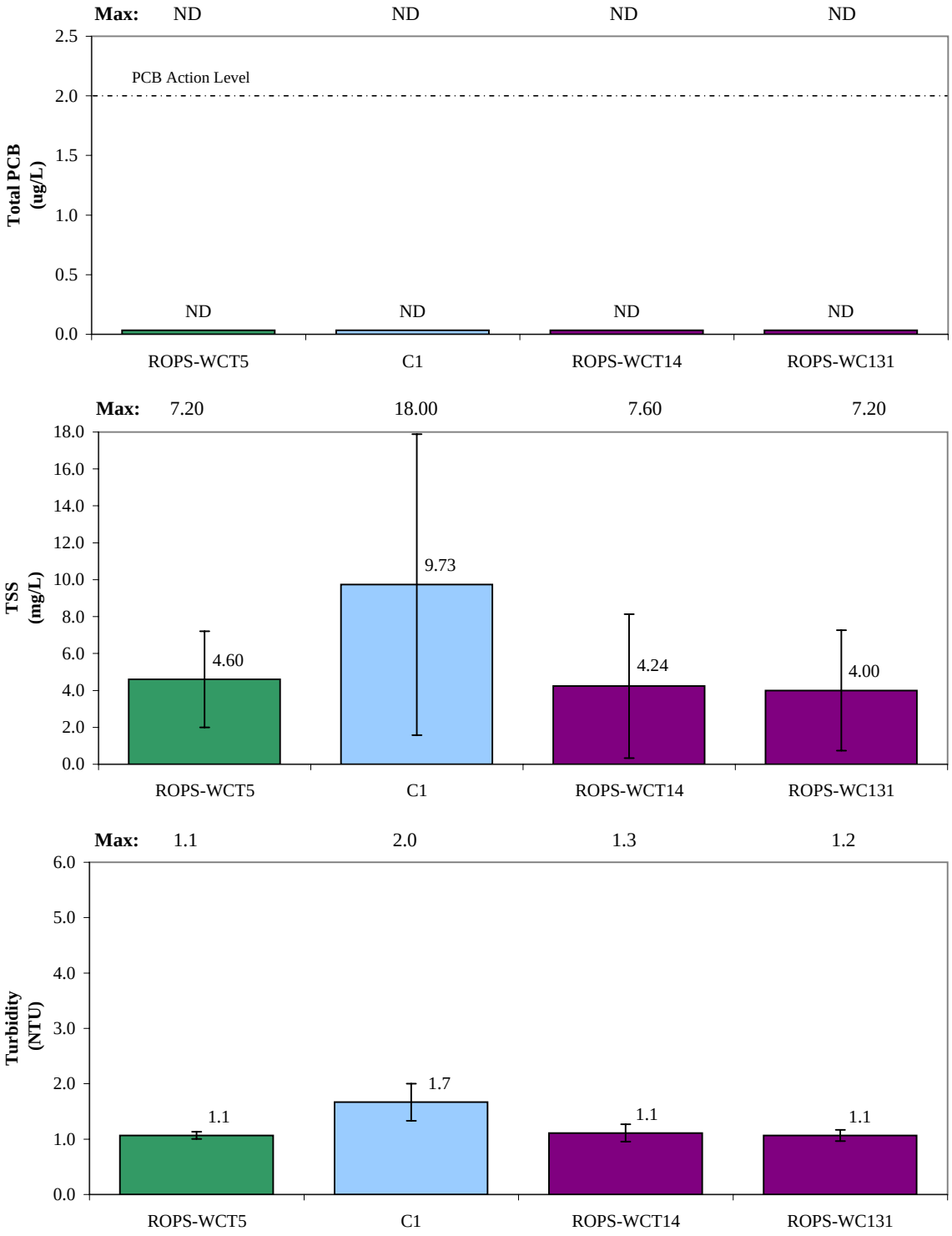


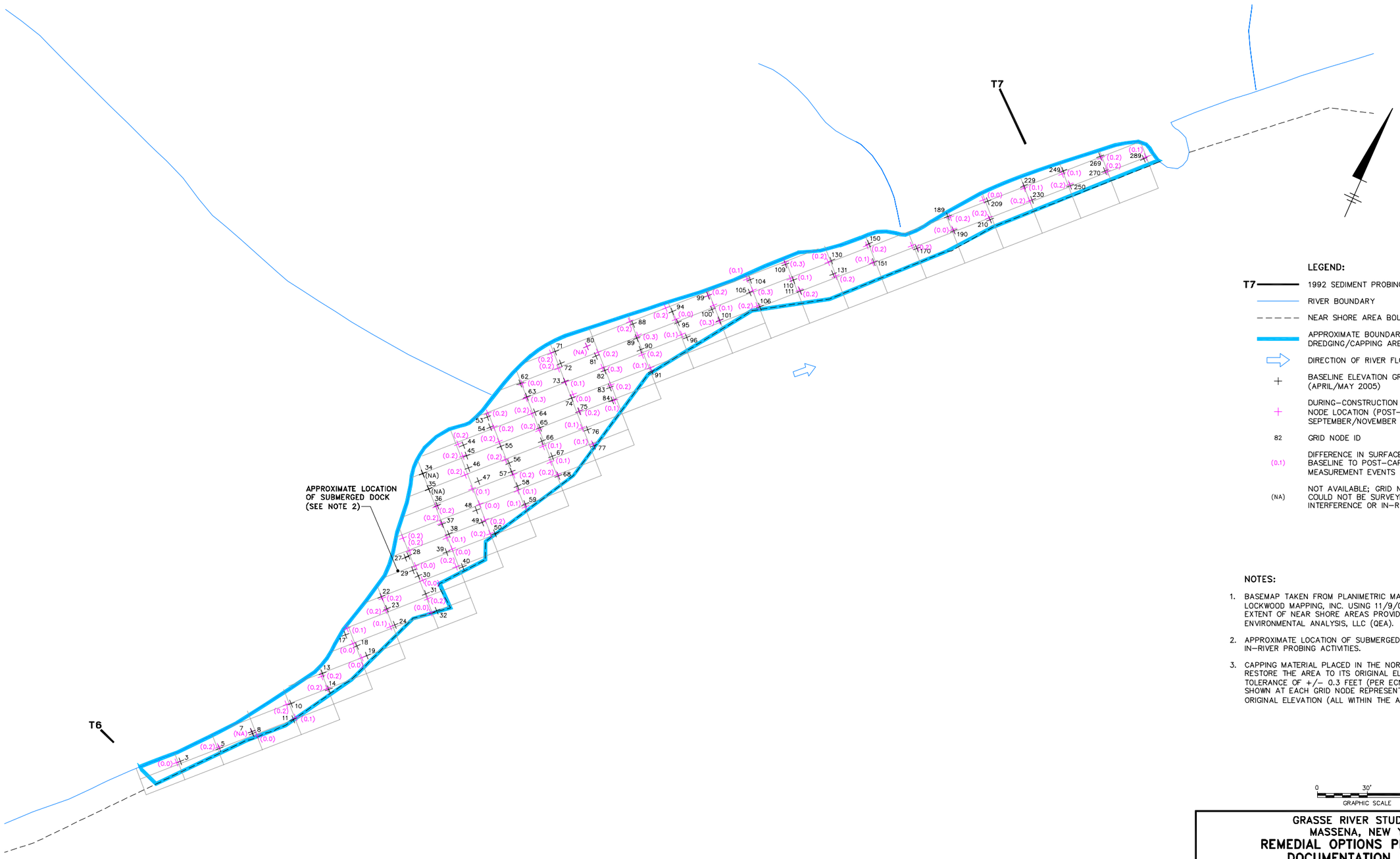
Figure A-45. Average Water Column Levels During Thin-Layer Capping in the Southern Near Shore

Values below the detection were set to half the detection limit prior to calculations.
Locations where all PCB levels were below the detection limit (0.065 ug/L) are labled as 'ND'.
Error bars represent 95% confidence intervals.
Maximum levels displayed along the top of each panel for each location.
PCB Action Level only applicable to ROPS-WCT14 and ROPS-WC131.

- Upstream
- Local
- Downstream

Date tables: water_aro_ROPS, water_field_ROPS

ARC- D:\ALCgra\Analysis\ROPS\IDL\water\watercolumn_spatialavg_barplots.xls
5/22/2006 11:51 AM



LEGEND:

T7	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA BOUNDARY
	APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
	DIRECTION OF RIVER FLOW
+	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
+	DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-CAPPING; SEPTEMBER/NOVEMBER 2005)
82	GRID NODE ID
(0.1)	DIFFERENCE IN SURFACE ELEVATION FROM BASELINE TO POST-CAPPING MEASUREMENT EVENTS (FT; SEE NOTE 3)
(NA)	NOT AVAILABLE; GRID NODE LOCATION COULD NOT BE SURVEYED DUE TO INTERFERENCE OR IN-RIVER OBSTRUCTION

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. APPROXIMATE LOCATION OF SUBMERGED DOCK DEFINED THROUGH IN-RIVER PROBING ACTIVITIES.
3. CAPPING MATERIAL PLACED IN THE NORTHERN NEAR SHORE TO RESTORE THE AREA TO ITS ORIGINAL ELEVATION WITHIN A TOLERANCE OF +/- 0.3 FEET (PER ECN 022). THE DIFFERENCE SHOWN AT EACH GRID NODE REPRESENTS THE CHANGE FROM THE ORIGINAL ELEVATION (ALL WITHIN THE ALLOWABLE TOLERANCE).

0 30' 60'
GRAPHIC SCALE

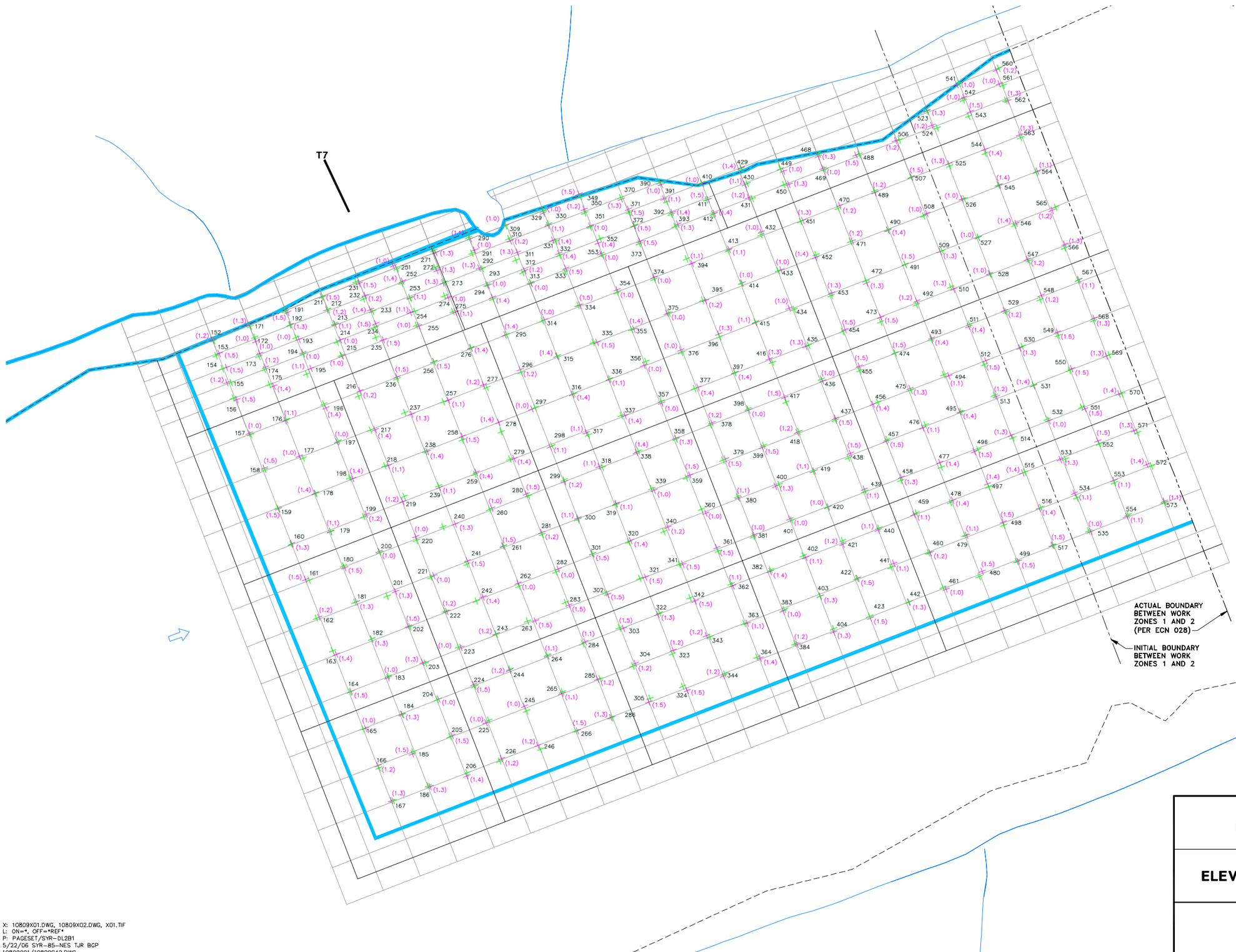
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING
ELEVATION MEASUREMENT RESULTS
FOR THE NORTHERN NEAR SHORE AREA

ALCOA

FIGURE
A-46

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G41.DWG



LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION (POST–DREDGING; OCTOBER 2005)
- DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION (POST–CAPPING; NOVEMBER 2005)
- 550 — GRID NODE ID
- (1.5) — CAP MATERIAL THICKNESS (FT; SEE NOTE 2)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE POST–DREDGING SURFACE ELEVATION (MEASURED IN OCTOBER 2005) AND THE POST–CAPPING ELEVATION (MEASURED IN NOVEMBER 2005). THE TARGET CAP MATERIAL THICKNESS WAS 1.0 FT WITH AN ALLOWABLE TOLERANCE OF +0.5 FT PER ECN 033.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 1

ALCOA

FIGURE
A-47

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES TJR BGP
10809001/10809G42.DWG

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-DREDGING; OCTOBER 2005)
- DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-CAPPING; NOVEMBER 2005)
- 819 — GRID NODE ID
- (1.5) — CAP MATERIAL THICKNESS (FT; SEE NOTE 2)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE POST-DREDGING SURFACE ELEVATION (MEASURED IN OCTOBER 2005) AND THE POST-CAPPING ELEVATION (MEASURED IN NOVEMBER 2005). THE TARGET CAP MATERIAL THICKNESS WAS 1.0 FT WITH AN ALLOWABLE TOLERANCE OF +0.5 FT PER ECN 033.

0 30' 60'
GRAPHIC SCALE

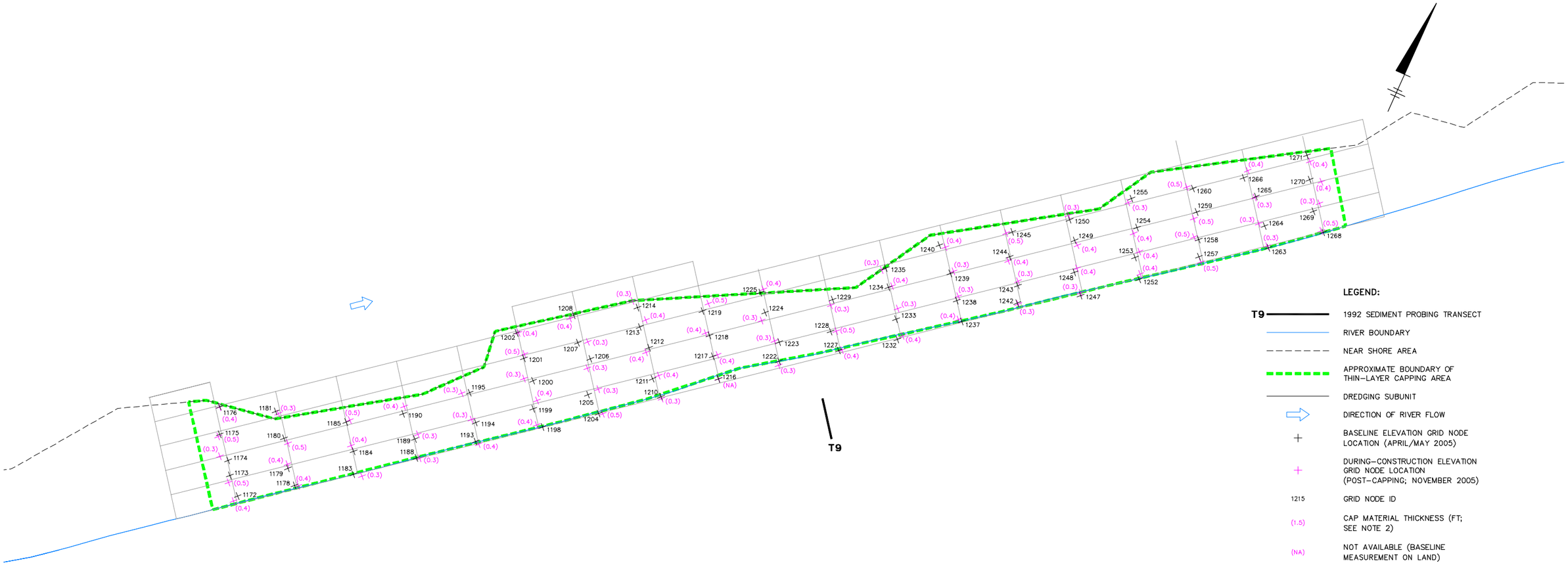
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR WORK ZONE 2

ALCOA

FIGURE
A-48

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G43.DWG



LEGEND:

T9	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
	DREDGING SUBUNIT
	DIRECTION OF RIVER FLOW
+	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
+	DURING-CONSTRUCTION ELEVATION GRID NODE LOCATION (POST-CAPPING; NOVEMBER 2005)
1215	GRID NODE ID
(1.5)	CAP MATERIAL THICKNESS (FT; SEE NOTE 2)
(NA)	NOT AVAILABLE (BASELINE MEASUREMENT ON LAND)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. CAP MATERIAL THICKNESS WAS DETERMINED BY CALCULATING THE DIFFERENCE BETWEEN THE POST-DREDGING SURFACE ELEVATION (MEASURED IN OCTOBER 2005) AND THE POST-CAPPING ELEVATION (MEASURED IN NOVEMBER 2005). THE TARGET CAP MATERIAL THICKNESS WAS 0.3 FT TO 0.5 FT.

0 20' 40'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CAPPING ELEVATION MEASUREMENT RESULTS FOR THE SOUTHERN NEAR SHORE AREA

ALCOA

FIGURE
A-49

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-NES DJP BGP
10809001/10809G44.DWG

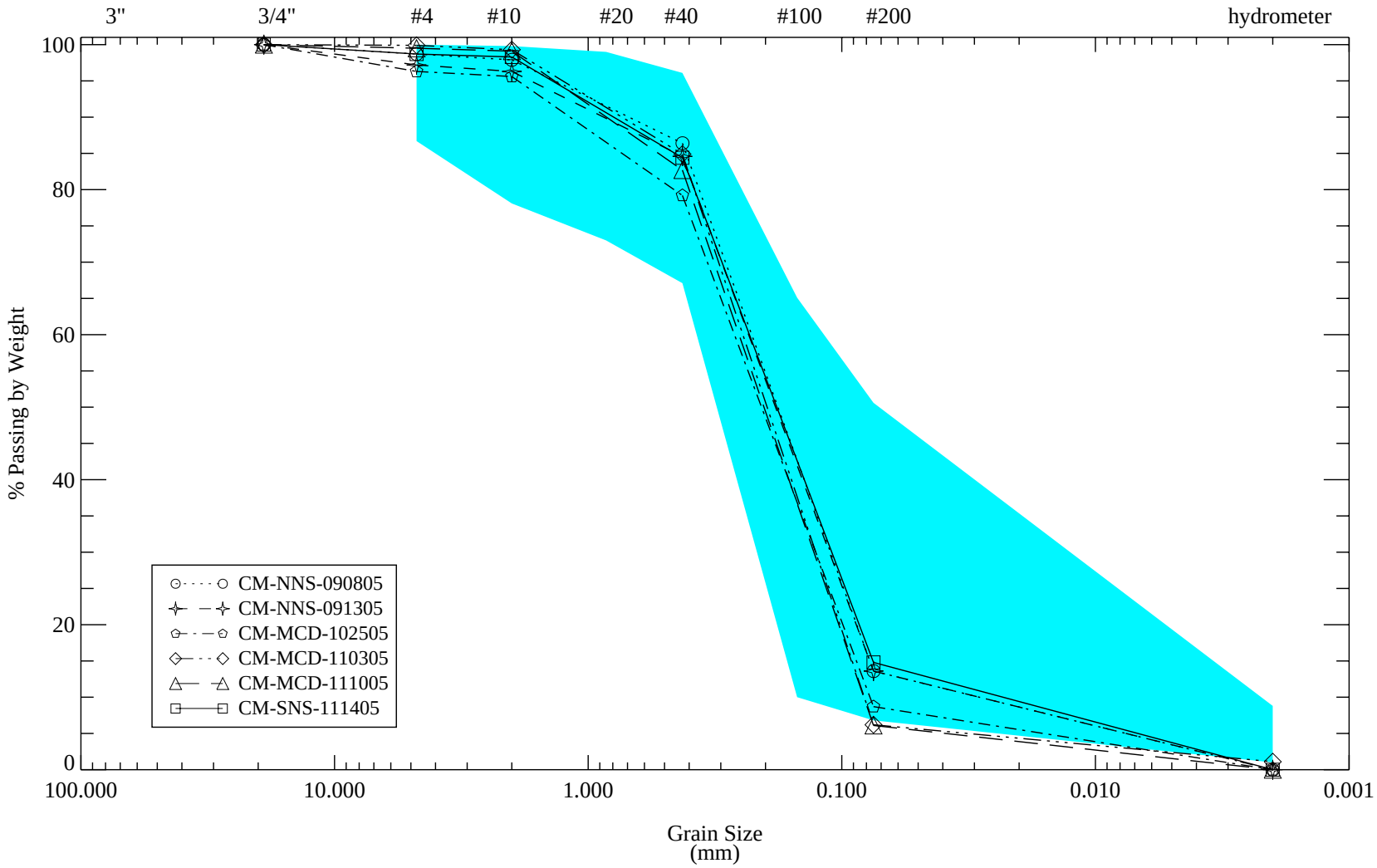
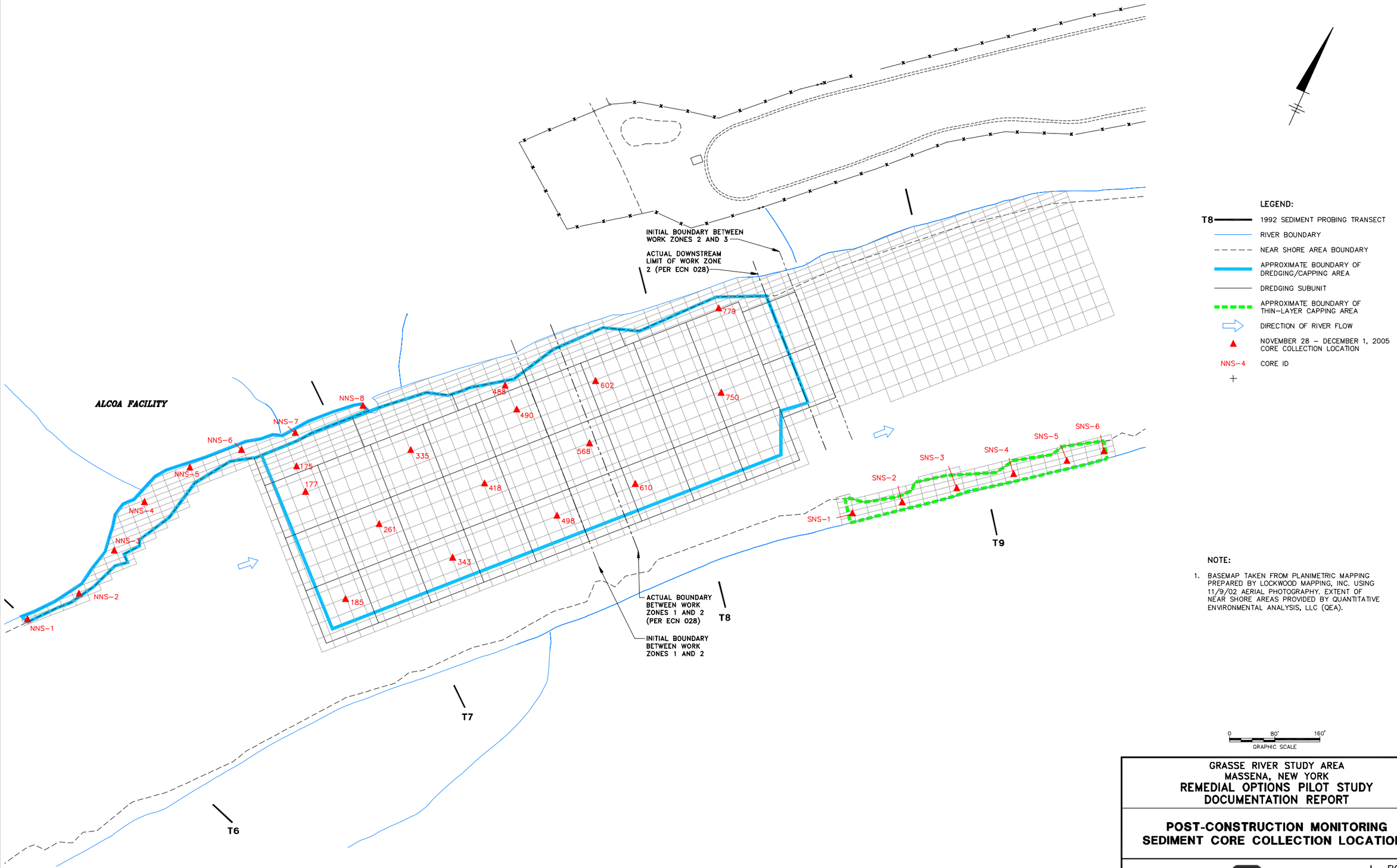


Figure A-50. Grain Size Distributions of Cap Material Used During Main Channel and Near Shore Capping

Six samples collected from cap material prior to placement: 3 for main channel, 2 for northern near shore, 1 for southern near shore. The blue polygon represents an envelope of cap material estimated from probability plots of native surface sediment in the ROPS area collected in 2003/2004 (excluding the upper and lower 10% of the data).

Data table: cap_material_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\capping\actualcap_grainsize_distrib.pro
Tue Jan 10 18:46:14 2006



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CONSTRUCTION MONITORING SEDIMENT CORE COLLECTION LOCATIONS

ALCOA

FIGURE
A-51

X: 10809X01, ...X02.DWG, ...X01.TIFF
L: ON=*, OFF=REF*
P: PAGESET/SYR-DL2B1
5/22/06 SYR-85-CBM TJR BGP
10809001/10809G25.DWG

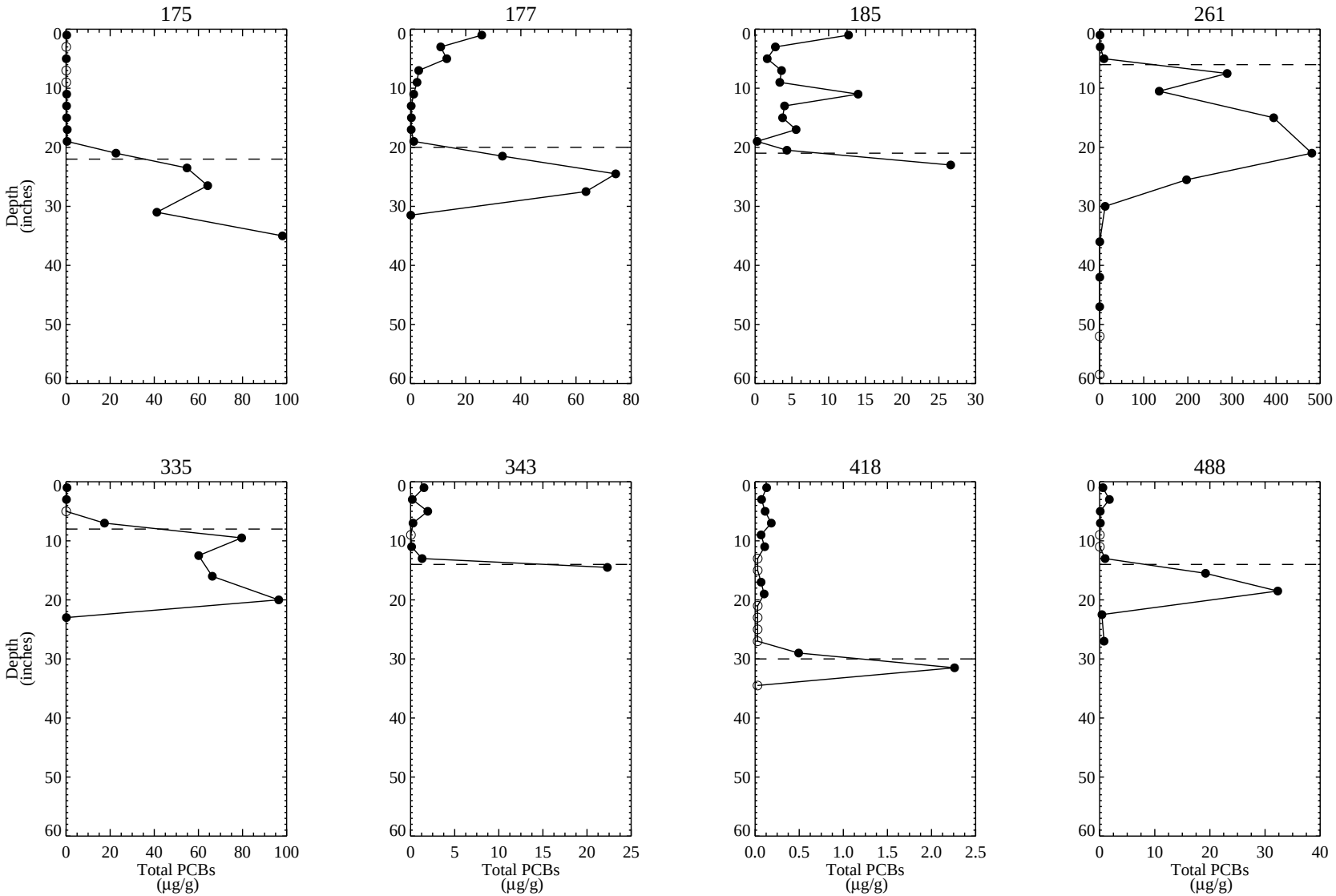


Figure A-52. Vertical Distribution of PCBs in Post-Capping Sediment Cores from the Main Channel Area (Work Zone 1).
Dashed line represents location of cap/sediment interface.
Non-detects are plotted at half the detection limit as open circles. Duplicates are averaged.

Data tables: sed_aro_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\sed_aro\core_profiles\post\MC_CoreProfiles_postROPS.pro
Thu Feb 09 12:10:01 2006

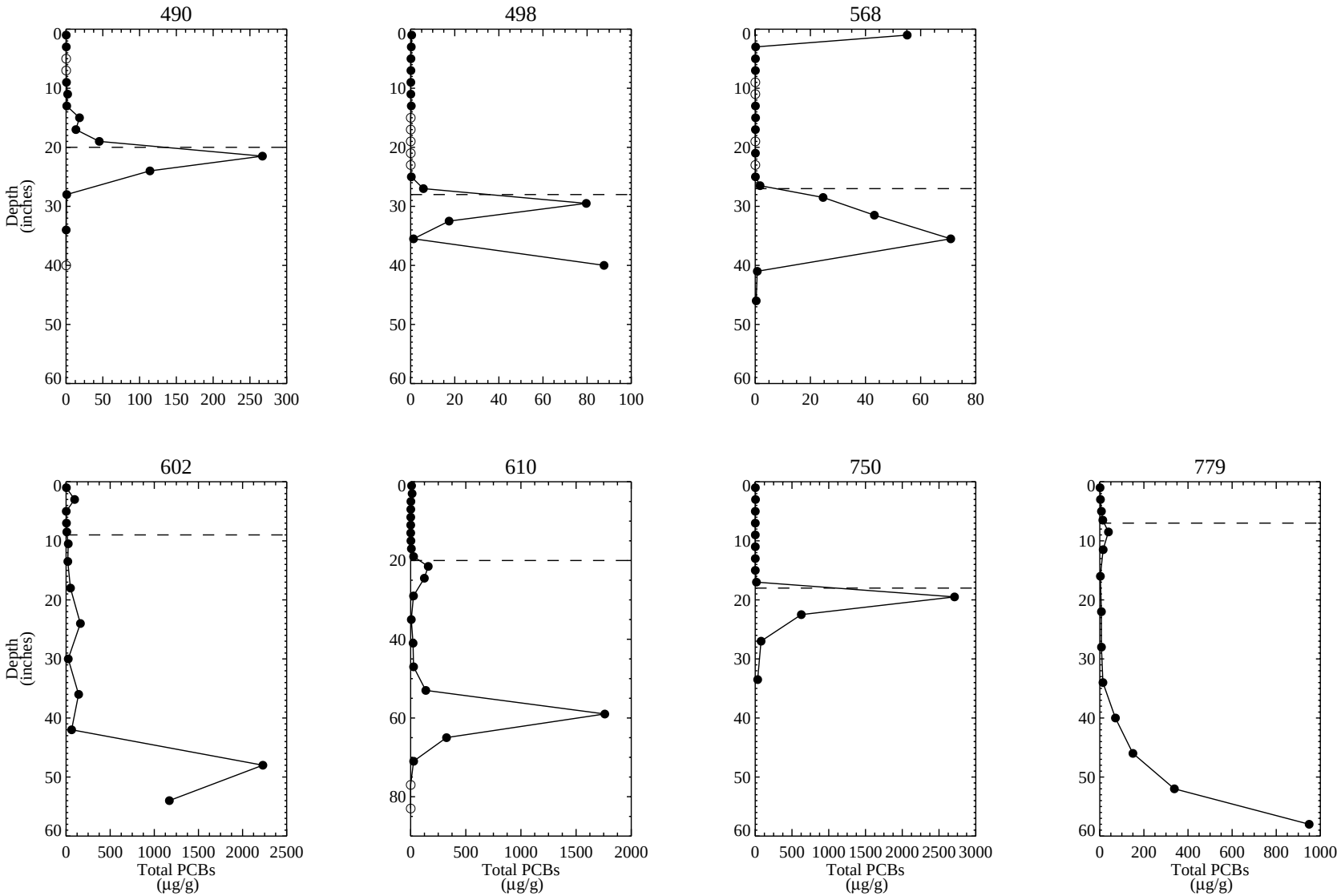


Figure A-53. Vertical Distribution of PCBs in Post-Capping Sediment Cores from the Main Channel Area (Work Zones 1 and 2).

Dashed line represents location of cap/sediment interface.
Non-detects are plotted at half the detection limit as open circles. Duplicates are averaged.
Top row represents cores collected from Work Zone 1. Bottom row represents cores collected from Work Zone 2.

Data tables: sed_aro_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\sed_aro\core_profiles\post\MC_CoreProfiles_postROPS.pro
Thu Feb 09 12:10:01 2006

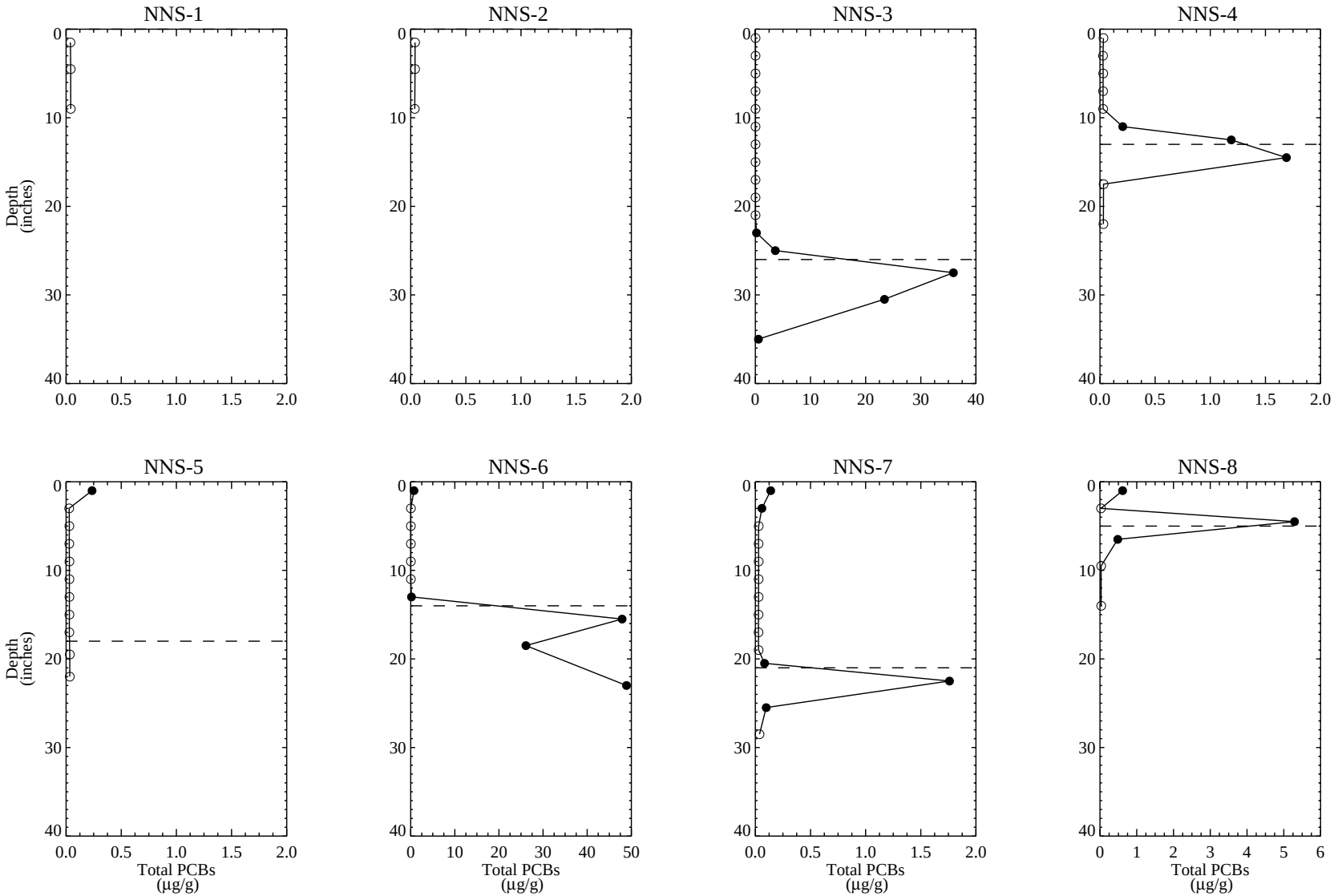


Figure A-54. Vertical Distribution of PCBs in Post-Capping Sediment Cores from the Northern Near Shore Area

Dashed line represents location of cap/sediment interface.
Non-detects are plotted at half the detection limit as open circles.
Duplicates are averaged.

Data tables: sed_aro_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\sed_aro\core_profiles\post\NS_CoreProfiles_postROPS.pro
Thu Feb 09 12:24:59 2006

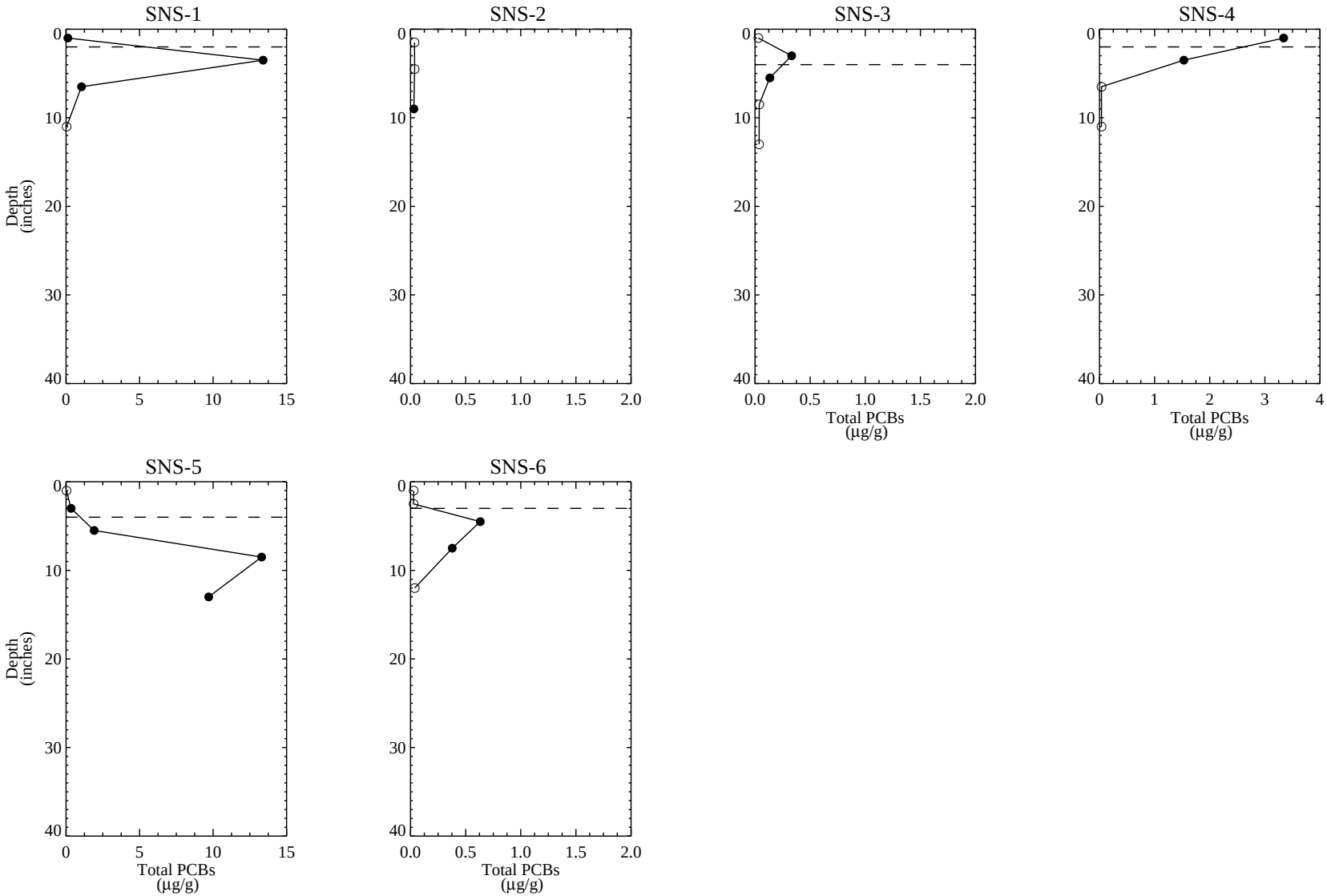
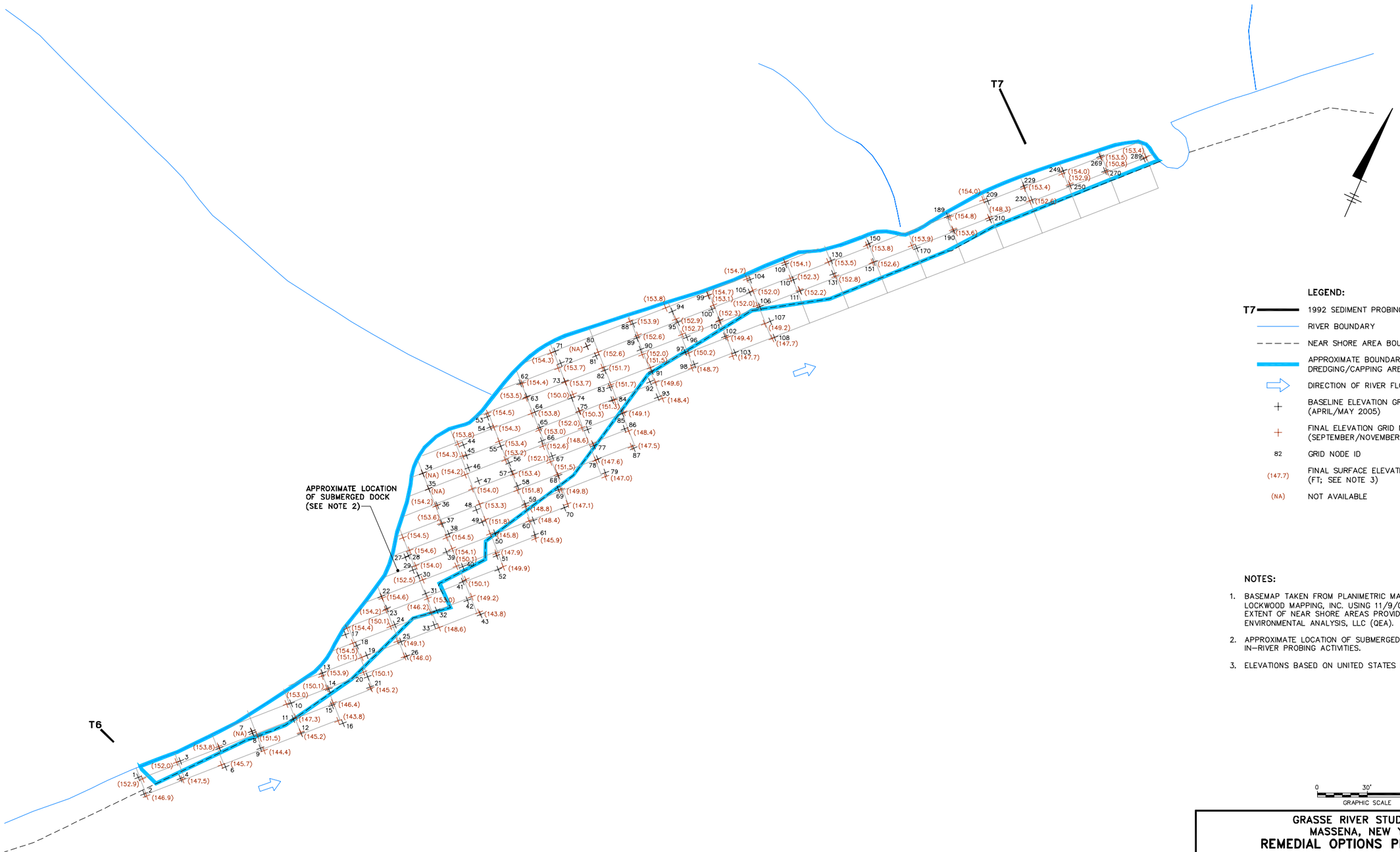


Figure A-55. Vertical Distribution of PCBs in Post-Capping Sediment Cores from the Southern Near Shore Area

Dashed line represents location of cap/sediment interface.
Non-detects are plotted at half the detection limit as open circles.
Duplicates are averaged.

Data tables: sed_aro_ROPS

ARC - D:\ALCgra\Analysis\ROPS\IDL\sediment\sed_aro\core_profiles\post\NS_CoreProfiles_postROPS.pro
Thu Feb 09 12:25:00 2006sS



LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DIRECTION OF RIVER FLOW
- + BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
- + FINAL ELEVATION GRID NODE LOCATION (SEPTEMBER/NOVEMBER 2005)
- 82 GRID NODE ID
- (147.7) FINAL SURFACE ELEVATION MEASUREMENT (FT; SEE NOTE 3)
- (NA) NOT AVAILABLE

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. APPROXIMATE LOCATION OF SUBMERGED DOCK DEFINED THROUGH IN-RIVER PROBING ACTIVITIES.
3. ELEVATIONS BASED ON UNITED STATES LAKE SURVEY (USLS) 1935.

0 30' 60'
GRAPHIC SCALE

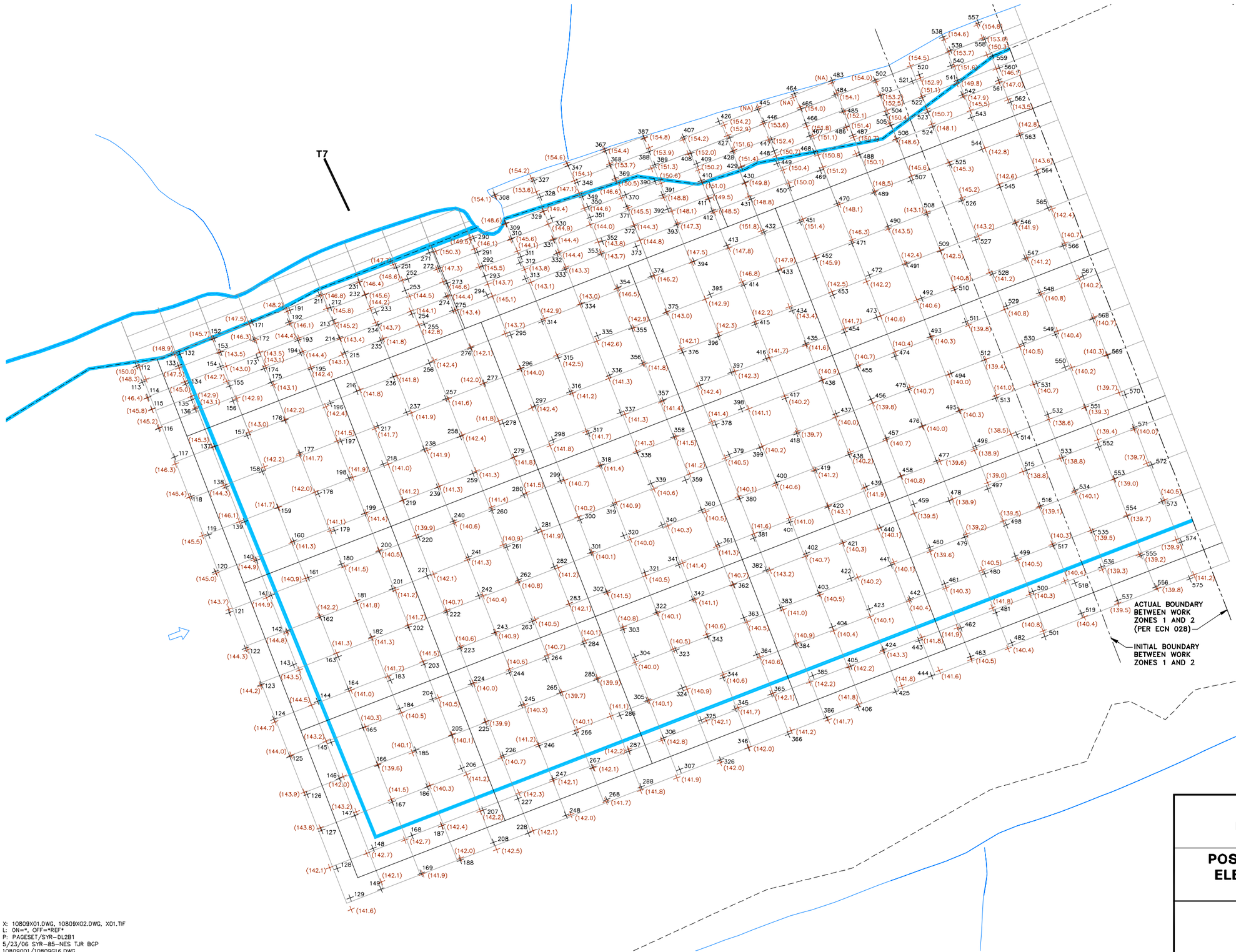
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CONSTRUCTION MONITORING ELEVATION MEASUREMENTS FOR THE NORTHERN NEAR SHORE AREA

ALCOA

FIGURE
A-56

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/23/06 SYR-85-NES DJP BGP
10809001/10809G15.DWG



LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- + DURING–CONSTRUCTION ELEVATION GRID NODE LOCATION (POST–DREDGING; OCTOBER 2005)
- + FINAL ELEVATION GRID NODE LOCATION (NOVEMBER 2005)
- 550 GRID NODE ID
- (140.0) FINAL SURFACE ELEVATION MEASUREMENT (FT; SEE NOTE 2)
- (NA) NOT AVAILABLE; NOVEMBER 2005 ELEVATION GRID NODE LOCATED ON LAND

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ELEVATIONS BASED ON UNITED STATES LAKE SURVEY (USLS) 1935.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CONSTRUCTION MONITORING ELEVATION MEASUREMENTS FOR WORK ZONE 1

ALCOA

FIGURE
A-57

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
L: ON=*, OFF=*REF*
P: PAGESET/SYR-DL2B1
5/23/06 SYR-85-NES TJR BGP
10809001/10809G16.DWG

LEGEND:

- T7 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF DREDGING/CAPPING AREA
- DREDGING SUBUNIT
- DIRECTION OF RIVER FLOW
- + BASELINE ELEVATION GRID NODE LOCATION (OCTOBER 2005)
- + FINAL ELEVATION GRID NODE LOCATION (NOVEMBER 2005)
- 819 GRID NODE ID
- (141.2) FINAL SURFACE ELEVATION MEASUREMENT (FT; SEE NOTE 2)
- (NA) NOT AVAILABLE; NOVEMBER 2005 ELEVATION GRID NODE LOCATED ON LAND

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ELEVATIONS BASED ON UNITED STATES LAKE SURVEY (USLS) 1935.

0 30' 60'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CONSTRUCTION MONITORING ELEVATION MEASUREMENTS FOR WORK ZONE 2

ALCOA

FIGURE
A-58

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
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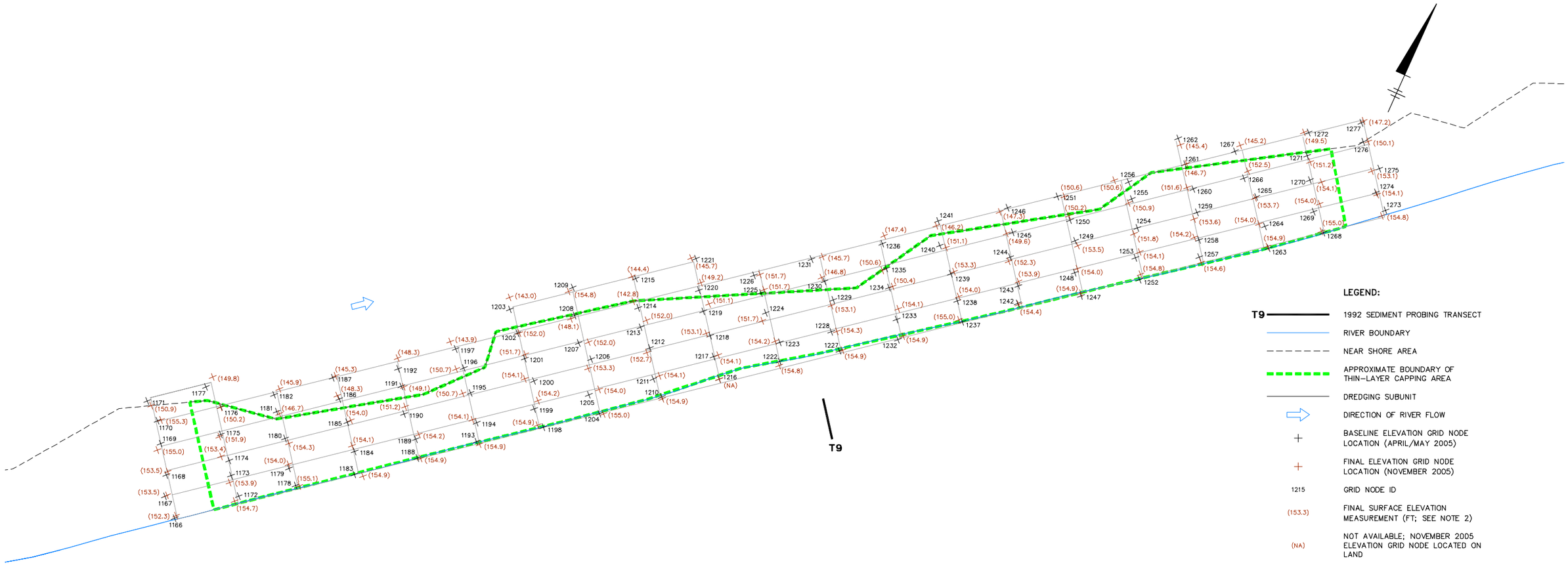
5/23/06 SYR-85-NES DJP BGP
10809001/10809G17.DWG



LEGEND:

T9	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE BOUNDARY OF THIN-LAYER CAPPING AREA
	DREDGING SUBUNIT
	DIRECTION OF RIVER FLOW
+	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
+	FINAL ELEVATION GRID NODE LOCATION (NOVEMBER 2005)
1215	GRID NODE ID
(153.3)	FINAL SURFACE ELEVATION MEASUREMENT (FT; SEE NOTE 2)
(NA)	NOT AVAILABLE; NOVEMBER 2005 ELEVATION GRID NODE LOCATED ON LAND

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. ELEVATIONS BASED ON UNITED STATES LAKE SURVEY (USLS) 1935.

0 20' 40'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CONSTRUCTION MONITORING ELEVATION MEASUREMENTS FOR THE SOUTHERN NEAR SHORE AREA

ALCOA

FIGURE
A-59

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
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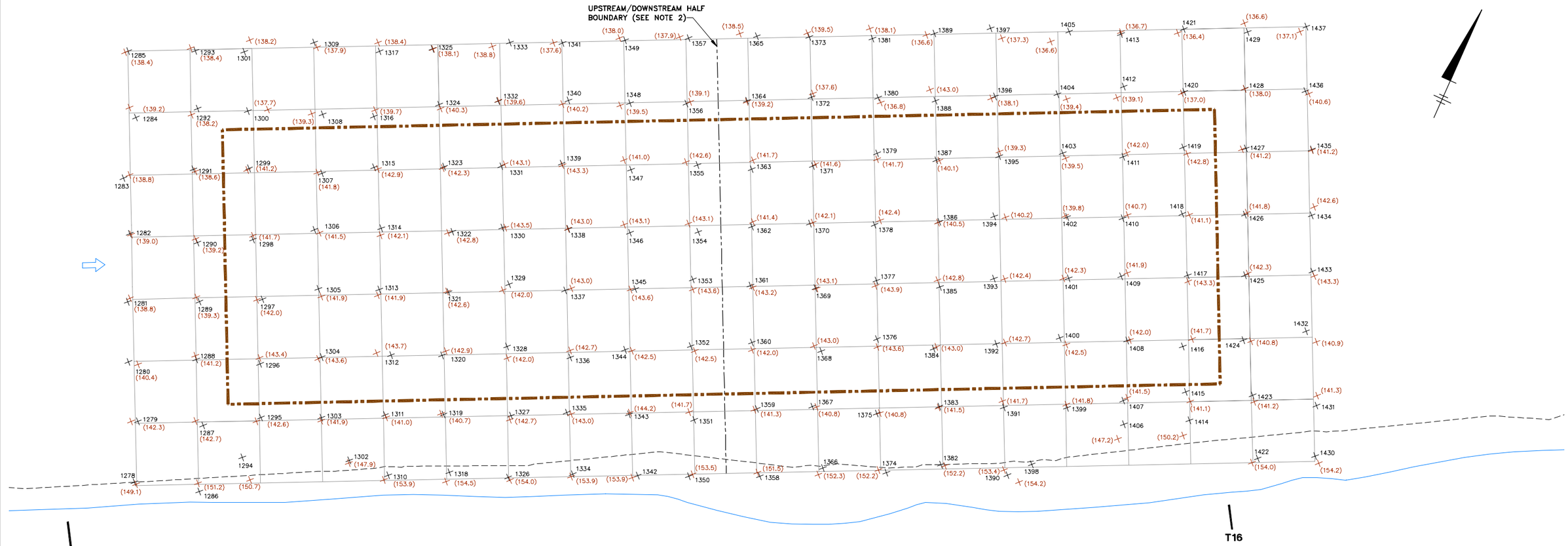
5/18/06 SYR-85-NES DJP BGP
10809001/10809G18.DWG



LEGEND:

T16	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
	DIRECTION OF RIVER FLOW
×	BASELINE ELEVATION GRID NODE LOCATION (APRIL/MAY 2005)
×	FINAL ELEVATION GRID NODE LOCATION
1352	GRID NODE ID
(153.9)	FINAL SURFACE ELEVATION MEASUREMENT (FT; SEE NOTE 3)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/02 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. THE ARMORED CAP AREA WAS DIVIDED INTO AN UPSTREAM AND DOWNSTREAM HALF AS DIFFERENT LAYERS WERE PLACED IN THESE AREAS.
3. ELEVATIONS BASED ON UNITED STATES LAKE SURVEY (USLS) 1935.

0 20' 40'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

POST-CONSTRUCTION MONITORING ELEVATION MEASUREMENTS FOR THE ARMORED CAPPING AREA

ALCOA

FIGURE
A-60

X: 10809X01.DWG, 10809X02.DWG, X01.TIF
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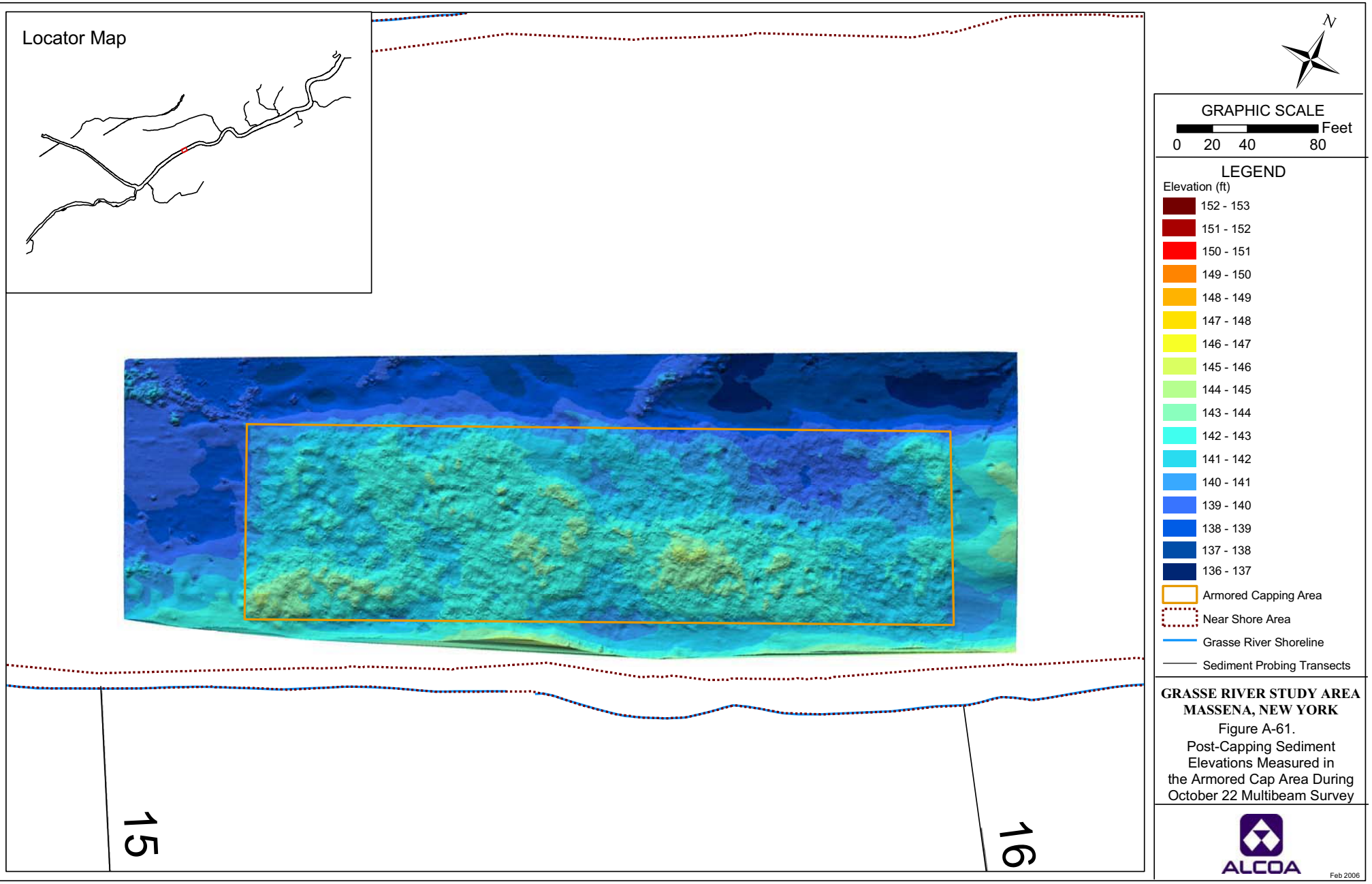
5/18/06 SYR-85-NES DJP BGP
10809001/10809G19.DWG



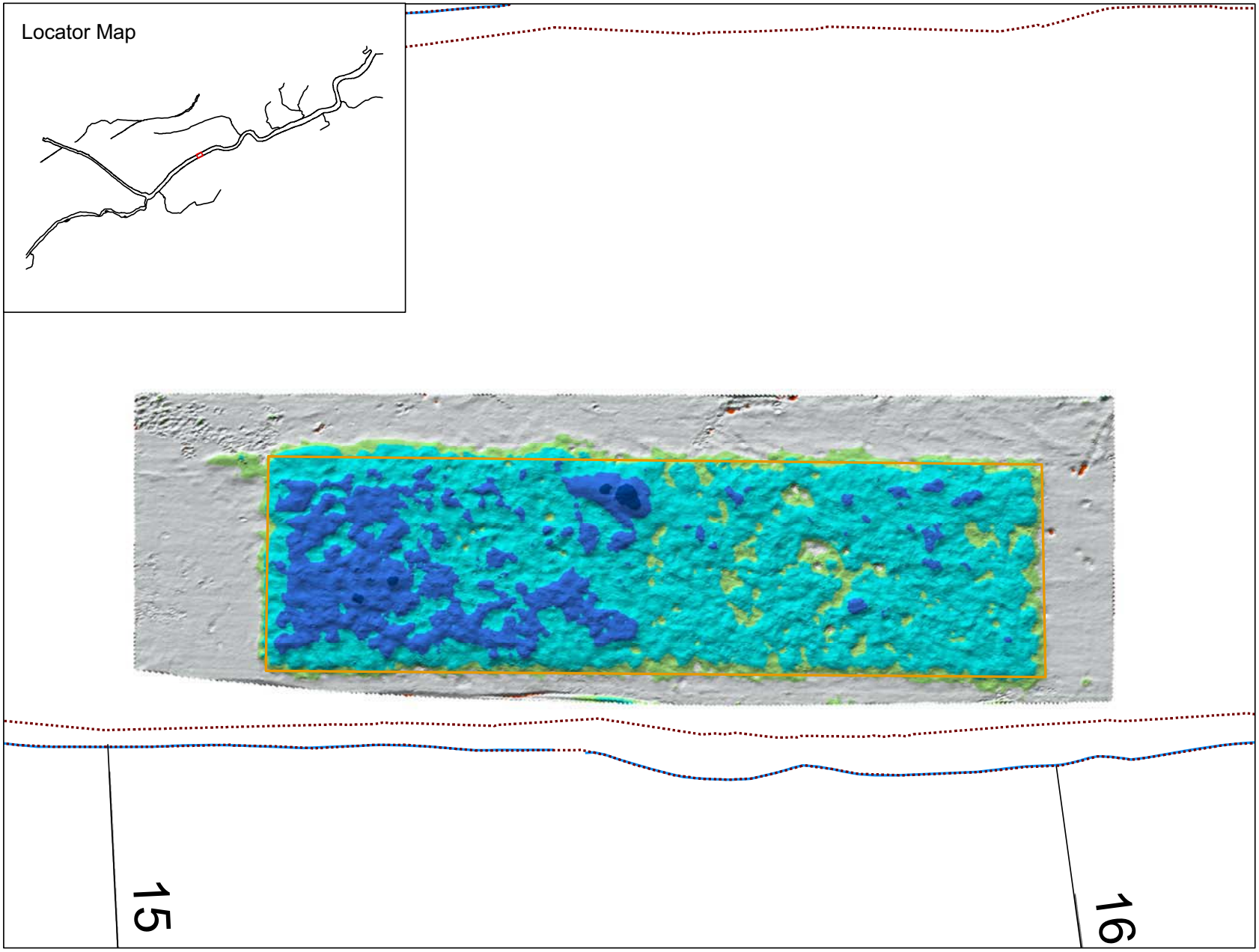
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-61.
Post-Capping Sediment Elevations Measured in the Armored Cap Area During October 22 Multibeam Survey

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



N

GRAPHIC SCALE

0 20 40 80 Feet

LEGEND

Capping Thickness (ft)

- 3.0 - 4.0
- 2.0 - 3.0
- 1.0 - 2.0
- 0.5 - 1.0
- -0.5 - 0.5
- -1.0 - -0.5
- -2.0 - -1.0
- Armored Capping Area
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

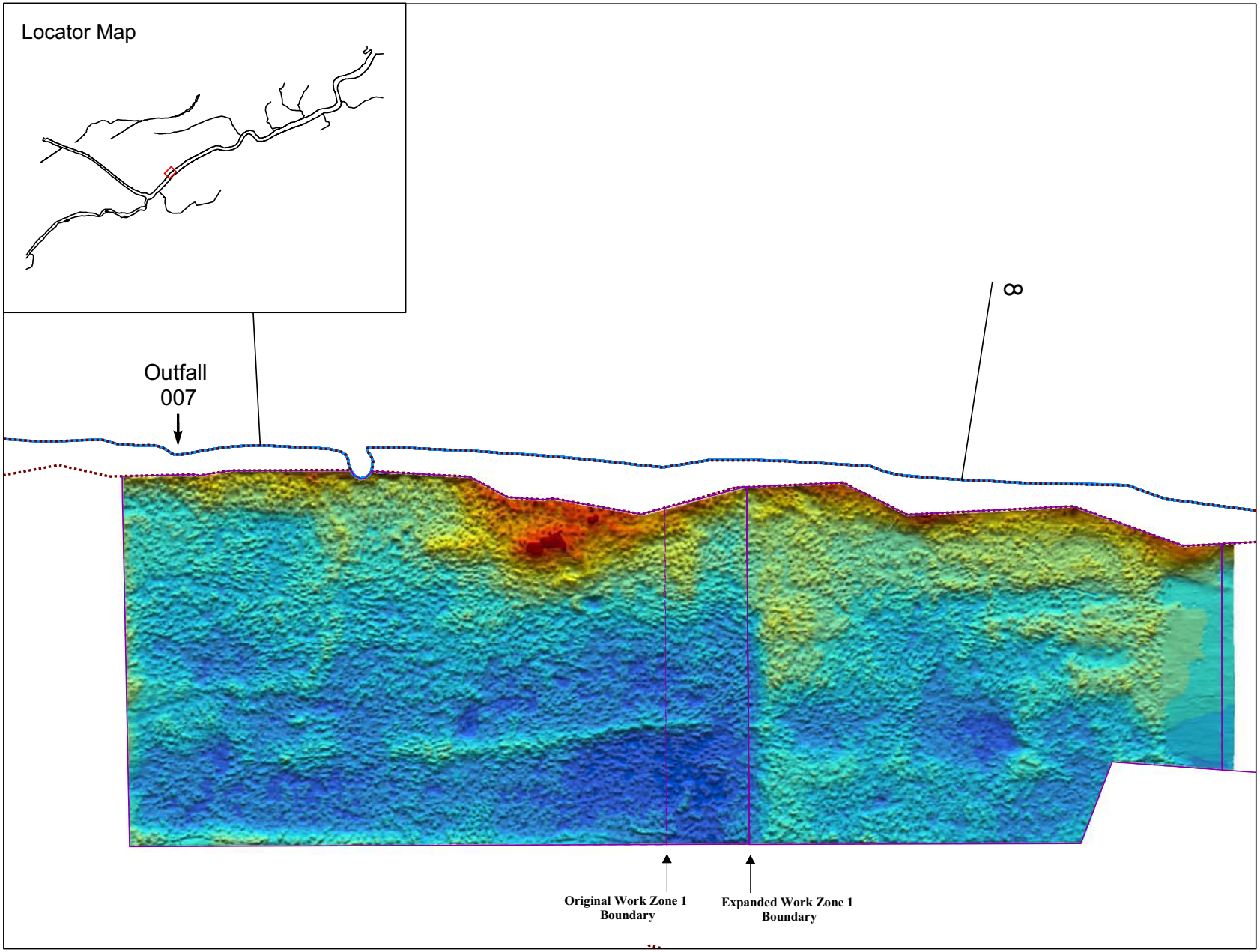
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-62.
Sediment Elevation Differences in the Armored Cap Area Between September 13 and October 22 Multibeam Bathymetry Surveys

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



N

GRAPHIC SCALE
Feet
0 25 50 100

LEGEND

Elevation (ft)
151 - 152
150 - 151
149 - 150
148 - 149
147 - 148
146 - 147
145 - 146
144 - 145
143 - 144
142 - 143
141 - 142
140 - 141
139 - 140
138 - 139
Work Zone Outline
Original Work Zone Boundary
Near Shore Area
Grasse River Shoreline
Sediment Probing Transects

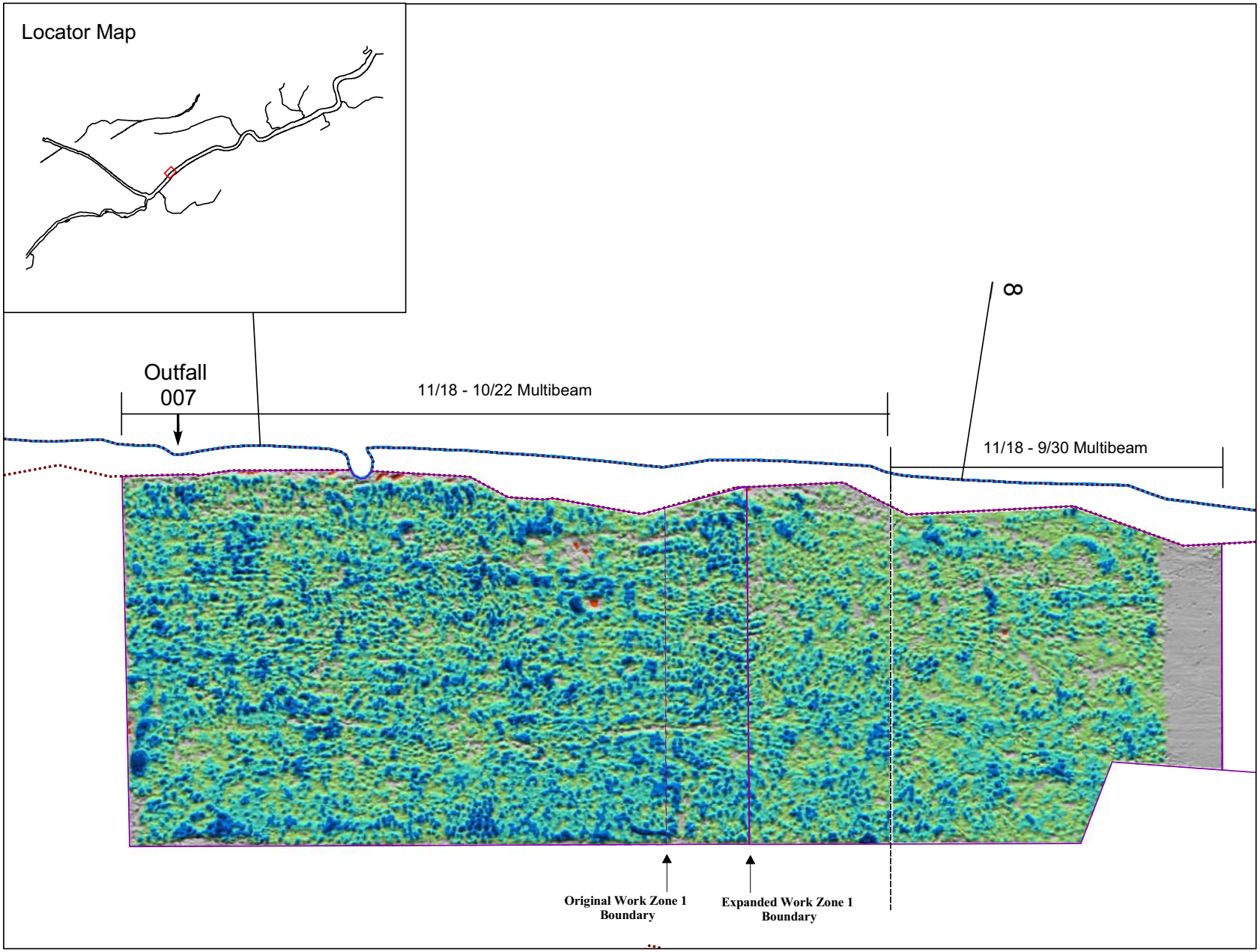
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-63.
Post-Capping Sediment Elevations Measured in the Main Channel During November 18 Multibeam Survey

ALCOA

Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



GRAPHIC SCALE
Feet
0 25 50 100

LEGEND

Capping Thickness (ft)
- > 2.0
- 1.5 - 2.0
- 1.0 - 1.5
- 0.5 - 1.0
- -0.5 - 0.5
- < -0.5

- Work Zone Outline
- Original Work Zone Boundary
- Near Shore Area
- Grasse River Shoreline
- Sediment Probing Transects

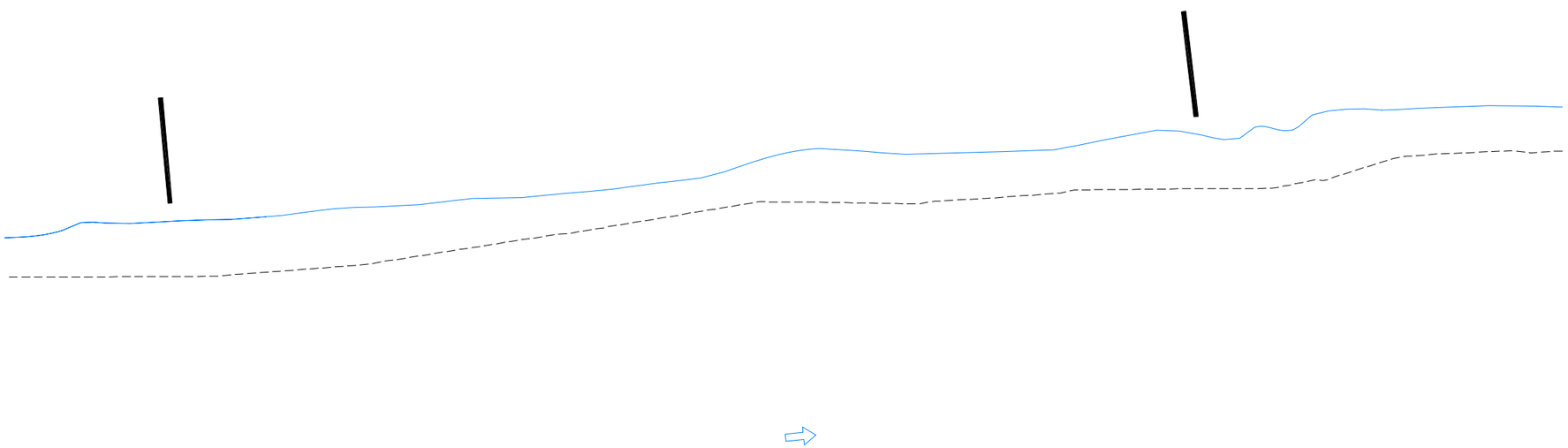
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Figure A-64.
Sediment Elevation Differences
Between Sept. 30/October 22
and November 18
Multibeam Bathymetry Surveys

ALCOA

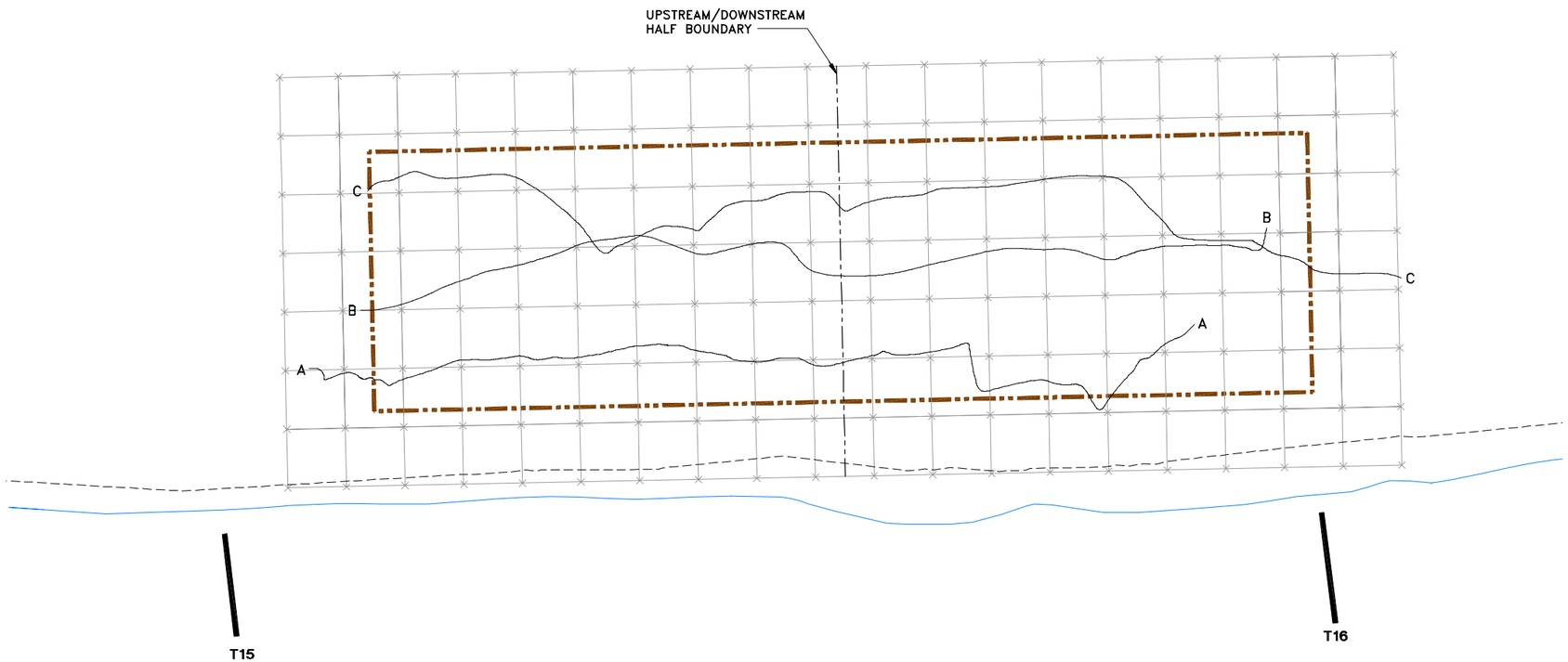
Feb 2006

ARC:\\ARC\D_drive\ALCgra\Analysis\ROPS\GIS\sediment\pre\probing\rops_probing_MC2005arc_060103.mxd



LEGEND:

- T15 — 1992 SEDIMENT PROBING TRANSECT
- RIVER BOUNDARY
- NEAR SHORE AREA BOUNDARY
- APPROXIMATE BOUNDARY OF ARMORED CAPPING AREA
- TARGETED GRID NODE LOCATION
- DIRECTION OF RIVER FLOW
- UNDERWATER VIDEO TRANSECT



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. THE ARMORED CAP AREA WAS DIVIDED INTO AN UPSTREAM AND DOWNSTREAM HALF AS DIFFERENT LAYERS WERE PLACED IN THESE AREAS.

0 30' 60'
GRAPHIC SCALE

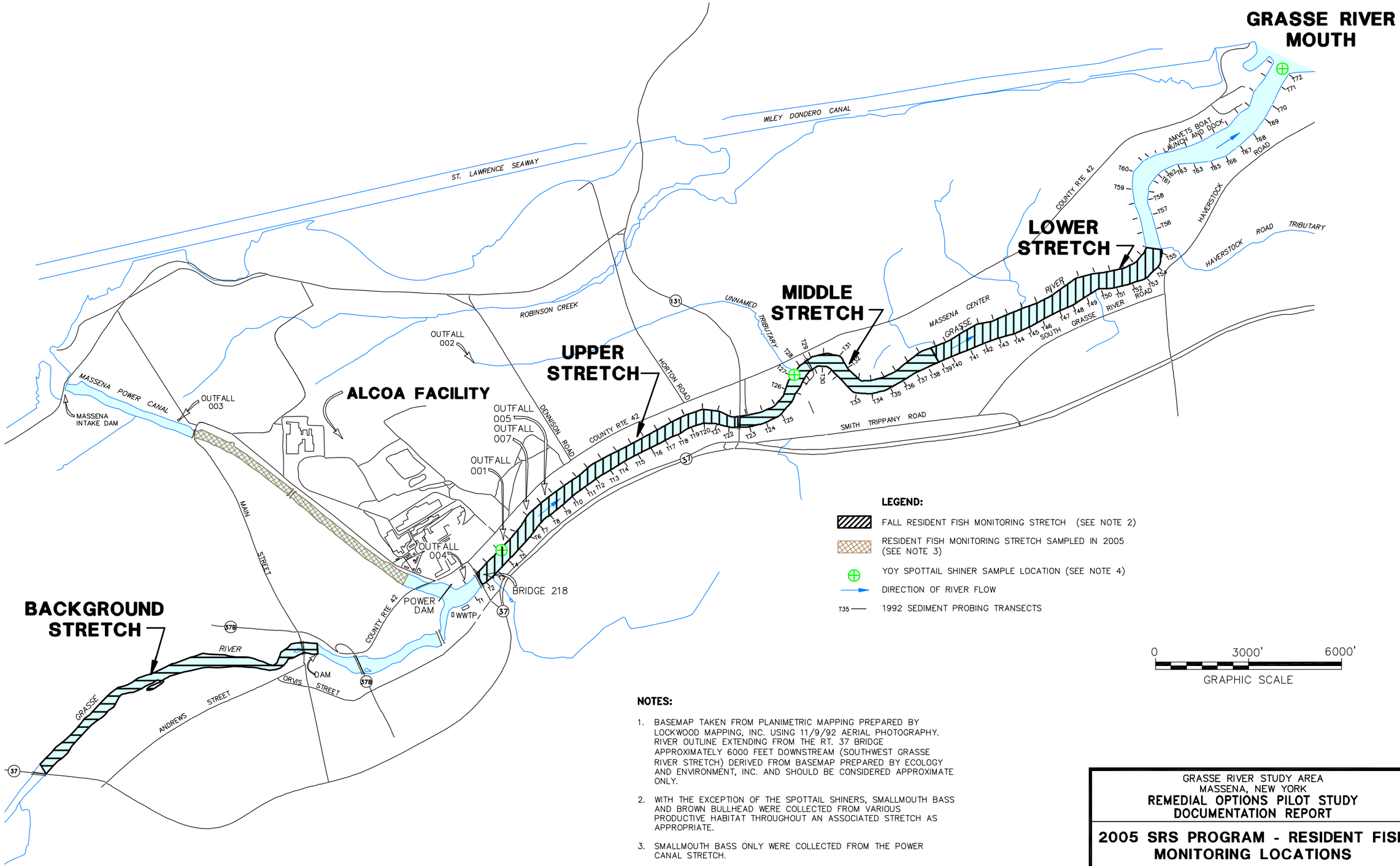
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

UNDERWATER VIDEO TRANSECTS IN ARMORED CAPPING AREA

ALCOA

FIGURE
A-65

X: 10809X01.DWG, X02.DWG, X01.TIF
L: ON=*, OFF=REF*
P: PAGESET/SYR-DL2B1
5/18/06 SYR-85-NES SDL BGP
10809001/10809B07.DWG



NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. RIVER OUTLINE EXTENDING FROM THE RT. 37 BRIDGE APPROXIMATELY 6000 FEET DOWNSTREAM (SOUTHWEST GRASSE RIVER STRETCH) DERIVED FROM BASEMAP PREPARED BY ECOLOGY AND ENVIRONMENT, INC. AND SHOULD BE CONSIDERED APPROXIMATE ONLY.
2. WITH THE EXCEPTION OF THE SPOTTAIL SHINERS, SMALLMOUTH BASS AND BROWN BULLHEAD WERE COLLECTED FROM VARIOUS PRODUCTIVE HABITAT THROUGHOUT AN ASSOCIATED STRETCH AS APPROPRIATE.
3. SMALLMOUTH BASS ONLY WERE COLLECTED FROM THE POWER CANAL STRETCH.
4. A COMPOSITE SPOTTAIL SHINER SAMPLE WAS ALSO COLLECTED FROM THE BACKGROUND STRETCH.

X: 10809X06.DWG, 10809X01.TIF
L: ON=*, OFF=REF
P: PAGESET/SYR-BL
5/19/06 SYR-BS-GHS NES BGP
10809001/10809B06.DWG

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY DOCUMENTATION REPORT

2005 SRS PROGRAM - RESIDENT FISH MONITORING LOCATIONS

ALCOA

FIGURE
A-66

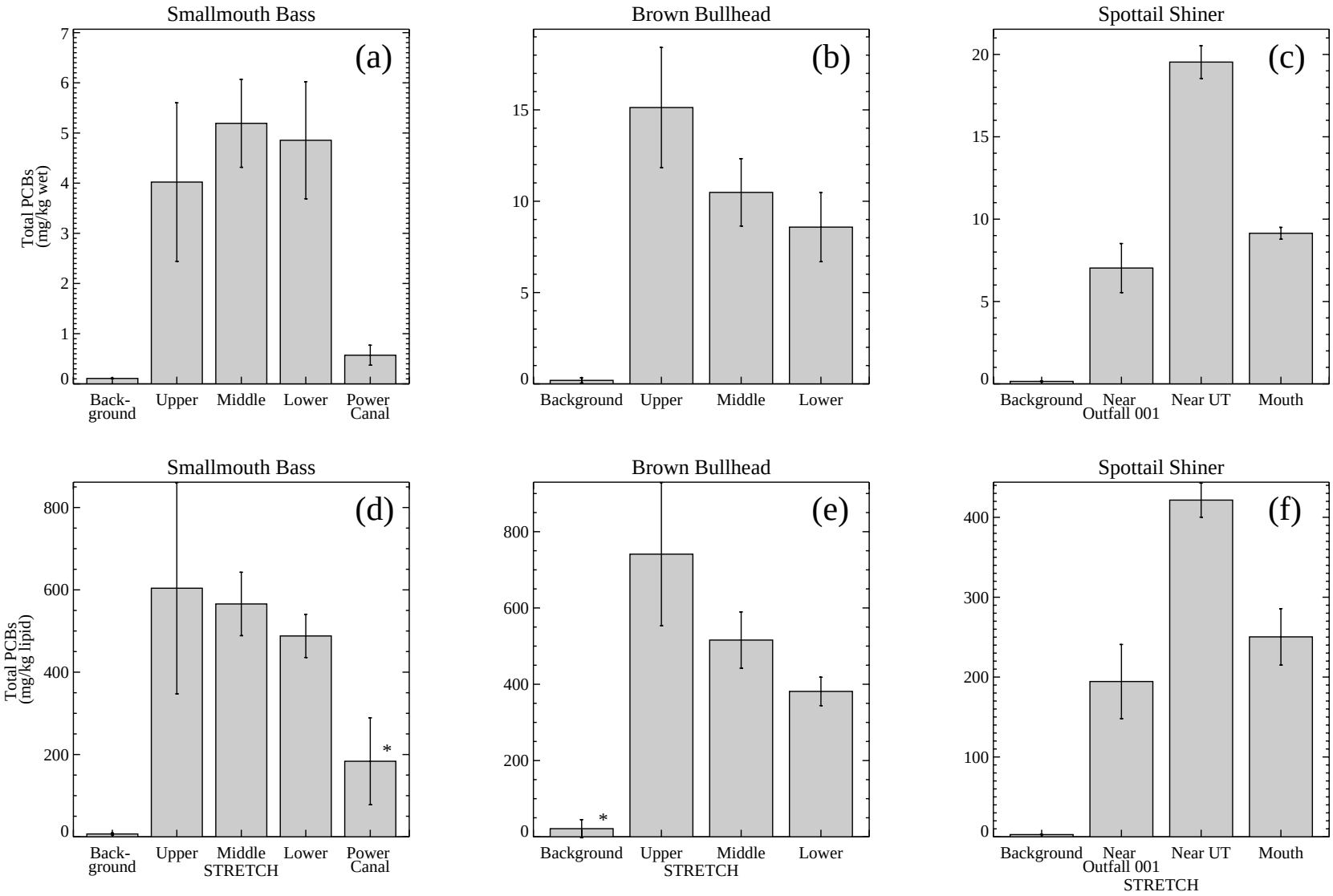


Figure A-67. Average Aroclor-Based PCB Concentrations in Fish Collected in Fall 2005

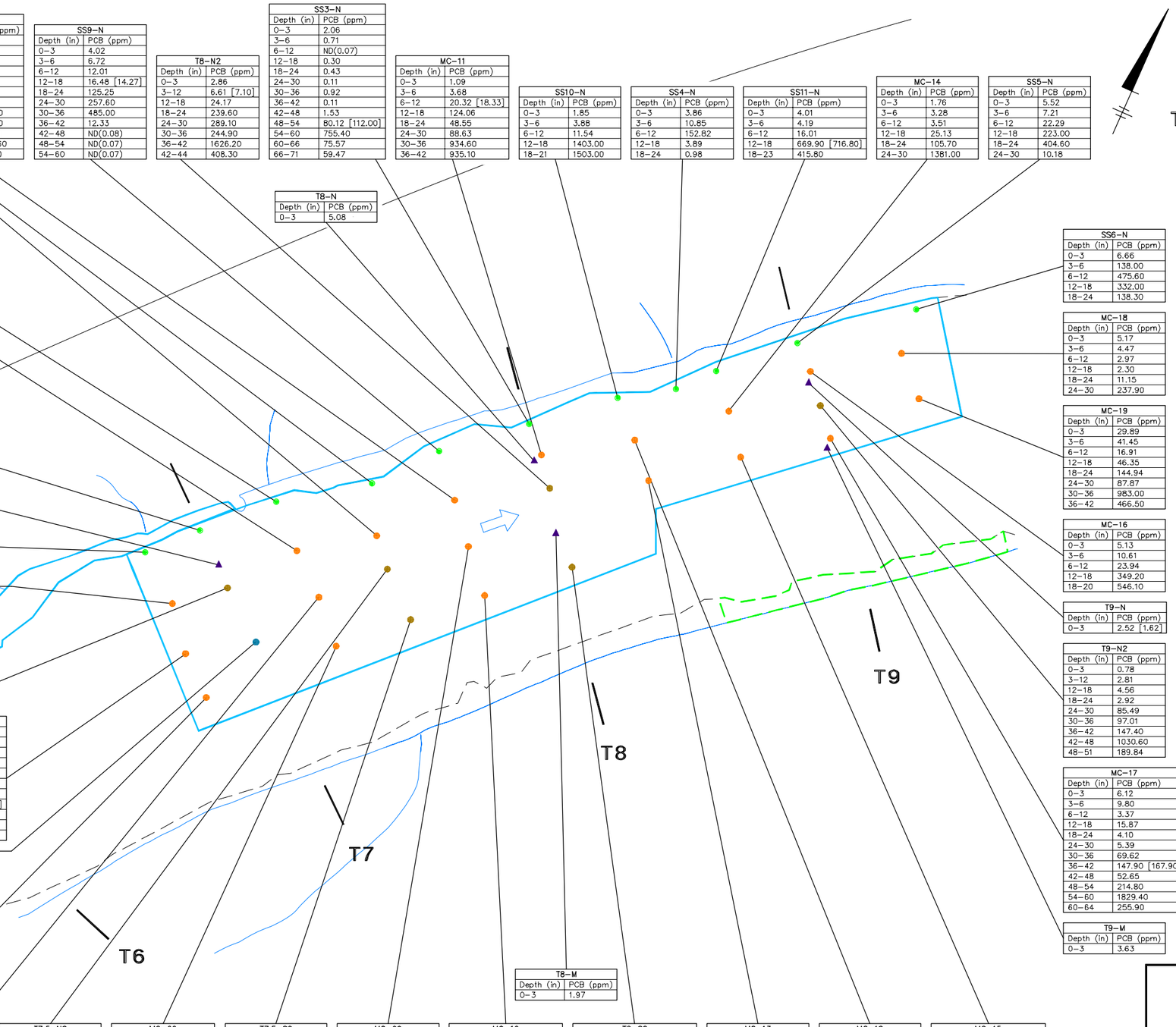
Values represent arithmetic averages (+/- 2 standard errors). Non-detect values set to half the detection limit prior to averaging.

** One smallmouth bass and one brown bullhead sample were excluded due to unreasonably low lipid content (<0.1%).*

Data table: resfish_aro

ARC - D:\ALCgra\Analysis\ResFish\fall05\IDL\summary_plots\resfish_barplot_by_survey.pro
Tue Feb 14 13:38:18 2006

Attachment A-1



SS2-N	
Depth (in)	PCB (ppm)
0-3	0.53
3-6	2.71
6-12	8.92
12-18	8.84
18-24	25.73
24-30	5.24
30-36	75.24
36-42	1923.10 [1232.20]
42-46	389.00

MC-08	
Depth (in)	PCB (ppm)
0-3	0.96
3-6	2.44
6-12	5.93
12-18	9.70
18-24	4.86
24-30	23.04
30-36	46.56
36-42	426.80
42-48	260.90
48-54	114.18
54-60	1477.60
60-64	281.70

SS9-N	
Depth (in)	PCB (ppm)
0-3	4.02
3-6	6.72
6-12	12.01
12-18	16.48 [14.27]
18-24	125.25
24-30	257.60
30-36	485.00
36-42	12.33
42-48	ND(0.08)
48-54	ND(0.07)
54-60	ND(0.07)

T8-N2	
Depth (in)	PCB (ppm)
0-3	2.86
3-12	6.61 [7.10]
12-18	24.17
18-24	239.60
24-30	289.10
30-36	244.90
36-42	1626.20
42-44	408.30

SS3-N	
Depth (in)	PCB (ppm)
0-3	2.06
3-6	0.71
6-12	ND(0.07)
12-18	0.30
18-24	0.43
24-30	0.11
30-36	0.92
36-42	0.11
42-48	1.53
48-54	80.12 [112.00]
54-60	755.40
60-66	75.57
66-71	59.47

MC-11	
Depth (in)	PCB (ppm)
0-3	1.09
3-6	3.68
6-12	20.32 [18.33]
12-18	124.06
18-24	48.55
24-30	88.63
30-36	934.60
36-42	935.10

SS10-N	
Depth (in)	PCB (ppm)
0-3	1.85
3-6	3.88
6-12	11.54
12-18	1403.00
18-21	1503.00

SS4-N	
Depth (in)	PCB (ppm)
0-3	3.86
3-6	10.85
6-12	152.82
12-18	3.89
18-24	0.98

SS11-N	
Depth (in)	PCB (ppm)
0-3	4.01
3-6	4.19
6-12	16.01
12-18	669.90 [716.80]
18-23	415.80

MC-14	
Depth (in)	PCB (ppm)
0-3	1.76
3-6	3.28
6-12	3.51
12-18	25.13
18-24	105.70
24-30	1381.00

SS5-N	
Depth (in)	PCB (ppm)
0-3	5.52
3-6	7.21
6-12	22.29
12-18	223.00
18-24	404.60
24-30	10.18

MC-07	
Depth (in)	PCB (ppm)
0-3	1.12
3-6	1.40
6-12	10.24
12-18	95.02 [111.95]
18-24	82.32
24-30	793.10
30-34	1695.00

T8-N	
Depth (in)	PCB (ppm)
0-3	5.08

SS8-N	
Depth (in)	PCB (ppm)
0-3	1.48
3-6	1.64
6-12	2.66
12-18	4.34
18-24	3.50
24-30	ND(0.07)
30-36	ND(0.06)
36-42	ND(0.06)
42-48	ND(0.06)
48-53	ND(0.07)

MC-04	
Depth (in)	PCB (ppm)
0-3	0.62
3-6	0.29
6-12	1.09
12-18	6.58
18-24	110.30
24-30	31.70
30-36	44.45
36-42	1461.30
42-48	726.20

SS1-N	
Depth (in)	PCB (ppm)
0-3	2.39
3-6	3.29
6-12	2.68
12-18	8.19 [8.58]
18-24	14.23
24-30	5.09
30-36	2.20
36-42	2.38
42-48	0.19
48-54	ND(0.06)
54-60	ND(0.06)

SS7-N	
Depth (in)	PCB (ppm)
0-3	2.68
3-6	3.32
6-12	3.80
12-18	17.37 [14.00]
18-24	13.84
24-30	3.85
30-36	9.84
36-42	5.83
42-48	0.74
48-54	0.37

T7-N	
Depth (in)	PCB (ppm)
0-3	0.54

MC-01	
Depth (in)	PCB (ppm)
0-3	0.88
3-6	0.47
6-12	3.45
12-18	6.51
18-24	6.06
24-30	143.20 [69.80]
30-36	40.69
36-40	420.00

T7-N2	
Depth (in)	PCB (ppm)
0-3	0.39
3-12	5.77
12-18	10.11
18-24	14.09
24-30	395.68
30-36	2150.80
36-42	1030.00
42-44	229.80

T7-M	
Depth (cm)	PCB (ppm)
0-1	5.35
1-2	2.05
2-3	0.84
3-4	0.61
4-5	0.23
5-6	ND(0.08)
6-7	0.47
7-8	0.24 [9.90]
9-10	0.09
14-15	0.08
19-20	1.27
24-25	5.57
29-30	6.53
34-35	1.48
39-40	0.87
44-45	6.88
49-50	14.89
54-55	5.28
59-60	7.33
64-65	2.21
69-70	100.07
74-75	133.30
79-80	12.63
84-85	357.00
89-90	65.63
94-95	98.30
99-100	149.90 [206.29]
104-105	565.60
109-110	3668.20 J
114-115	2635.00
119-120	1227.90
124-125	85.13
129-130	1169.00
134-135	1299.00 J
139-140	597.00
144-145	14.71
149-150	118.50
154-155	4.54
159-160	19.36
164-165	0.09

MC-02	
Depth (in)	PCB (ppm)
0-3	0.74
3-6	0.44
6-12	1.59
12-18	9.86
18-24	10.72
24-30	147.20
30-36	807.80 [963.60]
36-42	2992.00
42-48	575.10
48-54	172.80

MC-03	
Depth (in)	PCB (ppm)
0-3	0.14
3-6	4.30
6-12	3.71
12-18	2.40
18-24	2.94
24-30	5.86
30-36	254.50
36-42	480.40
42-48	665.80
48-51	104.37

T8-M	
Depth (in)	PCB (ppm)
0-3	1.97

MC-05	
Depth (in)	PCB (ppm)
0-3	0.14
3-6	ND(0.06)
6-12	2.32
12-18	6.46
18-24	60.53
24-30	662.70
30-36	102.56
36-42	575.10 [595.80]
42-48	2326.50
48-51	391.80

T7.5-N2	
Depth (in)	PCB (ppm)
0-3	50.23
3-12	43.68
12-18	46.93
18-24	125.72
24-30	43.09
30-36	50.23
36-42	1048.30
42-48	2162.00
48-50	378.20

MC-06	
Depth (in)	PCB (ppm)
0-3	1.11
3-6	1.82
6-12	9.58
12-18	14.69
18-24	7.95
24-30	6.71 [7.62]
30-36	101.80
36-42	1518.20
42-48	317.50
48-51	59.82

T7.5-S2	
Depth (in)	PCB (ppm)
0-3	0.62
3-12	2.92
12-18	5.44
18-24	22.43
24-30	58.78
30-36	1290.00
36-42	532.60
42-47	42.28

MC-09	
Depth (in)	PCB (ppm)
0-3	8.19
3-6	5.76
6-12	7.71
12-18	11.43
18-24	256.52
24-30	197.30
30-36	3859.00
36-43	554.30

MC-10	
Depth (in)	PCB (ppm)
0-3	1.46
3-6	2.01
6-12	10.24
12-18	13.17
18-24	6.09
24-30	88.80 [81.69]
30-36	2501.00
36-42	555.00
42-46	87.22

T8-S2	
Depth (in)	PCB (ppm)
0-3	0.84
3-12	42.79
12-18	19.55
18-22	330.30 [347.20]

MC-13	
Depth (in)	PCB (ppm)
0-3	8.95
3-6	50.58
6-12	16.24
12-18	8.59
18-24	128.29
24-30	90.10
30-36	93.96
36-42	1452.00

MC-12	
Depth (in)	PCB (ppm)
0-3	3.11
3-6	4.80
6-12	1.53
12-18	0.46
18-24	4.68
24-30	8.33
30-36	52.81
36-41	2170.00

MC-15	
Depth (in)	PCB (ppm)
0-3	7.56
3-6	6.94
6-12	18.32
12-18	20.97
18-24	54.33
24-30	76.45
30-36	50.49 [58.25]
36-42	2482.00
42-46	781.60

SS6-N	
Depth (in)	PCB (ppm)
0-3	6.66
3-6	138.00
6-12	475.60
12-18	332.00
18-24	138.30

MC-18	
Depth (in)	PCB (ppm)
0-3	5.17
3-6	4.47
6-12	2.97
12-18	2.30
18-24	11.15
24-30	237.90

MC-19	
Depth (in)	PCB (ppm)
0-3	29.89
3-6	41.45
6-12	16.91
12-18	46.35
18-24	144.94
24-30	87.87
30-36	983.00
36-42	466.50

MC-16	
Depth (in)	PCB (ppm)
0-3	5.13
3-6	10.61
6-12	23.94
12-18	349.20
18-20	546.10

T9-N	
Depth (in)	PCB (ppm)
0-3	2.52 [1.62]

T9-N2	
Depth (in)	PCB (ppm)
0-3	0.78
3-12	2.81
12-18	4.56
18-24	2.92
24-30	85.49
30-36	97.01
36-42	147.40
42-48	1030.60
48-51	189.84

MC-17	
Depth (in)	PCB (ppm)
0-3	6.12
3-6	9.80
6-12	3.37
12-18	15.87
18-24	4.10
24-30	5.39
30-36	69.62
36-42	147.90 [167.90]
42-48	52.65
48-54	214.80
54-60	1829.40
60-64	255.90

T9-M	
Depth (in)	PCB (ppm)
0-3	3.63

LEGEND:

- T5 — 1992 SEDIMENT PROBING TRANSECT
- APPROXIMATE DREDGING/CAPPING AREA
- APPROXIMATE THIN-LAYER CAPPING AREA
- RIVER BOUNDARY
- NEAR SHORE AREA
- 2003 NEAR SHORE SURFACE SEDIMENT LOCATION
- 2003 HIGH RESOLUTION CORE LOCATION (SEE NOTE 4)
- 2004 LOW RESOLUTION CORE LOCATION
- 2004 ROPS BASELINE SIDE SLOPE CORE LOCATION
- 2004 ROPS BASELINE MAIN CHANNEL LOCATION
- DIRECTION OF RIVER FLOW
- PCB — POLYCHLORINATED BIPHENYLS
- in — INCHES
- cm — CENTIMETERS
- ppm — PARTS PER MILLION
- J — ESTIMATED VALUE
- ND(0.06) — NON DETECT (PRACTICAL QUANTITATION LIMIT)
- [ ] — DUPLICATE RESULT

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. SEDIMENT SAMPLES COLLECTED IN 2003 WERE OBTAINED IN TWO PHASES. PHASE I INCLUDED COLLECTION OF ALL SAMPLES FROM T15 TO T21 (EXCEPT FOR STRATIGRAPHIC CORES) AND WAS CONDUCTED FROM 6/19/03 THROUGH 7/2/03. PHASE I PCB RESULTS REPRESENT CONGENER ANALYSIS. PHASE II WAS PERFORMED FROM 9/24/03 THROUGH 11/13/03 AND INCLUDED COLLECTION OF ALL OTHER 2003 SAMPLES THROUGHOUT THE RIVER (INCLUDING ALL STRATIGRAPHIC CORES). ADDITIONAL SAMPLES WERE COLLECTED FROM 1/20/04 THROUGH 1/27/04. PHASE II AND JANUARY 2004 PCB RESULTS REPRESENT AROCLOR ANALYSIS.
3. SEDIMENT SAMPLES COLLECTED IN 2004 WERE OBTAINED DURING THE 2004 REMEDIAL OPTIONS PILOT STUDY BASELINE MONITORING PROGRAM. PCB RESULTS REPRESENT AROCLOR ANALYSIS.
4. AT EACH HIGH RESOLUTION CORE LOCATION, A CO-LOCATED CORE WAS COLLECTED FOR GRAIN SIZE ANALYSIS.

0 200' 400'
GRAPHIC SCALE

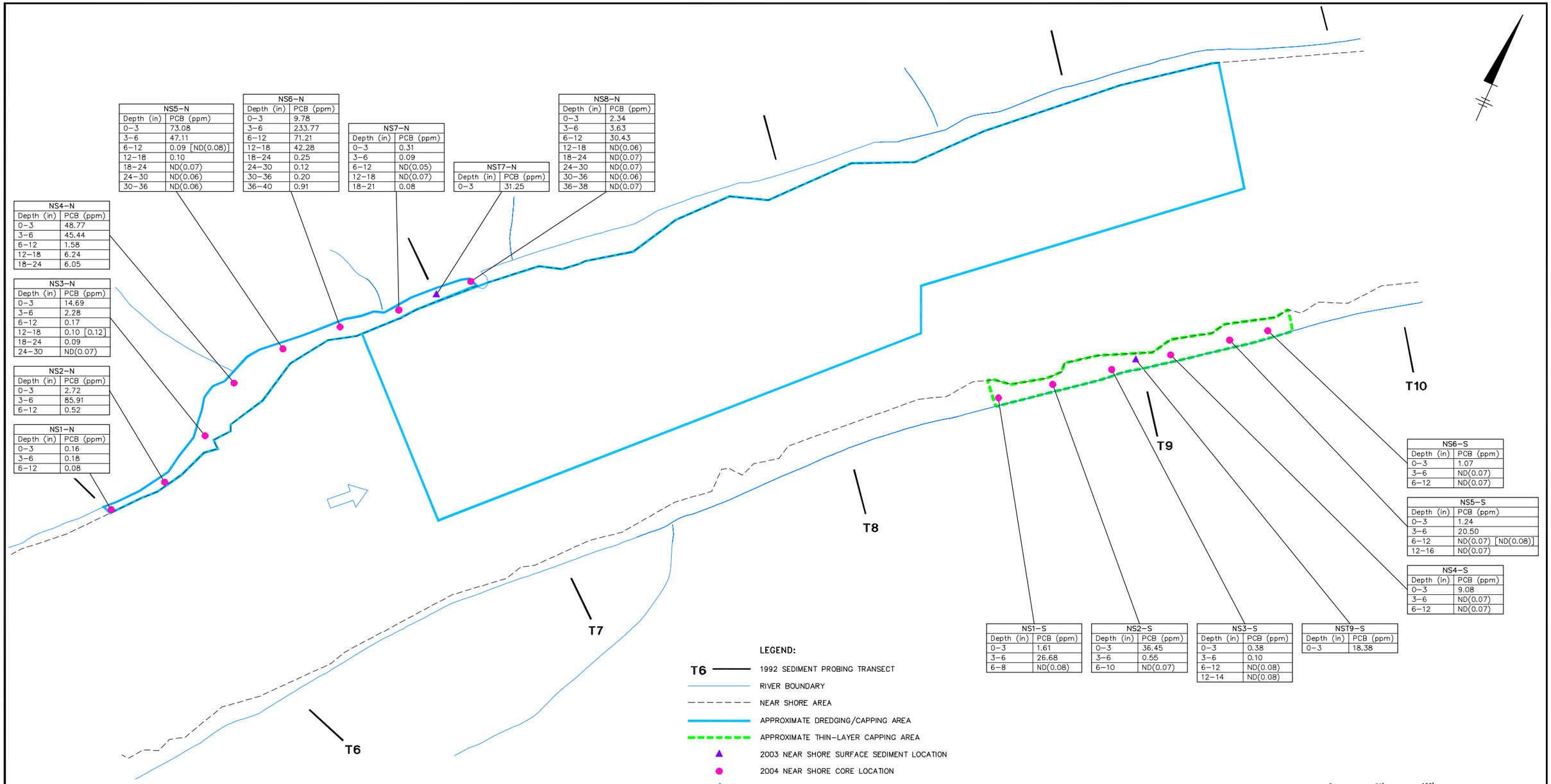
X: 10809X01.DWG, X07.DWG, 10809X01.TIF
L: ON=*, OFF=REF*, |TRANSECT
P: PAGESET/SYR-DL
5/19/06 SYR-85-CBM LAF BGP
10808001/10809G45.DWG

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

2003-2004 MAIN CHANNEL DREDGING/CAPPING AREA SEDIMENT SAMPLING LOCATIONS AND PCB RESULTS

ALCOA

FIGURE 1



NS5–N	
Depth (in)	PCB (ppm)
0–3	73.08
3–6	47.11
6–12	0.09 [ND(0.08)]
12–18	0.10
18–24	ND(0.07)
24–30	ND(0.06)
30–36	ND(0.06)

NS6–N	
Depth (in)	PCB (ppm)
0–3	9.78
3–6	233.77
6–12	71.21
12–18	42.28
18–24	0.25
24–30	0.12
30–36	0.20
36–40	0.91

NS7–N	
Depth (in)	PCB (ppm)
0–3	0.31
3–6	0.09
6–12	ND(0.05)
12–18	ND(0.07)
18–21	0.08

NST7–N	
Depth (in)	PCB (ppm)
0–3	31.25

NS8–N	
Depth (in)	PCB (ppm)
0–3	2.34
3–6	3.63
6–12	30.43
12–18	ND(0.06)
18–24	ND(0.07)
24–30	ND(0.07)
30–36	ND(0.06)
36–38	ND(0.07)

NS4–N	
Depth (in)	PCB (ppm)
0–3	48.77
3–6	45.44
6–12	1.58
12–18	6.24
18–24	6.05

NS3–N	
Depth (in)	PCB (ppm)
0–3	14.69
3–6	2.28
6–12	0.17
12–18	0.10 [0.12]
18–24	0.09
24–30	ND(0.07)

NS2–N	
Depth (in)	PCB (ppm)
0–3	2.72
3–6	85.91
6–12	0.52

NS1–N	
Depth (in)	PCB (ppm)
0–3	0.16
3–6	0.18
6–12	0.08

NS6–S	
Depth (in)	PCB (ppm)
0–3	1.07
3–6	ND(0.07)
6–12	ND(0.07)

NS5–S	
Depth (in)	PCB (ppm)
0–3	1.24
3–6	20.50
6–12	ND(0.07) [ND(0.08)]
12–16	ND(0.07)

NS4–S	
Depth (in)	PCB (ppm)
0–3	9.08
3–6	ND(0.07)
6–12	ND(0.07)

NS1–S	
Depth (in)	PCB (ppm)
0–3	1.61
3–6	26.68
6–8	ND(0.08)

NS2–S	
Depth (in)	PCB (ppm)
0–3	36.45
3–6	0.55
6–10	ND(0.07)

NS3–S	
Depth (in)	PCB (ppm)
0–3	0.38
3–6	0.10
6–12	ND(0.08)
12–14	ND(0.08)

NST9–S	
Depth (in)	PCB (ppm)
0–3	18.38

0 80' 160'
GRAPHIC SCALE

LEGEND:

T6	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA
	APPROXIMATE DREDGING/CAPPING AREA
	APPROXIMATE THIN–LAYER CAPPING AREA
▲	2003 NEAR SHORE SURFACE SEDIMENT LOCATION
●	2004 NEAR SHORE CORE LOCATION
⇨	DIRECTION OF RIVER FLOW
PCB	POLYCHLORINATED BIPHENYLS
in	INCHES
ppm	PARTS PER MILLION
ND(0.06)	NON DETECT (PRACTICAL QUANTITATION LIMIT)
[ ]	DUPLICATE RESULT

NOTE:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).

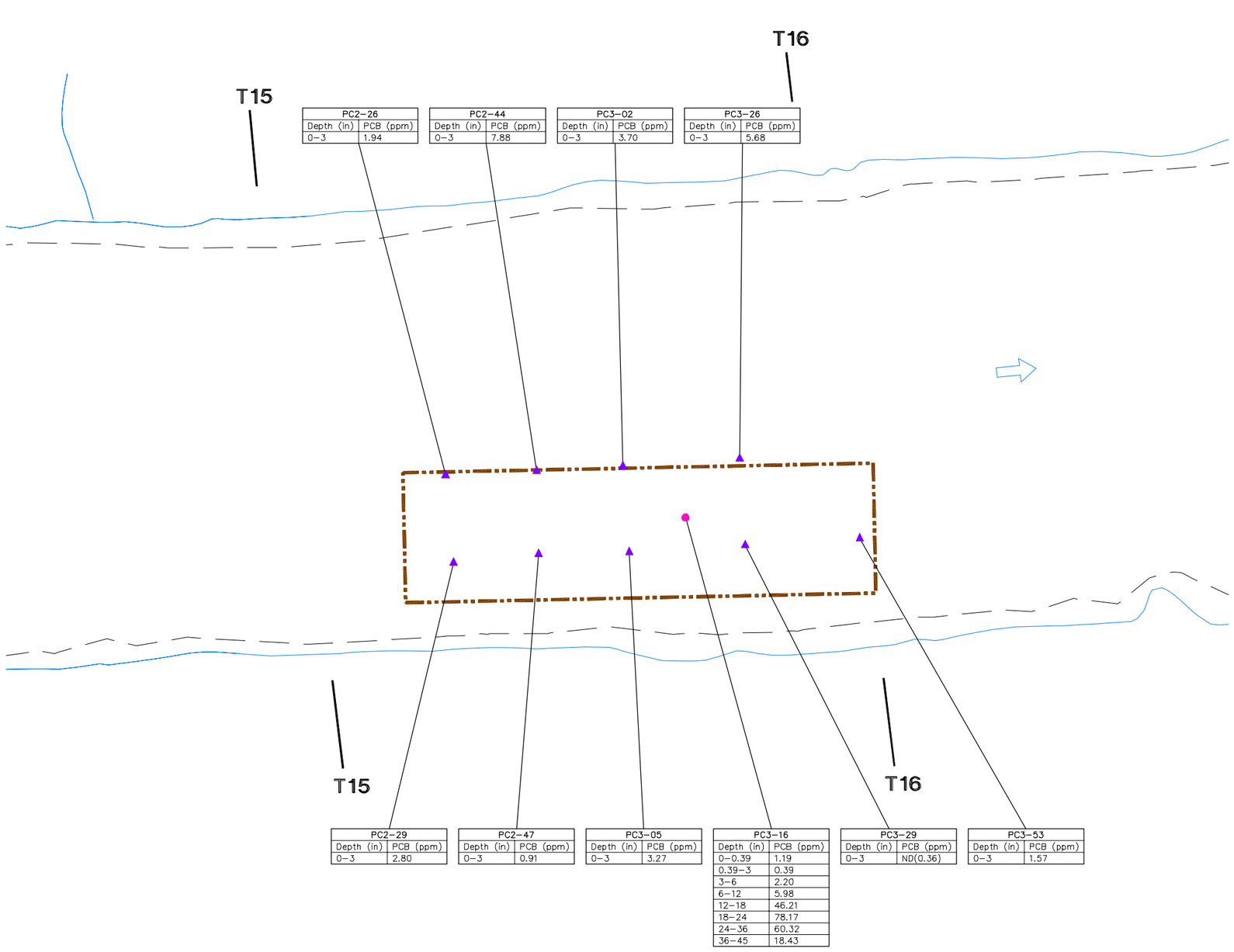
GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

2003-2004 NEAR SHORE DREDGING/CAPPING AND THIN-LAYER CAPPING AREAS SEDIMENT SAMPLING LOCATIONS AND PCB RESULTS

ALCOA

FIGURE
2

X: 10809X01, X04, X07.DWG, 10809X01.TIF
L: ON=*, OFF=REF*, (FRZ)
P: PAGESET/SYR-DL2B1
5/23/06 SYR-85-NES SDL BGP
10809001/10809G47.DWG



PC2-26	
Depth (in)	PCB (ppm)
0-3	1.94

PC2-44	
Depth (in)	PCB (ppm)
0-3	7.88

PC3-02	
Depth (in)	PCB (ppm)
0-3	3.70

PC3-26	
Depth (in)	PCB (ppm)
0-3	5.68

PC2-29	
Depth (in)	PCB (ppm)
0-3	2.80

PC2-47	
Depth (in)	PCB (ppm)
0-3	0.91

PC3-05	
Depth (in)	PCB (ppm)
0-3	3.27

PC3-16	
Depth (in)	PCB (ppm)
0-0.39	1.19
0.39-3	0.39
3-6	2.20
6-12	5.98
12-18	46.21
18-24	78.17
24-36	60.32
36-45	18.43

PC3-29	
Depth (in)	PCB (ppm)
0-3	ND(0.36)

PC3-53	
Depth (in)	PCB (ppm)
0-3	1.57

LEGEND:

T16	1992 SEDIMENT PROBING TRANSECT
	RIVER BOUNDARY
	NEAR SHORE AREA BOUNDARY
	APPROXIMATE BOUDARY OF ARMORED CAPPING AREA
▲	2003 SURFACE SEDIMENT SAMPLE LOCATION
●	2003 CORE LOCATION
⇨	DIRECTION OF RIVER FLOW
PCB	POLYCHLORINATED BIPHENYLS
in	INCHES
ppm	PARTS PER MILLION
ND(0.06)	NON DETECT (PRACTICAL QUANTITATION LIMIT)

NOTES:

1. BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA).
2. SEDIMENT SAMPLES COLLECTED IN 2003 WERE OBTAINED IN TWO PHASES. PHASE I INCLUDED COLLECTION OF ALL SAMPLES FROM T15 TO T21 (EXCEPT FOR STRATIGRAPHIC CORES) AND WAS CONDUCTED FROM 6/19/03 THROUGH 7/2/03. PHASE I PCB RESULTS REPRESENT CONGENER ANALYSIS. PHASE II WAS PERFORMED FROM 9/24/03 THROUGH 11/13/03 AND INCLUDED COLLECTION OF ALL OTHER 2003 SAMPLES THROUGHOUT THE RIVER (INCLUDING ALL STRATIGRAPHIC CORES). ADDITIONAL SAMPLES WERE COLLECTED FROM 1/20/04 THROUGH 1/27/04. PHASE II AND JANUARY 2004 PCB RESULTS REPRESENT AROCLOR ANALYSIS.
3. SEVERAL LOCATIONS WERE NOT SAMPLED DUE TO LACK OF RECOVERABLE SEDIMENT IN THE IMMEDIATE AREA (i.e., APPROXIMATELY 3 TO 10 FEET AROUND THE SAMPLE LOCATION).

0 50' 100'
GRAPHIC SCALE

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

2003 ARMORED CAPPING AREA SEDIMENT SAMPLING LOCATIONS AND PCB RESULTS

ALCOA

FIGURE
3

X: 10809X01, X04, X07.DWG, 10809X01.TIF
L: ON=*, OFF=REF*, *FLOW
P: PAGESET/SYR-DL1
5/22/06 SYR-85-CBM SDL BGP
10809001/10809G46.DWG

Attachment A-2

Sediment Core Collection in the Main Channel Within Work Zone 1
Remedial Options Pilot Study
Grasse River, Massena, NY

Objective: Collect cores for PCB analysis in the main channel within Work Zone 1 to understand conditions post-production dredging.

Sample Locations: A total of 10 sediment cores will be collected from the main channel in Work Zone 1 (see attached figure) using manual collection techniques. In general, sediment cores will be collected from the targeted areas described below.

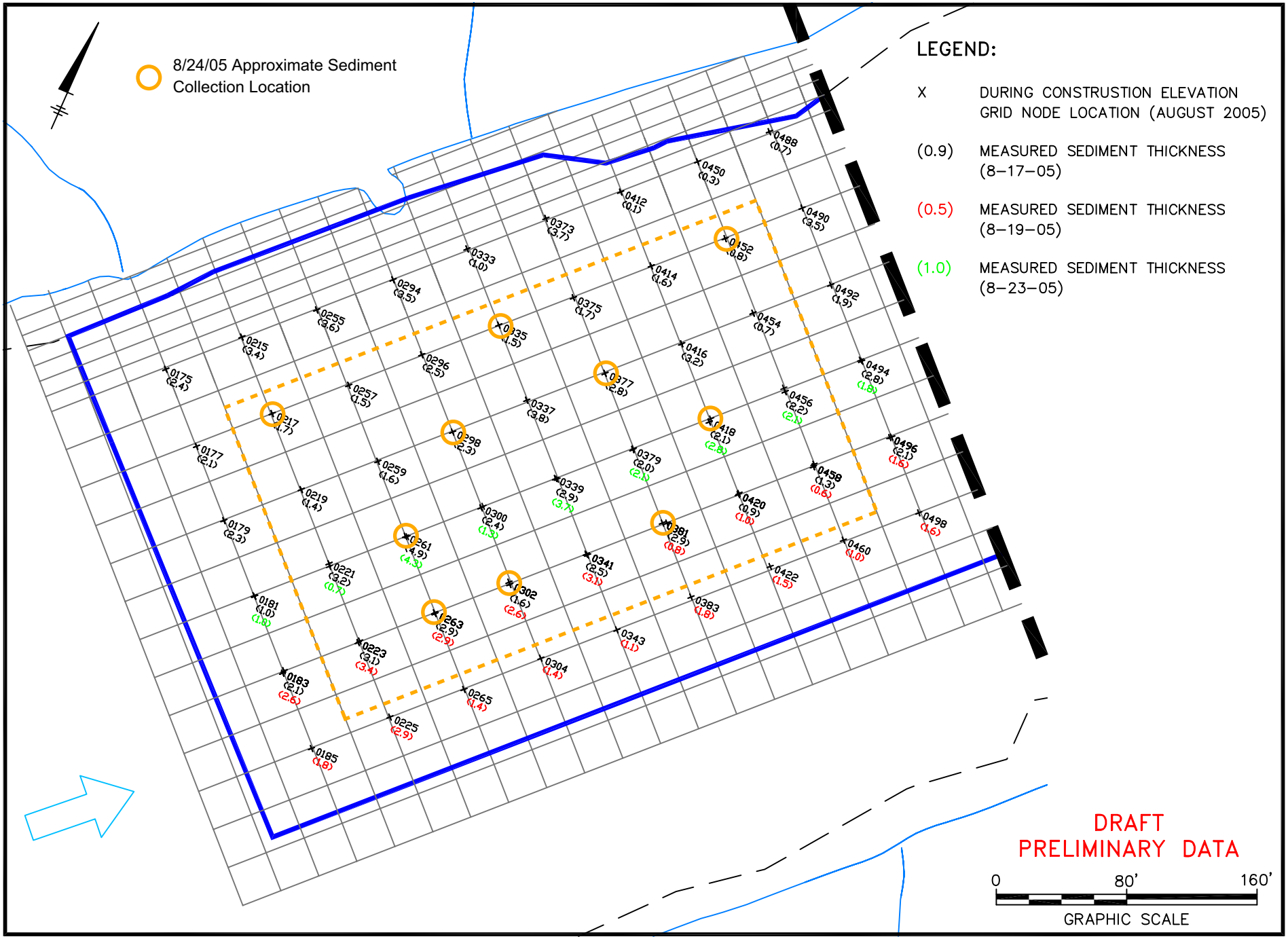
- One core each from an area exhibiting an increase, decrease, and no change in sediment depth between the August 17, 2005 sediment probing/elevation measurements and the August 19, 2005 sediment probing/elevation measurements (i.e., total of 3 cores).
- Seven locations spaced along a grid within the interior of Work Zone 1 (i.e., 7 cores). The interior grid does not include the outside rows/columns to reduce potential effects from side slopes, dredge boundary perimeter, silt curtain, etc.

Note that all cores will be collected from locations along the existing 25 foot by 25 foot grid used for sediment probing/elevation measurements.

Collection Protocol: Sediment cores will be collected in accordance with the procedure outlined in Attachment VI of the Remedial Options Pilot Study Operations Plan (Sevenson, May 2005). Each targeted sediment core location will be located using DGPS techniques, probed, and sediment will be collected using Lexan tubing with a check valve device. If sediment is observed to be present during probing but is not recoverable using Lexan tubing, the sediment sample will be collected using a petite ponar dredge sampler (i.e., if less than 6 inches of sediment, sample will be collected using the petite ponar dredge sampler). Similar to previous sampling events, cores will be segmented as follows: 0 to 3 inches, 3 to 6 inches, 6 to 12 inches, and every 6 inches thereafter. Each core and sample will be photographed and visual descriptions of the core will be recorded in the field book.

Laboratory Analysis: All samples will be submitted for PCB (Aroclor), TOC, percent moisture, bulk density, and grain size analyses. Samples will be submitted to NEA for PCB (Aroclor), TOC, percent moisture, and bulk density analyses, and to the CDM Soils Laboratory for grain size analyses. PCB (Aroclor) analyses will be requested on an accelerated TAT (i.e., 48 hours), and the remaining analyses will be requested on a standard TAT.

QA/QC: QA/QC samples will include one blind duplicate and one MS/MSD sample for 20 sediment samples collected. The blind duplicate sample will be analyzed for all analyses listed above. MS/MSD samples will be analyzed for PCB (Aroclor) analysis. One rinse blank sample will be collected per 20 sediment samples collected with non-disposable equipment for PCB (Aroclor) analysis.


8/24/05 Approximate Sediment Collection Location
LEGEND:
X DURING CONSTRUSTION ELEVATION GRID NODE LOCATION (AUGUST 2005)
(0.9) MEASURED SEDIMENT THICKNESS (8-17-05)
(0.5) MEASURED SEDIMENT THICKNESS (8-19-05)
(1.0) MEASURED SEDIMENT THICKNESS (8-23-05)
DRAFT
PRELIMINARY DATA
0
80'
160'
GRAPHIC SCALE

Sediment Core Collection via Vibracoring in the Main Channel
Remedial Options Pilot Study Grasse River, Massena, NY

Objective: Collect sediment cores using vibracoring techniques from the main channel within Work Zones 1 and 2 to investigate the physical and chemical characteristics of the sediment column and correlate depths within the sediment column to post-dredge/current conditions in the river.

Sample Locations: A one-day sampling effort consisting of the collection of 12 sediment cores will be performed in the main channel in Work Zones 1 and 2 using vibracore collection techniques. This number may be adjusted based on the findings of outstanding analytical work and conditions encountered within the sediment bed. Sediment cores will be collected throughout Work Zones 1 and 2 on pre-determined locations along the existing 25 foot by 25 foot grid used for sediment probing/elevation measurements.

Collection locations are shown on the attached figure (along with core locations from previous vibracoring work and recent Lexan core collection efforts) and have been selected to evaluate a variety of conditions that have been/may be encountered during work efforts. Proposed locations include the following:

Work Zone 1:

- Grid Node 179 – current top of sediment elevation is at or below pre-dredge predicted bottom of sediment elevation
- Grid Node 257 – several feet of sediment removed during initial production dredging efforts, efforts beyond this resulted in no change in sediment depth
- Grid Node 343 – representative of area dredged in the vicinity of the main channel silt curtain
- Grid Node 351 – side slope location
- Grid Node 418 - several feet of sediment removed during initial production dredging efforts, efforts beyond this resulted in increased sediment depth, Lexan core collected at this location exhibited odor
- Grid Node 492 – less than one foot of sediment removed during initial production dredging efforts, efforts beyond this resulted in no change in sediment depth

Work Zone 2:

- Grid Node 571 – deeper sediment area (5.8') that may not yet have been impacted by current removal efforts (allow for observation of undisturbed sediment above native material)
- Grid Node 635 – side slope location
- Grid Node 640 - deeper sediment area (5.9') that may not yet have been impacted by current removal efforts
- Grid Node 735 – area where debris removal efforts indicated the presence of large boulders and clay
- Grid Nodes 820 and 847 – provide representative areal coverage throughout the work zone of locations with varying physical characteristics (as observed during baseline probing efforts)

Collection Protocol: Sediment cores will be collected in accordance with the procedure outlined in Attachment VI of the Remedial Options Pilot Study Operations Plan (Sevenson, May 2005).

Each targeted sediment core location will be located using DGPS techniques, probed, and sediment will be collected using a specially designated boat designed for vibracoring. Cores will be collected to a depth of refusal or the limitation of the sampling equipment (e.g., ~13-14 feet, depending on sediment conditions). Aluminum tubing will be utilized for this collection effort. Once collected, each core will be split, photographed, and visual descriptions of the core will be recorded in the field book. Cores will be segmented for analysis as follows: 0 to 3 inches, 3 to 6 inches, 6 to 12 inches, and every 6 inches thereafter. Segmentation may be altered to conform with stratigraphic boundaries if such boundaries are visible.

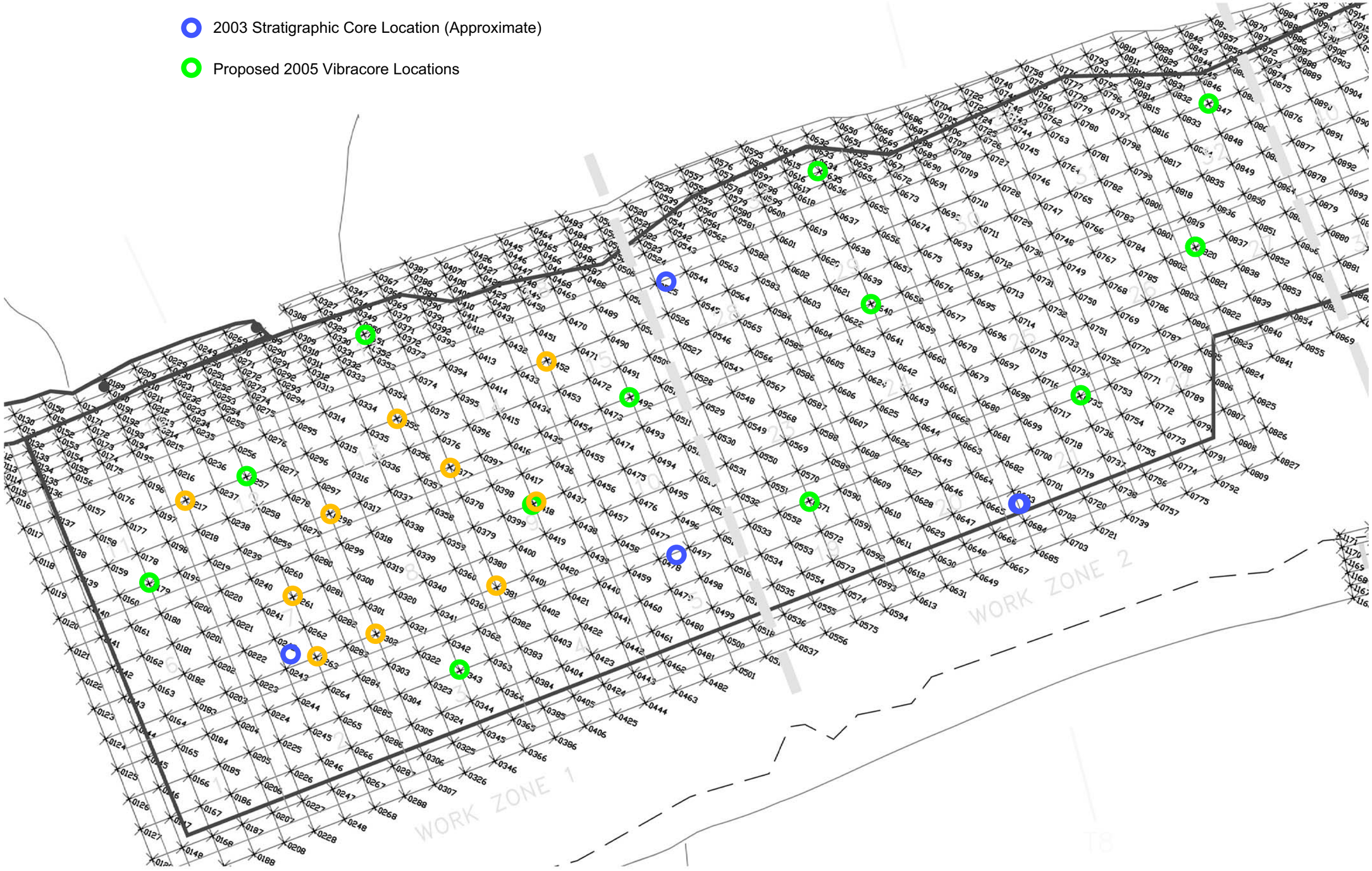
Laboratory Analysis: All samples will be submitted for PCB (Aroclor), TOC, percent moisture, bulk density, and grain size analyses. Samples will be submitted to NEA for PCB (Aroclor), TOC, percent moisture, and bulk density analyses, and to the CDM Soils Laboratory for grain size analyses. PCB (Aroclor) analyses will be requested on an accelerated TAT (i.e., 48 hours), and the remaining analyses will be requested on a standard TAT.

QA/QC: QA/QC samples will include one blind duplicate and one MS/MSD sample per 20 sediment samples collected. The blind duplicate sample will be analyzed for all analyses listed above. MS/MSD samples will be analyzed for PCB (Aroclor) analysis. One rinse blank sample will be collected per 20 sediment samples collected with non-disposable equipment for PCB (Aroclor) analysis.

Location of Cores Collected 8/23-8/24/05 (Approximate)

2003 Stratigraphic Core Location (Approximate)

Proposed 2005 Vibracore Locations



Sediment Core Collection via Vibracoring in the Main Channel
Remedial Options Pilot Study Grasse River, Massena, NY

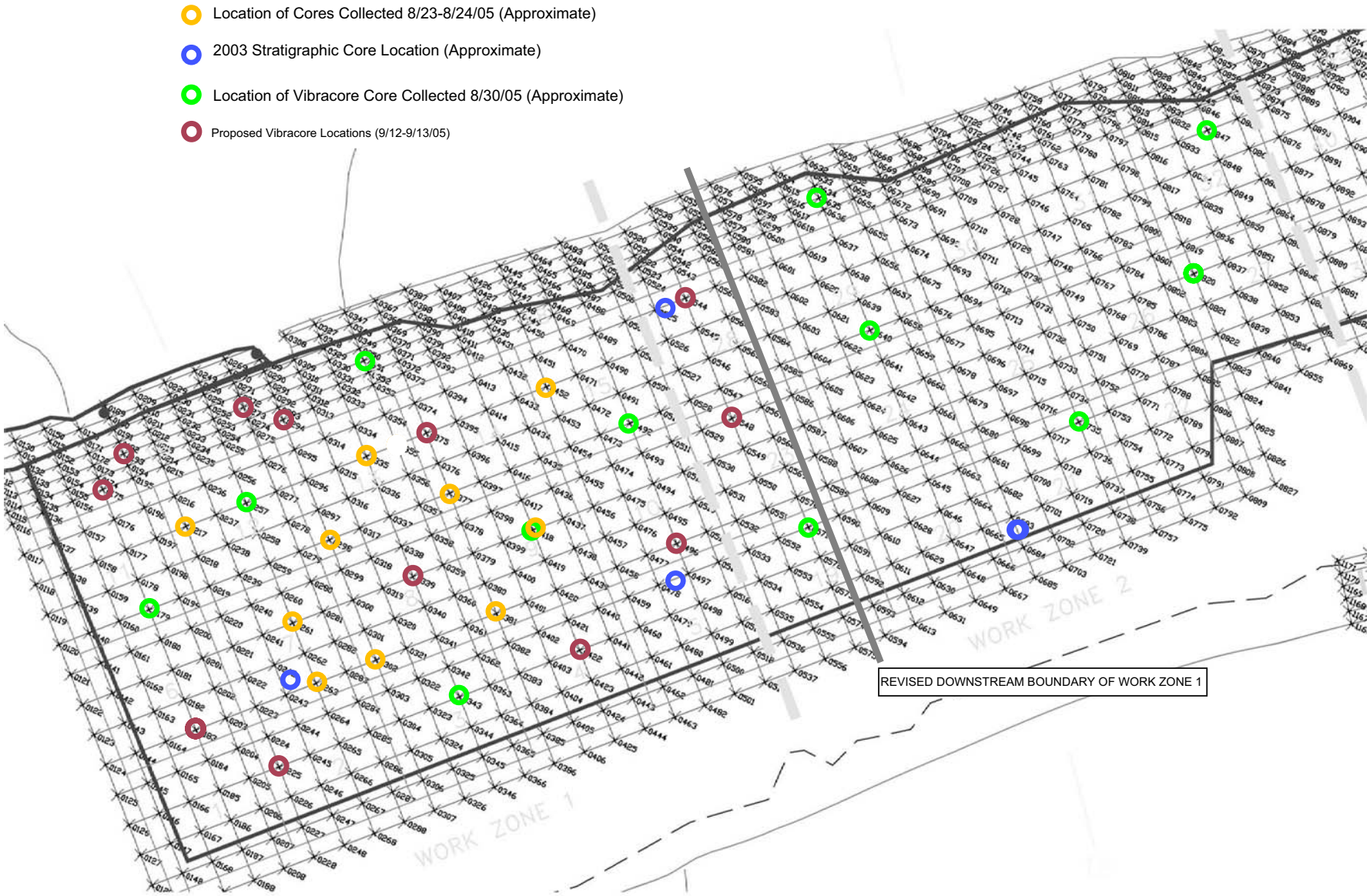
Objective: Collect sediment cores using vibracoring techniques from the main channel within Work Zone 1 to further investigate the physical and chemical characteristics of the sediment column and correlate depths within the sediment column to post-dredge/current conditions in the river.

Sample Locations: A sampling effort consisting of the collection of 12 sediment cores will be performed in the main channel in Work Zone 1 using vibracore collection techniques. Sediment cores will be collected throughout Work Zone 1 on pre-determined locations along the existing 25 foot by 25 foot grid used for sediment probing/elevation measurements. Collection locations are shown on the attached figure (along with core locations from previous vibracoring work and recent Lexan core collection efforts).

Collection Protocol: Sediment cores will be collected in accordance with the procedure outlined in Attachment VI of the Remedial Options Pilot Study Operations Plan (Sevenson, May 2005). Each targeted sediment core location will be located using DGPS techniques, probed, and sediment will be collected using a specially designated boat designed for vibracoring. Cores will be collected to a depth of refusal or the limitation of the sampling equipment (e.g., ~13-14 feet, depending on sediment conditions). Aluminum tubing will be utilized for this collection effort. Once collected, each core will be split, photographed, and visual descriptions of the core will be recorded in the field book. Cores will be segmented for analysis as follows: 0 to 3 inches, 3 to 6 inches, 6 to 12 inches, and every 6 inches thereafter. Segmentation may be altered to conform with stratigraphic boundaries if such boundaries are visible.

Laboratory Analysis: All samples will be submitted for PCB (Aroclor), TOC, percent moisture, bulk density, and grain size analyses. Samples will be submitted to NEA for PCB (Aroclor), TOC, percent moisture, and bulk density analyses, and to the CDM Soils Laboratory for grain size analyses. PCB (Aroclor) analyses will be requested on an accelerated TAT (i.e., 48 hours), and the remaining analyses will be requested on a standard TAT.

QA/QC: QA/QC samples will include one blind duplicate and one MS/MSD sample per 20 sediment samples collected. The blind duplicate sample will be analyzed for all analyses listed above. MS/MSD samples will be analyzed for PCB (Aroclor) analysis. One rinse blank sample will be collected per 20 sediment samples collected with non-disposable equipment for PCB (Aroclor) analysis.


Location of Cores Collected 8/23-8/24/05 (Approximate)
2003 Stratigraphic Core Location (Approximate)
Location of Vibracore Core Collected 8/30/05 (Approximate)
Proposed Vibracore Locations (9/12-9/13/05)
REVISED DOWNSTREAM BOUNDARY OF WORK ZONE 1
WORK ZONE 1
WORK ZONE 2

Sediment Core Collection and Elevation Measurements in Work Zone 1
Following the September 2005 Storm Event

Remedial Options Pilot Study
Grasse River, Massena, NY

Objective: Evaluate river bottom conditions within Work Zone 1 following the September 2005 storm event that resulted in significantly increased river flows (over 10,000 cubic feet per second).

Three different monitoring tools will be utilized to evaluate current river conditions: 1) Hypack survey (single-beam bathymetry) to be performed by Sevenson; 2) sediment probing/elevation measurements; and 3) sediment core collection for visual observation. Each of these tools can be compared with previous data collected to evaluate potential changes resulting from the high flow event.

Single-Beam Bathymetry: Similar to previous surveys, Sevenson will conduct a single-beam bathymetric survey using the Hypack system over Work Zone 1 to obtain sediment bed elevation measurements.

Sediment Probing/Elevation Measurement Protocol: Sediment probing and elevation measurements will be collected along the 50' x 50' grid established as part of the monitoring activities during dredging (see attached Figure 1). Each targeted grid node will be located using DGPS techniques. At each location, the water surface elevation will be obtained, depth of water will be measured to determine the top of sediment elevation using a survey rod affixed with a circular plate, and soft sediment depth will be estimated using a probe rod.

Core Sample Locations/Protocol: A total of 11 sediment cores will be collected from Work Zone 1 as illustrated on the attached Figure 2. Collection locations have been selected considering locations where previous sediment cores have been collected for comparison purposes.

Sediment cores will be collected in accordance with the procedure outlined in Attachment VI of the Remedial Options Pilot Study Operations Plan (Sevenson, May 2005). Each targeted sediment core location will be located using DGPS techniques, probed (using manual techniques), and sediment will be collected manually using Lexan tubing with a check valve core device. Cores will be collected to obtain approximately the top 12 inches of material. Sediment depth probed, penetrated, and recovered will also be recorded in association with each collection location. If an adequate sample can not be recovered, the sample location will be adjusted (within the immediate proximity of the original intended location) until recoverable sediments are obtained.

Once collected, each core will be split, photographed, and visual descriptions of the core will be recorded in the field book with a particular focus on sediment located at the surface of the sediment column. Following visual observation, cores will be appropriately disposed.

FIGURE 1

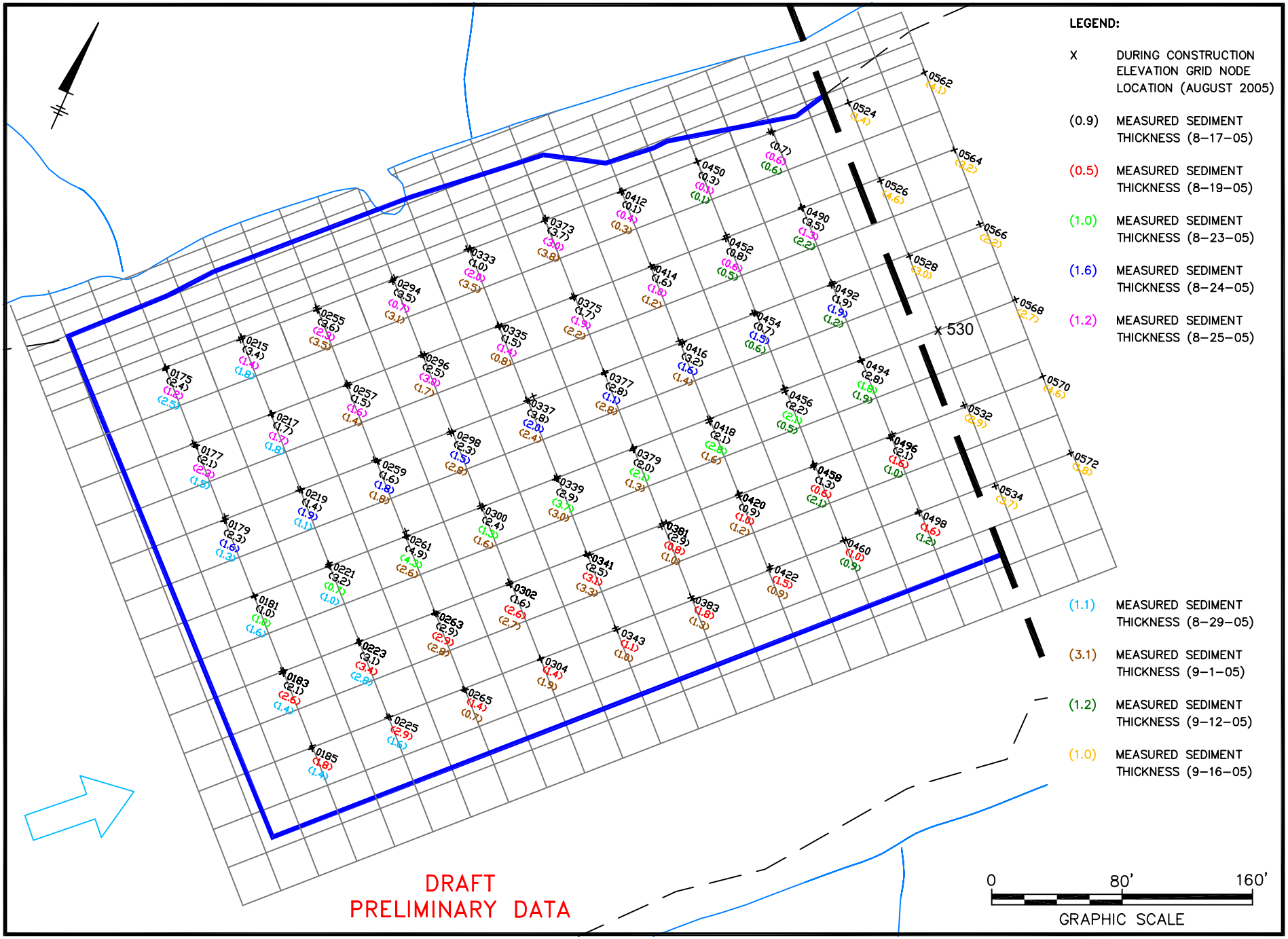
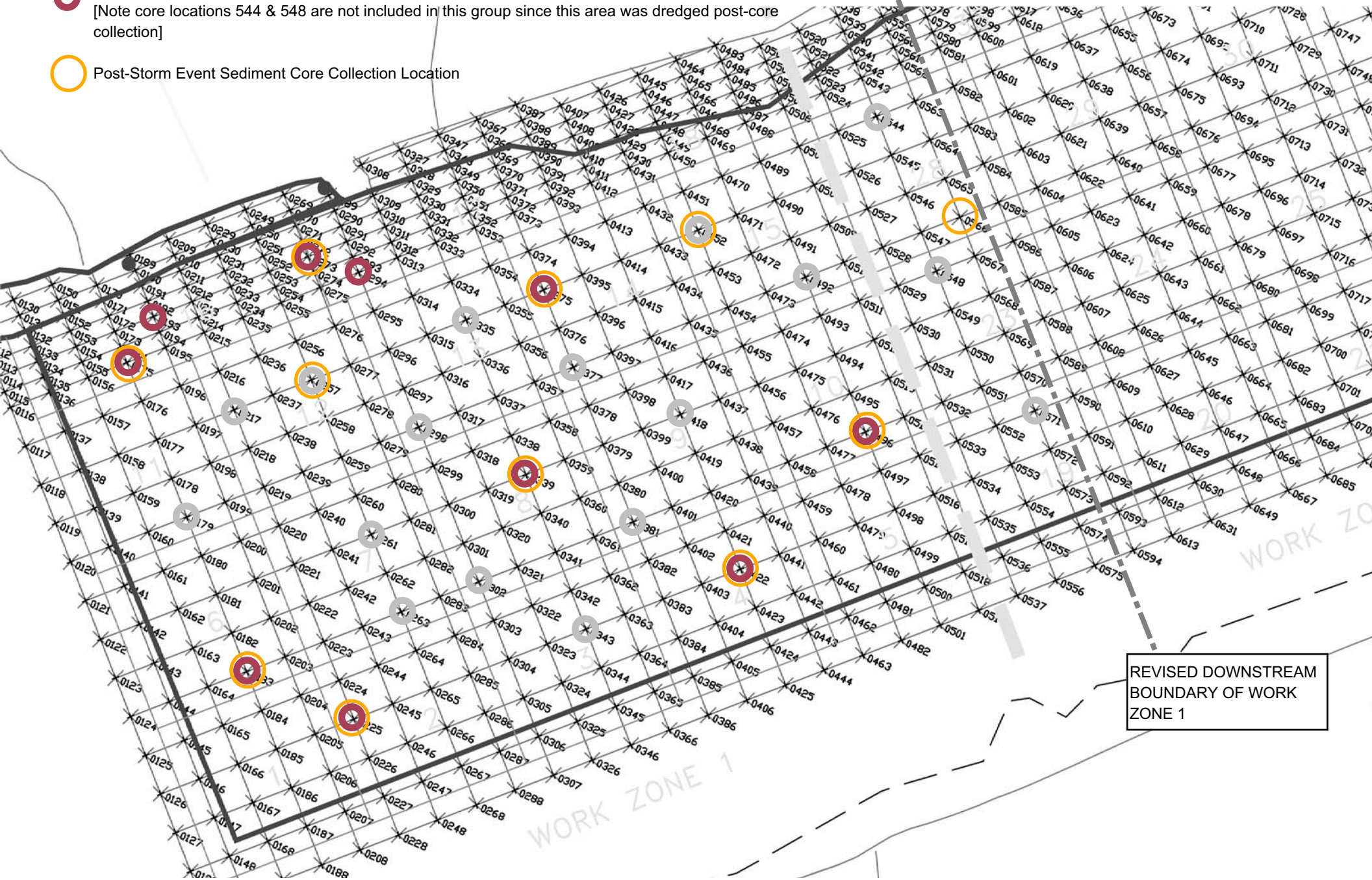

LEGEND:
X DURING CONSTRUCTION ELEVATION GRID NODE LOCATION (AUGUST 2005)
(0.9) MEASURED SEDIMENT THICKNESS (8–17–05)
(0.5) MEASURED SEDIMENT THICKNESS (8–19–05)
(1.0) MEASURED SEDIMENT THICKNESS (8–23–05)
(1.6) MEASURED SEDIMENT THICKNESS (8–24–05)
(1.2) MEASURED SEDIMENT THICKNESS (8–25–05)
(1.1) MEASURED SEDIMENT THICKNESS (8–29–05)
(3.1) MEASURED SEDIMENT THICKNESS (9–1–05)
(1.2) MEASURED SEDIMENT THICKNESS (9–12–05)
(1.0) MEASURED SEDIMENT THICKNESS (9–16–05)
530
DRAFT
PRELIMINARY DATA
0
80'
160'
GRAPHIC SCALE

FIGURE 2

Previous During Dredging WZ1 Core Collection Location (approximate; both manual and vibracore)

Vibracore Location 9/12-9/13/05 (approximate)
[Note core locations 544 & 548 are not included in this group since this area was dredged post-core collection]

Post-Storm Event Sediment Core Collection Location



Appendix B

ROPS Environmental Database
Included on Separate CD

Appendix B – Data Dictionary for ROPS Environmental Database

Table B-1	Data Dictionary for air_field_PM10_ROPS
Table B-2	Data Dictionary for air_field_VOC_ROPS
Table B-3	Data Dictionary for air_field_wind_ROPS
Table B-4	Data Dictionary for air_lab_PAH_ROPS
Table B-5	Data Dictionary for air_lab_PCB_ROPS
Table B-6	Data Dictionary for air_lab_PM10_ROPS
Table B-7	Data Dictionary for air_lab_VOC_ROPS
Table B-8	Data Dictionary for benthic_comm_ROPS
Table B-9	Data Dictionary for cap_material_ROPS
Table B-10	Data Dictionary for ChaseMills_ROPS
Table B-11	Data Dictionary for dredge_material_ROPS
Table B-12	Data Dictionary for fish_comm_ROPS
Table B-13	Data Dictionary for resfish_aro_ROPS
Table B-14	Data Dictionary for sed_aro_ROPS
Table B-15	Data Dictionary for sed_char_ROPS
Table B-16	Data Dictionary for sed_field_ROPS
Table B-17	Data Dictionary for sed_probe_ROPS
Table B-18	Data Dictionary for treated_effluent_discharge_flow_ROPS
Table B-19	Data Dictionary for treated_effluent_discharge_lab_ROPS
Table B-20	Data Dictionary for veg_aquatic_ROPS
Table B-21	Data Dictionary for veg_floodplain_ROPS
Table B-22	Data Dictionary for water_aro_ROPS
Table B-23	Data Dictionary for water_field_ROPS
Table B-24	Data Dictionary for water_turbidity_ROPS

Table B-1
Data Dictionary for air_field_PM10_ROPS

Data Table Description: 2005 ROPS air particulate matter less than or equal to 10 microns in diameter (PM_{10}) data as measured in the field using a DustTrak meter

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Location	Sampling location (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6, AIRSLF)
Start_date	Starting date for 15-minute monitoring period
Start_time	Starting time for 15-minute monitoring period (HH:MM:SS)
PM10	15-minute running average concentration of particulate matter less than or equal to 10 microns in diameter (milligrams per cubic meter)

Table B-2
Data Dictionary for air_field_VOC_ROPS

Data Table Description: 2005 ROPS air volatile organic compound (VOC) data as measured in the field using a photoionization detector (PID) meter

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Location	Sampling location (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6)
Start_date	Starting date for 5-minute monitoring period
Start_time	Starting time for 5-minute monitoring period (HH:MM)
MinVOC	Minimum total VOC measured during 5-minute interval (parts per million)
AvgVOC	5-minute running average concentration of total VOCs (parts per million)
MaxVOC	Maximum total VOC measured during 5-minute interval (parts per million)

Table B-3
Data Dictionary for air_field_wind_ROPS

Data Table Description: Wind data during times of 2005 ROPS air sampling

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Start_date	Starting date for monitoring period
End_date	Ending date for monitoring period
Wind_speed	Average wind speed (miles per hour)
Direction	Prevailing wind direction (from North)
Bckgrd_loc	Location of background station, as indicated by prevailing wind direction (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6, AIRSLF)
Notes	Additional notes reported by the field crew

Comments:

(1) Average wind speed and prevailing wind direction were estimated from data obtained from the National Weather Service weather station at the Massena International Airport – Richards Field (Station ID: KMSS), located approximately 1 mile (as the crow flies) from the site.

(2) Prior to 10/26/05, background locations were determined considering the river as the central location. From 10/26/06 and later, background locations were determined considering the secure landfill as the central location.

(3) During some days, the wind direction was reported to be fluctuating or coming from two different directions. In those cases, the direction includes all directions reported and the background location was determined for each reported direction.

Table B-4
Data Dictionary for air_lab_PAH_ROPS

Data Table Description: 2005 ROPS data for air samples collected over a 24-hour period and analyzed in the laboratory for polycyclic aromatic hydrocarbons (PAHs)

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Lab	Laboratory where samples were analyzed (Con-Test = Con-Test Analytical Laboratories)
Lab_ID	Laboratory identification number
Sample_ID	Sample identification code
Type	Sample type (sample = field sample, QAQC = quality assurance/quality control)
Location	Location of sampling station (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6)
Retr_month	Sample retrieval month
Retr_day	Sample retrieval day
Retr_year	Sample retrieval year
Acenaphthene_*through* Pyrene	Amount and concentration of individual PAH (microgram and microgram per cubic meter)
Air_vol	Volume of air sampled (liter)
Nitrobenzene-d5_perrec *through* Benzo(a)pyrene -7,8-d12	Percent recovery of surrogates (%)
Naphthalene _perrec *through* Perylene_perrec	Percent recovery of individual PAH (%)
Qual_indeno(1, 2,3-cd)pyrene	Data qualifier for indeno(1,2,3-cd)pyrene (J = estimated)

Comments:
(1) -999 indicates parameter not measured/not reported by laboratory
(2) Negative numbers (other than -999) indicate the concentration was below the reporting limit (RL), i.e. -0.1 means the concentration was less than the RL of 0.1 micrograms

Table B-5
Data Dictionary for air_lab_PCB_ROPS

Data Table Description: 2005 ROPS data for air samples collected over a 24-hour period and analyzed in the laboratory for polychlorinated biphenyls (PCBs [Aroclor])

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Lab	Laboratory where samples were analyzed (Con-Test = Con-Test Analytical Laboratories)
Lab_ID	Laboratory identification number
Sample_ID	Sample identification code
Type	Sample type (sample = field sample, dup = field duplicate, QAQC = quality assurance/quality control)
Location	Location of sampling station (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6)
Retr_month	Sample retrieval month
Retr_day	Sample retrieval day
Retr_year	Sample retrieval year
A_1016 *through* A_1260	Aroclor_# amount and concentration, where # = 1016, 1221, 1232, 1242, 1248, 1254, 1260 (microgram and micrograms/cubic meter)
Air_vol_L	Volume of air sampled (liter)
Total_PCBs	Total PCB concentration (micrograms per cubic meter)
Deca_perrec	Percent recovery of decachlorobiphenyl (%)
Tetra_perrec	Percent recovery of tetrachloro-m-xylene (%)
A1232_perrec *through* A1254_perrec	A# percent recovery, where # = 1232, 1242, 1248, 1254 (%)
Qual_A1232 *through* Qual_A1248	Data qualifiers for Aroclors 1232, 1242, and 1248 (J = estimated)

Comments:

(1) -999 indicates parameter not measured/not reported by laboratory

(2) Negative numbers (other than -999) indicate the concentration was below the reporting limit (RL), i.e. -0.1 means the concentration was less than the RL of 0.1 micrograms

Table B-6
Data Dictionary for air_lab_PM10_ROPS

Data Table Description: 2005 ROPS data for air samples collected over a 24-hour period and analyzed in the laboratory for particulate matter less than or equal to 10 microns in diameter (PM_{10})

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Lab	Laboratory where samples were analyzed (Con-Test = Con-Test Analytical Laboratories)
Lab_ID	Laboratory identification number
Sample_ID	Sample identification code
Type	Sample type (sample = field sample)
Location	Location of sampling station (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6)
Retr_month	Sample retrieval month
Retr_day	Sample retrieval day
Retr_year	Sample retrieval year
PM10_mg	Mass of PM_{10} (milligram)
PM10_mgm3	Concentration of PM_{10} (milligram per cubic meter)
Air_vol	Volume of air sampled (liter)

Table B-7
Data Dictionary for air_lab_VOC_ROPS

Data Table Description: 2005 ROPS data for air samples collected over a 24-hour period and analyzed in the laboratory for volatile organic compounds (VOCs)

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Lab	Laboratory where samples were analyzed (Con-Test = Con-Test Analytical Laboratories)
Lab_ID	Laboratory identification number
Sample_ID	Sample identification code
Type	Sample type (sample = field sample, QAQC = quality assurance/quality control)
Location	Location of sampling station (AIR1, AIR2, AIR3, AIR4, AIR5, AIR6)
Retr_month	Sample retrieval month
Retr_day	Sample retrieval day
Retr_year	Sample retrieval year
Acetone_ppbV_*through* o-Xylene_ppbV	Concentration of individual VOC by volume (parts per billion by volume)
Acetone_ugm3 *through* o-Xylene_ugm3	Concentration of individual VOC (microgram per cubic meter)
4-Bromofluorobenzene_perrec	Percent recovery of surrogate 4-Bromofluorobenzene (%)
Acetone_perrec through o-Xylene_perrec	Percent recovery of individual VOC (%)
Qual_acetone *through* Qual_1,2,4-trichlorobenzene	Data qualifiers for acetone, 4-methyl-2-pentanone, MBTE, hexachlorobutadiene, 1,2,4-trichlorobenzene (J = estimated)

Comments:
(1) -999 indicates parameter not measured/not reported by laboratory
(2) Negative numbers (other than -999) indicate the concentration was below the reporting limit (RL), i.e. -0.5 ppbV means the concentration was less than the RL of 0.5 ppbV

Table B-8
Data Dictionary for benthic_comm_ROPS

Data Table Description: Benthic community data from near the proposed location for an ice control structure (ICS) and from near shore areas.

Field Name	***Description***
Survey	Survey period (pre-ROPS = prior to ROPS construction)
Lab	Laboratories where samples were analyzed (CDM = Camp Dresser & McKee Soils Laboratory (grain size); Chadwick = Chadwick & Associates. (benthic); NEA = Northeast Analytical, Inc. (TOC))
Year	Sample year
Month	Sample month
Day	Sample day
Sampling_Area	General area of sampling (near ICS, near shore)
Sample_Method	Sampling method (net = sweep net in vegetated shoreline areas, ponar = petite ponar grab in the river channel)
Sample_ID	Location where sample was collected (US* = upstream of proposed ICS; DS* = downstream of proposed ICS; CON* = control station near Madrid, NY; *N = north (1/4 the distance across river from the northern shoreline); *C = center (1/2 the distance across river); *S = south (1/4 the distance across river from southern shoreline); *NS* = near shore; *NB* = northern bank/shoreline; *SB* = southern bank/shoreline)
Wc_dep	Total depth of water column (feet)
pH	pH (standard units)
Cond	Specific conductivity (milliSiemens/centimeter)
Turb	Turbidity (nephelometric turbidity units)
DO	Dissolved oxygen (milligrams/liter)
Temp	Temperature (degrees Celsius)
Secchi_dep	Water clarity depth (feet)
Velocity	Water velocity (feet per second)
Gravel_coarse	Coarse gravel composition (% by mass)

(continued)

Table B-8
Data Dictionary for benthic_comm_ROPS
(continued)

Field Name	***Description***
Gravel_fine	Fine gravel composition (% by mass)
Sand_coarse	Coarse sand composition (% by mass)
Sand_medium	Medium sand composition (% by mass)
Sand_fine	Fine sand composition (% by mass)
Silt	Silt composition (% by mass)
Clay	Clay composition (% by mass)
TOC	Total organic carbon (%)
Caenis amica *through* Sphaerium sp.	Number of species identified
Tot_indiv	Total number of individuals identified
Tot_taxa	Total number of taxa identified

Comments:
(1) -999 indicates parameter not measured.
(2) See Figure A-17 of Appendix A for sampling locations.
(3) The proposed ice control structure site was to be located approximately 0.5 miles upstream of the Route 37 Bridge. However, due to community concerns related to the proposed location of the structure, the ICS was not installed as planned as part of the ROPS.
(4) Water quality data were taken within one foot of substrate.

Table B-9
Data Dictionary for cap_material_ROPS

Data Table Description: Laboratory analyses of cap material prior to placement in the river during the 2005 ROPS

Field Name	***Description***
Survey	ROPS survey (during-ROPS = during ROPS construction)
Lab	Laboratories where samples were analyzed (CDM = Camp Dresser & McKee Soils Laboratory (grain size); NEA = Northeast Analytical, Inc. (TOC and % solids))
Lab_ID	Identification number assigned by the laboratory (NEA)
Sample_ID	Sample identification code
Year	Sample collection year
Month	Sample collection month
Day	Sample collection day
Hour	Sample collection hour
TOC	Total organic carbon (milligram/kilogram dry weight)
Per_solids	Percent solids (%)
Per_pass_19mm	Percent of sample passing 19 mm sieve (%)
Per_pass_4pt75_mm	Percent of sample passing 4.75 mm sieve (%)
Per_pass_2pt00_mm	Percent of sample passing 2 mm sieve (%)
Per_pass_0pt425_mm	Percent of sample passing 0.425 mm sieve (%)
Per_pass_0pt075_mm	Percent of sample passing 0.075 mm sieve (%)
Per_pass_0pt002_mm	Percent of sample passing 0.002 mm sieve (%)
D50	Median particle size (millimeters)

Table B-10
Data Dictionary for ChaseMills_ROPS

Data Table Description: 2004 and 2005 river flow data from the USGS station on the Grasse River at Chase Mills (gage #04265432)

Field Name	***Description***
Year	Sample year
Month	Sample month
Day	Sample day
Minute	Sample minute
Gage_height	Stage height at Chase Mills (feet)
Flow	River flow (cubic feet per second)

Comments:
(1) -999 indicates no measurement available due to the presence of ice on the river

Table B-11
Data Dictionary for dredge_material_ROPS

Data Table Description: 2005 ROPS ex-situ dredge material data during ROPS construction

Field Name	***Description***
Lab	Laboratories where samples were analyzed (CDM = Camp Dresser & McKee Soils Laboratory (grain size); ChemLab = Aloca Massena ChemLab (PCBs); NEA = Northeast Analytical, Inc. (TOC and % solids))
Lab_ID1	Identification number assigned by the laboratory (ChemLab = Alcoa Massena ChemLab – analysis for PCBs and % Moisture)
Lab_ID2	Identification number assigned by the laboratory (Northeast Analytical, Inc. – analysis for % Solids & TOC)
Sample_ID	Sample identification code
QC_type	Sample type (sample= field sample, ms=matrix spike, sd=matrix spike duplicate, blk=laboratory blank, lcs*=laboratory control spike)
Sample_type	Type of stockpile sample (sand or filter cake)
Collection_ date	Sample collection date and time
A_1016 *through* A_1260	Aroclor_# concentration, where # = 1016, 1221, 1232, 1242, 1248, 1254, 1260 (milligram/kilogram dry weight)
Decachlorobip henyl	Decachlorobiphenyl concentration (milligrams/kilogram dry weight)
Moisture	Percent moisture (%)
Tetracholor-m-xylene	Tetrachloro-meta-xylene concentration (milligrams/kilogram dry weight)
Total_PCB	Aroclor total PCB concentration (milligram/kilogram dry weight)
TOC	Total organic carbon (milligram/kilogram dry weight)
Per_solids	Percent solids (%)
Per_pass_75m m	Percent of sample passing 75 mm sieve (%)
Per_pass_19m m	Percent of sample passing 19 mm sieve (%)
Per_pass_4pt7 5_mm	Percent of sample passing 4.75 mm sieve (%)
Per_pass_2pt0 0_mm	Percent of sample passing 2 mm sieve (%)

(continued)

Table B-11
Data Dictionary for dredge_material_ROPS
(continued)

Per_pass_0pt425_mm	Percent of sample passing 0.425 mm sieve (%)
Per_pass_0pt075_mm	Percent of sample passing 0.075 mm sieve (%)
Per_pass_0pt002_mm	Percent of sample passing 0.002 mm sieve (%)
D50	Median particle size (millimeters)
Perrec_#	Percent recovery of Aroclor_# , where # = 1016, 1221, 1232, 1242, 1248, 1254, 1260 (%)
Perrec_decachlorobiphenyl	Percent recovery of decachlorobiphenyl (%)
Perrec_tetrachloro-m-xylene	Percent recovery of tetrachloro-m-xylene (%)
Qualifier_A1248	Data qualifier for Aroclor 1248 (J = estimated)

Comments:

(1) -999 indicates parameter not measured

(2) Negative numbers (other than -999) indicate the concentration was below the detection limit (DL), i.e. -1100 means the concentration was less than the DL of 1100 milligrams per kilogram)

Table B-12
Data Dictionary for fish_comm_ROPS

Data Table Description: Fish community data from near the proposed location for an ice control structure.

Field Name	***Description***
Survey	Survey period (pre-ROPS = prior to ROPS construction)
Year	Sample year
Month	Sample month
Day	Sample day
Sample_Method	Sampling method (electrofish = electrofishing unit used in near shore areas, net = gill net used in mid-river channel areas, trap = minnow trap used in mid-river channel areas)
Sampling_Area	Location where sample was collected (Upstream = upstream of proposed ICS; Downstream = downstream of proposed ICS; Control = upstream control location near Madrid, NY)
American eel *through* Yellow perch	Number of species identified
Tot_indiv	Total number of individuals identified

Comments:

(1) See 2004 ROPS Baseline Report for sampling locations.

(2) The proposed ice control structure site was to be located approximately 0.5 miles upstream of the Route 37 Bridge. However, due to community concerns related to the proposed siting of the structure, the ICS was not installed as planned as part of the ROPS.

Table B-13
Data Dictionary for resfish_aro

Data Table Description: 1991 RSI Phase I, 1993 RSI Phase II, 1995 Post-NTCRA, 1996-2005 TMS, and 1998-1999 YOY resident fish data (Aroclor)

Field Name	***Description***
Survey	Survey name (RSI Phase I and Phase II = River and Sediment Investigation Phase I and II, Post-NTCRA = Post-Non-Time-Critical Removal Action, TMS = Trend Monitoring Survey, YOY = Young-of-the-Year Monitoring Program)
Year	Sample year
Month	Sample month
Day	Sample day
Lab_id	Laboratory identification code
Sample_id	Sample identification code ("_YOY" indicates young-of-year fish)
Lab	Lab where samples were analyzed (EEASC = Ecology and Environment Analytical Services Center, EnChem, HES = Hazelton Environmental Services, NEA = Northeast Analytical, Inc.)
Species	Species being analyzed (BBUL = Brown Bullhead, PKSD = Pumpkinseed, SHIN = Spottail Shiner, SMBS = Smallmouth Bass)
Tissue	Fish portion being analyzed (CARC = carcass, FILL = fillet, VISC = viscera, WHOL = whole fish)
Location	Location (BACK = Background, DS-ENA = Further downstream of Outfall 001, ENA = Downstream of Outfall 001, GR_UT = Unnamed Tributary, LOWR = Lower Stretch, MIDL = Middle Stretch, MOUTH = River Mouth for spottail shiner or Mouth Stretch for smallmouth bass and brown bullhead, OF001 = Near Outfall 001, PC = Power Canal, UPPR = Upper Stretch, RCH# = Reach Number)
Northing	Estimated 1983 NY State Plane Northing (feet)
Easting	Estimated 1983 NY State Plane Easting (feet)
No_fish	Number of fish in composite
Min_length	Minimum length of fish (centimeters; applies to composite samples only)
Max_length	Maximum length of fish (centimeters; applies to composite samples only)

(continued)

Table B-13
Data Dictionary for resfish_aro
(continued)

Field Name	***Description***
Length	Length of fish (centimeters)
Tiss_weight	Weight of tissue analyzed (grams)
Tot_weight	Total weight of fish (grams)
Per_lip	Percent lipids (%)
Calib_corr	Calibration correction applied?
Bias_corr	Bias correction applied?
BZ_corr	BZ correction applied?
A_1216 *through* A_ 1260	Aroclor_# concentration, where # = 1216, 1221, 1232, 1242, 1248, 1254, 1260 (milligrams/kilogram wet weight)
Tot_PCB_aro	Aroclor total PCB concentration (milligrams/kilogram wet weight)
Col_type	Column type used for analysis (DB1_cap = capillary, PCK_col = packed column)
Per_rec	Laboratory spike percent recovery (%)

Comments:

(1) -999 indicates parameter not measured

(2) Negative numbers (other than -999) indicate the concentration was below the detection limit (DL), i.e. -124 means the concentration was less than the DL of 124 milligrams per kilogram wet-weight

Table B-14
Data Dictionary for sed_aro_ROPS

Data Table Description: 2003 PhaseII, January 2004, 2004 pre-ROPS, 2005 during and post ROPS sediment core data (Aroclor)

Field Name	***Description***
Survey	Survey name (PhaseII = Phase II, Jan2004 = January 2004, pre-/during-/post-ROPS = prior to/during/after ROPS construction)
Year	Sample year
Month	Sample month
Day	Sample day
Lab	Laboratory where samples were analyzed (MSS = Mass Spec Services (Cesium-137), NEA = Northeast Analytical, Inc. (Aroclor))
Lab_id	Laboratory identification number
Sample_id	Sample identification code
Type	Sample type (core, grab, or qaqc = quality assurance/quality control)
Rmile	River mile estimated from confluence of Grasse and St. Lawrence Rivers
Northing	1983 NY State Plane Northing (feet)
Easting	1983 NY State Plane Easting (feet)
Start_dep	Starting depth of sample
End_dep	Ending depth of sample
Dep_units	Units of depth of measured sample
A_1016 *through* A_1260	Aroclor_# concentration, where # = 1016, 1221, 1232, 1242, 1248, 1254, 1260 (milligrams/kilogram dry weight)
Tot_PCB_aro	Aroclor total PCB concentration (milligrams/kilogram dry weight)
TOC	Total organic carbon (milligram/kilogram dry weight)
Soil_type	Physical description of sediment sample
Per_solids	Percent solids (%)

(continued)

Table B-14
Data Dictionary for sed_aro_ROPS
(continued)

Field Name	***Description***
Cs_137	Cesium-137 (picoCurie/gram dry weight)
B_dens	Bulk density (grams/milliliter)
Per_moist	Percent moisture (%)
Location	Location of sample collection
DUP	Indication of whether sample is a field duplicate or not (DUP = yes, blank = no)
Per_rec	Laboratory spike percent recovery (%)
Hour	Time of sample collection
QUAL_PCB	Data qualifier (J = estimated)
Tetrachlor	Tetrachloro-meta-xylene concentration (milligrams/kilogram dry weight)

Comments:

(1) -999 indicates parameter not measured

(2) Negative numbers (other than -999) indicate the concentration was below the detection limit (DL), i.e. -124 means the concentration was less than the DL of 124 milligrams per kilogram dry-weight

(3) Only samples from 2003 Phase II and January 2004 within the ROPS area are included.

(4) See Appendix N for photographs and physical descriptions of cores collected prior to and during ROPS construction.

Table B-15
Data Dictionary for sed_char_ROPS

Data Table Description: 2003 PhaseII, January 2004, 2004 pre-ROPS, 2005 during and post ROPS sediment physical characterization data

Field Name	***Description***
Survey	Survey name (PhaseII = Phase II, Jan2004 = January 2004, pre-/during-/post-ROPS = prior to/during/after ROPS construction)
Year	Sample year
Month	Sample month
Day	Sample day
Lab	Laboratory where samples were analyzed (CDM = Camp, Dresser & McKee, Inc. for grain size)
Sample_ID	Sample identification code (cores & grabs)
Start_dep	Starting depth of sample
End_dep	Ending depth of sample
Units	Units of depth of measured sample
Per_pass_75mm	Percent of sample passing 75 mm sieve (%)
Per_pass_19mm	Percent of sample passing 19 mm sieve (%)
Per_pass_4pt75_mm	Percent of sample passing 4.75 mm sieve (%)
Per_pass_2pt00_mm	Percent of sample passing 2 mm sieve (%)
Per_pass_0pt85_mm	Percent of sample passing 0.85 mm sieve (%)
Per_pass_0pt425_mm	Percent of sample passing 0.425 mm sieve (%)
Per_pass_0pt15_mm	Percent of sample passing 0.15 mm sieve (%)
Per_pass_0pt075_mm	Percent of sample passing 0.075 mm sieve (%)
Per_pass_0pt002_mm	Percent of sample passing 0.002 mm sieve (%)
Location	Location of sample collection
DUP	Indication of whether sample is a field duplicate or not (DUP = yes, blank = no)

(continued)

Table B-15
Data Dictionary for sed_char_ROPS
(continued)

Field Name	***Description***
D50	Median particle size (millimeters)
Comments	Laboratory notes

Comments:
(1) -999 indicates parameter not measured
(2) Only samples from 2003 Phase II and January 2004 within the ROPS area are included.

Table B-16
Data Dictionary for sed_field_ROPS

Data Table Description: 2003 PhaseII, January 2004, 2004 Focused, 2004 pre-ROPS, 2005 during and post ROPS sediment core data (Aroclor)

Field Name	***Description***
Survey	Survey name (PhaseII = Phase II, Jan2004 = January 2004, Focused = Focused Studies, pre-/during-/post-ROPS = prior to/during/after ROPS construction)
Year	Sample year
Month	Sample month
Day	Sample day
Point_ID	Sample identification code (matches with "location" in sed_aro_ROPS and sed_char_ROPS)
Northing	1983 NY State Plane Northing (feet)
Easting	1983 NY State Plane Easting (feet)
Water_elev	Water elevation (feet)
Sed_elev	Sediment elevation (feet)
Water_dep	Depth of water (feet)
Sed_dep	Sediment probing depth (feet)
Penet_ft	Penetration depth (feet)
Recovery	Sediment recovered during coring (feet)
HB_elev	Hard bottom elevation based on probing depth (feet)
Core_type	Sample collection technique (manual = manual push cores, Vibracore = Vibracore)

Comments:
(1) -999 indicates parameter not measured
(2) Water and sediment elevations based on USLS 35

Table B-17
Data Dictionary for sed_probe_ROPS

Data Table Description: 2004 and 2005 ROPS sediment probing data

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Year	Sample year
Month	Sample month
Day	Sample day
Grid_ID	Sample identification code (matches with "location" in sed_aro_ROPS and sed_char_ROPS)
Northing	1983 NY State Plane Northing (feet)
Easting	1983 NY State Plane Easting (feet)
Water_elev	Water elevation (feet)
Sed_elev	Sediment elevation (feet)
Water_dep	Depth of water (feet)
Sed_dep	Sediment probing depth (feet)
HB_elev	Hard bottom elevation based on probing depth (feet)
Comments	Notes reported by field crew

Comments:
(1) -999 indicates parameter not measured
(2) Water and sediment elevations based on USLS 35

Table B-18
Data Dictionary for treated_effluent_discharge_flow_ROPS

Data Table Description: Flow data measured on the discharge line following final water treatment during 2005 ROPS effluent discharge monitoring

Field Name	***Description***
Start_date_time	Starting date and time for monitoring period
Avg_flow_gpm	Average flow during hour (gallons per minute)
Max_flow_gpm	Maximum flow during hour (gallons per minute)
Max_time	Time when maximum occurred (HH:MM:SS)
Vol_gal	Volume of water discharged (gallon)
Sample	Indication of approximately when grab or composite sample of effluent discharge taken (x = yes, blank = no sample); 4 sequential x's indicate that a 4-hour composite sample was taken; 1 x indicates a grab sample

Comments:
(1) See treated_effluent_discharge_lab_ROPS for results of effluent discharge sampling.

Table B-19
Data Dictionary for treated_effluent_discharge_lab_ROPS

Data Table Description: Field and laboratory results from samples taken during 2005 ROPS effluent discharge monitoring

Field Name	***Description***
Lab	Laboratory where samples were analyzed (Aquatec = Aquatic Biological Sciences, Inc.; ChemLab = Alcoa Massena ChemLab)
Lab_ID	Identification number assigned by the laboratory (ChemLab)
Sample_ID	Sample identification code
Collection_date	Sample collection date and time
Sample_type	Location of sample (INTERNAL = during process treatment; LAB = laboratory QA/QC sample, OUTFALL = after treatment)
QC_type	Type of sample (sample = field sample, blk = lab blank, lcs* = lab control sample, ms* = matrix spike, sd = matrix spike duplicate)
Parameter	Analyte or field parameter
Qualifier	Data qualifier (U = not detected)
Concentration	Result
Units	Units of result
Perrec_spike	Percent recovery of added spike (%)

Comments:
(1) See treated_effluent_discharge_flow_ROPS for results of discharge flow monitoring.
(2) -999 indicates parameter not measured/not reported by laboratory

Table B-20
Data Dictionary for veg_aquatic_ROPS

Data Table Description: Aquatic vegetation data from near the proposed location for an ice control structure and from near shore areas.

Field Name	***Description***
Survey	Survey period (pre-ROPS = prior to Remedial Options Pilot Study)
Year	Sample year
Month	Sample month
Day	Sample day
Sampling_Area	General area of sampling (near_ICS, near_shore)
Sample_ID	Location where sample was collected (US = upstream of proposed ICS; DS = downstream of proposed ICS; CON = control location near Madrid, NY; NB = northern bank/shoreline; SB = southern bank/shoreline)
Percent_Sed	Percentage of sediment (%)
Percent_Veg	Percentage of vegetation (%)
Veg_Width	Average width of vegetation (feet)
Wild celery *through* broad-leaved cattail	Percent Abundance of species identified (0 indicates no species found; '-5' = < 5% abundance)

Comments:

(1) See 2004 ROPS Baseline Report (Alcoa, April 2005) for sampling locations.

(2) The proposed ice control structure site was to be located approximately 0.5 miles upstream of the Route 37 Bridge. However, due to community concerns related to the proposed siting of the structure, the ICS was not installed as planned as part of the ROPS.

Table B-21
Data Dictionary for veg_floodplain_ROPS

Data Table Description: Floodplain vegetation data collected on September 7 and 8, 2004 near the proposed location for an ice control structure.

Field Name	***Description***
Survey	Survey period (pre-ROPS = prior to Remedial Options Pilot Study)
Forest_Cover	Type of forest cover (HERB = herbaceous, SHRB = shrubs, TREE = trees)
Common_Name	Common name of vegetation
TxPx	Transect number and plot (quadrant location along transect); Per = percentages of cover by individual species (%), count = number of stems of species)

Comments:
(1) 0 indicates 0% and a count of zero
(2) See 2004 ROPS Baseline Report (Alcoa, April 2005) for sampling locations.
(3) The proposed ice control structure site was to be located approximately 0.5 miles upstream of the Route 37 Bridge. However, due to community concerns related to the proposed siting of the structure, the ICS was not installed as planned as part of the ROPS.

Table B-22
Data Dictionary for water_aro_ROPS

Data Table Description: 2005 ROPS water column data analyzed for PCBs and TSS

Field Name	***Description***
Survey	ROPS survey (pre-ROPS = prior to ROPS construction, during-ROPS = during ROPS construction)
Lab	Laboratory where samples were analyzed (ChemLab = Alcoa Massena ChemLab)
Lab_ID	Laboratory identification number
Sample_ID	Sample identification code
QC_TYPE	Sample type (sample=unfiltered field sample, soluble_pcb=filtered field sample, ms1=matrix spike, sd1=matrix spike duplicate, blk=TSS blank, lcs*=laboratory control spike)
Collection_date _time	Sample collection date and time
A_1016 *through* A_1260	Aroclor_# concentration, where # = 1016, 1221, 1232, 1242, 1248, 1254, 1260 (micrograms/liter)
Total PCB	Aroclor total PCB concentration (micrograms/liter)
TSS	Total suspended solids (milligrams/liter)
TSS_dup_rec	Total suspended solids duplicate recovery (%)
TSS_rec	Total suspended solids recovery (%)
Location	Sample collection location
DUP	Indication of whether sample is a field duplicate or not (DUP = yes, blank = no)
QUAL_PCB	Data qualifier (J = estimated)
Decachlorobiph enyl	Decachlorobiphenyl concentration (micrograms/liter)
Tetrachloro-m-xylene	Tetrachloro-meta-xylene concentration (micrograms/liter)
Deca_perrec	Percent recovery of decachlorobiphenyl (%)
Tetra_perrec	Percent recovery of tetrachloro-m-xylene (%)

(continued)

Table B-22
Data Dictionary for water_aro_ROPS
(continued)

Field Name	***Description***
A1221_perrec *through* A1260_perrec	A# percent recovery, where # = 1221, 1242, 1248, 1254, 1260 (%)

Comments:

(1) -999 indicates parameter not measured

(2) Negative numbers (other than -999) indicate the concentration was below the detection limit (DL), i.e. -0.065 means the concentration was less than the DL of 0.065 micrograms per liter.

(3) Parentheses indicate depth at which sample was collected. If no depth is indicated, then sample is a composite of samples taken at 0.2, 0.5, and 0.8 the water column depth.

Table B-23
Data Dictionary for water_field_ROPS

Data Table Description: 2005 ROPS field water quality measurements made during water column sample collection

Field Name	***Description***
Survey	Survey name (pre-ROPS = prior to ROPS construction; during-ROPS = during ROPS construction; post-ROPS = after ROPS construction)
Year	Sample year
Month	Sample month
Day	Sample day
Samp_time	Time of sample collection
Location	Sample collection location
Wc_dep	Depth of water (feet)
Sample_dep	Depth of sample (feet)
Temp	Temperature (degrees Celsius)
PH	pH (standard units)
Cond	Specific conductivity (milliSiemens/centimeter)
Turb	Turbidity (nephelometric turbidity units)
DO	Dissolved Oxygen (milligrams/liter)
Weather	Description of weather during sampling.
Air_temp	Air temperature (degrees Celsius)
Construct_ activity	Description of daily construction activity
Comments	Field notes
Strat_present	Stratification indicator (No = no stratification recorded; Yes = stratification was present, numbers indicate depth(s) of sample composited for analysis)
DepFrac_ Collected	Water column depth fraction at which samples were collected for analysis
DUP_Collect Loc	Duplicate sample location

Comments:
(1) -999 indicates parameter not measured; N/A indicates parameter not applicable

Table B-24
Data Dictionary for water_turb_ROPS

Data Table Description: 2005 ROPS turbidity measurements during silt curtain anchor installation, scow transport out of the silt curtain area, and air curtain usage

Field Name	***Description***
Survey	Survey name (pre-ROPS = prior to ROPS construction; during-ROPS = during ROPS construction)
Year	Year of measurement
Month	Month of measurement
Day	Day of measurement
Time	Time of measurement
Location	Sample collection location
Loc_descrip	Additional description of sample collection location (Adj to Curtains = adjacent to silt curtains; D/S of Curtains = downstream of silt curtains; U/S of Curtains* = upstream of silt curtains; North Shore = northern bank/shoreline; Center Channel = center (1/2 the distance across river); South Shore = southern bank/shoreline)
Wc_dep	Depth of water (feet)
0.2Turb	Turbidity at the water column depth fraction of 0.2 (nephelometric turbidity units)
0.5Turb	Turbidity at the water column depth fraction of 0.5 (nephelometric turbidity units)
0.8Turb	Turbidity at the water column depth fraction of 0.8 (nephelometric turbidity units)
Comments	Field notes

Comments:
(1) -999 indicates parameter not measured

Appendix C

Table C-1
Appendix C - Environmental Health and Safety-Related Information
Table of Contents

Remedial Options Pilot Study Documentation Report
Grasse River Study Area, Massena, New York

Description	File Name
Alcoa Corporate Audit Report (Major and Minor Recommendations and Observations)	Alcoa Corporate Audit Report.pdf
Corrective Action Log	Correct Action Log.pdf
Example Activity Hazard Analysis (AHA) Form	Ex AHA.pdf
Example Allen Marine Services (AMS) Daily Dive Plan	Ex AMS Dive Plan.pdf
Example Job Hazard Analysis (JHA) Form	Ex JHA.pdf
Example Job Safety Analysis (JSA) Form	Ex JSA.pdf
Example Project Environmental, Health and Safety Reviews (PESHR)	Ex PEHSR.pdf
Example Release Response and Notification Form	Ex Release Resp+Notify Form.pdf
Example Safety and Health Evaluation of Outside Contractors and Subcontractors	Ex Safety+Health Eval.pdf
Example Self Scored Audit	Ex Self-Score Audit.pdf
Example Safety Log	Ex Sevenson Daily Safey Log.pdf
Example Safety Observation Report (SOR)	Ex SOR Form.pdf
Example Safe Standard Operation Procedure (SSOP)	Ex SSOP.pdf
Independent Audit (Steve Frost) Reports (Health and Safety Inspection of Grasse River Dredging Project and Review of Dredging Requirements and Agency Jurisdictions)	Independent Audit Reports - SFrost.pdf
Safety Observation Report (SOR) Cumulative Tracking Log	SOR Log.pdf
Vehicle/Pedestrian Separation Plan	Vehicle_Pedestrian Separation Plan.pdf

Note:
1. Appendix C contents listed in alphabetical order by file name.

ALCOA

Global Audit Team

Alcoa Audit Report

DATE REPORT ISSUED: [ ]

Grasse River Remediation Project

Alcoa Remediation Work Group

Massena, NY

Dates Audit Conducted: July 12 – 14, 2005

Date Responses Received: Type Date Here

In This Report:

Health & Safety
Environmental

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Major Recommendations .....#

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Executive Summary

BACKGROUND

The Grasse River is located in northern New York State and flows through the town of Massena before entering the St. Lawrence River. Since 1903, Alcoa has owned and operated a 2,700-acre aluminum smelting and fabricating facility situated at the confluence of the Massena Power Canal and the Grasse River. Historic disposal of production waste by-products into onsite landfills and lagoons, a practice that was common and widely accepted at the time, resulted in the release of Polychlorinated Biphenyls (PCBs) into the Grasse River. Cleanup activities at the Alcoa plant site, which were completed in 2001, have greatly reduced this source of PCBs to the river. Currently the river sediments, which were impacted by past discharges, are the primary source of PCBs to the fish. Due to elevated PCB levels observed in fish collected in the 7-mile section that runs from the Massena Power Canal to the St. Lawrence River, the New York State Department of Health has issued a fishing advisory that prohibits the eating of fish caught in this area. Alcoa has been working with the US Environmental Protection Agency (EPA), the New York State Department of Environmental Conservation, the St. Regis Mohawk Tribe and the local community to investigate the sources of the PCBs and to evaluate possible solutions for reducing these levels.

Alcoa is currently conducting a Remedial Options Pilot Study (ROPS) to further evaluate the potential remediation options to be considered for the lower Grasse River. The ROPS project involves dredging of contaminated sediments to sediment processing and water treatment systems constructed on the Alcoa Massena plant site, with final disposal in a secure landfill also constructed on plant site. Dredging activities began in June and are scheduled for completion in November.

The Grasse River remediation project is managed by the Alcoa Remediation Services employing three main contractors and numerous subcontractors. Approximately 86 contract employees are on site.

CONCLUSION

Business reviews were conducted for the Environmental and Health & Safety areas focusing on compliance with laws and regulations and applicable Alcoa requirements. A business review (BR) is limited in scope and therefore is not graded. Self assessments were not completed for the environmental audit. Applicable objectives in the Alcoa Self Assessment Tool (ASAT) for the purposes of the Health & Safety audit.

The Health and Safety business review was satisfactory with the facility receiving a rating of BR. Areas of risk include Contracted Services since the project is comprised largely of contract employees and fall protection. Some deficiencies were noted in the areas of Confined Space, Fall Protection and storage of Flammable Liquids. The Safe Observation Reports program was recognized as a best practice.

The Environmental business review was satisfactory with the facility receiving a rating of BR. Environmental risk at the location is considered moderate to high. Areas of risk include compliance with TSCA and CERCLA regulations. Deficiencies were noted around landfill security and equipment decontamination. The Grasse River web site is recognized as a best practice supporting community relations.

Global Audit Team

Executive Summary

Location: Type Location Name Here ***Business Unit: Type Business Unit Name Here***

SCORE

Health & Safety	Environmental
BR	BR

**BR = Business Review*
BP = Provisional Business Review

A definition of grading levels can be found by **pasting** the following URL into your browser and clicking on *Audit Grading Legend* under **FAQs – IAD**.

http://my.alcoa.com/portal/communities/community.asp?UserID=348415&CommunityID=354&CommPageID=-354&intCurrentPageIndex=0#

HEALTH & SAFETY CURRENT DATA (INFORMATION TO BE DEVELOPED BY H&S TEAM LEAD)

Lost Work Day Rate	2005 (Month)	2004	Total Recordable Rate	2005 (Month)	2004
Grasse River Contractors	0	0.60	Grasse River Contractors	2.15	4.18
RWG Average			RWG Average		
Alcoa Average		0.09	Alcoa Average		1.67

KEY FINDINGS OR RISKS

(NC-Noncompliance · PNC-Potential noncompliance · PP-Alcoa Policy and Procedure · LF-Location Focus)

Health & Safety

- (NC) The confined space entry program does not meet Alcoa or OSHA standards.
- (PP) The fall protection program does not meet Alcoa standards.
- (PP) Access to medical records is not properly controlled.
- (NC) Flammable storage practices require improvement.

Environmental

- (NC) Some documents have been submitted without proper signatory authority.
- (NC) Landfill security does not meet all regulatory requirements.
- (PNC) Decontamination procedures require improvement.

Minor Recommendations & Observations: There were **11** minor recommendations and observations. This information was provided to a location representative at the conclusion of the audit.

Executive Summary

Location: Type Location Name Here ***Business Unit: Type Business Unit Name Here***

Even though these findings are considered minor, the content is important and should be given due consideration.

BEST PRACTICE:

Health & Safety

- The Safety Observations Report (SOR) process is recognized as a best practice.

Environmental

- The Grasse River remediation team web site is recognized as a best practice in the area of community relations.

Executive Summary

Location: Type Location Name Here ***Business Unit: Type Business Unit Name Here***

HEALTH & SAFETY: (NC-Noncompliance, PNC-Potential noncompliance, PP-Alcoa Policy and Procedure, LF-Location Focus)

1. **The safety observations report (SOR) program is recognized as a Best Practice.** The Grasse River Remediation project is comprised largely of contractor's employees. At the suggestion of Alcoa, Sevensons Inc., has effectively implemented an observations program to proactively focus on injury-free events, identifying unsafe behaviors prior to injuries occurring. A rewards system is in place to encourage employee participation and suggestions are tracked to completion.

   Recommendation: Continue to implement the SOR program.

2. (NC) **The confined space entry program does not meet Alcoa or OSHA Standards.** The following deficiencies were observed:

   a) A hazard assessment has not been completed on all confined spaces to determine if spaces are permit required for entry.
   b) Numerous errors were noted on entry permits (54 errors on 34 permits). Some names on permits are unreadable.
   c) Training process for confined space entrants/attendants/supervisor is weak. Proficiency testing is not required.
   d) Detailed procedures for entry have not been developed.
   e) Detailed pre-rescue plans have not been developed. Rescue plan developed for carbon tanks specify using mobile crane to extract victim from space with load line. Existing procedures are not clear on rescue procedures.
   f) Alarms on atmospheric monitoring equipment are not set for Alcoa standards.

   Recommendation: Revise program to address all items identified. Use existing Massena forms and procedures in revisions.

   Response/Action Plan and Date:

   - Start typing action task #1 here starting with a bullet.
     Responsible: type name(s) Completion Date: Month/Year

   - Start typing action task #2 here starting with a bullet.
     Responsible: type name(s) Completion Date: Month/Year

3. (PP) **The fall protection program does not meet Alcoa standards.**

   a) Anchor points have not been "approved", may not meet 5,000 lbs requirement.
   b) Contractor does not have documented inspection program for fall protection equipment.
   c) No documented training for users of fall arrest equipment

d) Contractor using guard rail for tie-off on "frac" tank when guard rail section is removed for loading a pallet of material.
e) No documented "qualified person" on site for fall protection
f) Contractor not completing a fall control plan when utilizing fall arrest equipment

Recommendation:
a) Identify all anchor points and have Structural/Mechanical Engineer review for adequacy.
b) Implement documented inspection program for all fall protection equipment.
c) Implement documented training for all users of fall arrest equipment
d) Implement fall control plan for this task that meets all Alcoa and OSHA requirements.
e) Identify a "qualified" person for fall protection, ensure this person has the required qualifications (see AES 18.2.1)
f) Implement fall control plan for any task requiring fall arrest/restraint equipment.

Response/Action Plan and Date:

- Start typing action task #1 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

- Start typing action task #2 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

4. (PP) **Access to medical records for Alcoa personnel is not restricted to Licensed Health Care Providers (LHCP) or placed in secure storage.** Alcoa personnel are asked to complete a medical questionnaire that includes confidential medical questions. Information is not collected by LHCP or retained in a locked file.

   Recommendation: If it is necessary for Alcoa employees to complete this form, have information collected by LHCP and retained in secured medical files, or implement another method to ensure compliance with the requirement.

5. (NC) **Flammable liquid & gasses are not stored and handled according to Alcoa or OSHA standards.**
   a) Acetylene tanks are being stored on racks by oxygen tanks – tank buggy in oxygen storage area with acetylene container
   b) "No Smoking" signage missing in acetylene storage area
   c) Flammable cabinet with gasoline located by egress door to "Collins Hammond" office trailer

   Recommendation:
   Review storage practices for flammable liquids and gasses.

Executive Summary

Location: Type Location Name Here ***Business Unit: Type Business Unit Name Here***

Response/Action Plan and Date:

- Start typing action task #1 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

- Start typing action task #2 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

6. (NC) **The electrical safety program does not meet Alcoa or OSHA standards.**
   a) The contractor does not have a written "Assured Grounding Program" as required by OSHA Std. 1910.404(b)(iii).
   b) Two holes in side of electrical disconnect panel by office trailers, one covered with tape, one open.

Recommendation:
Review storage practices for flammable liquids and gasses.

Response/Action Plan and Date:

- Start typing action task #1 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

- Start typing action task #2 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

Major Recommendations

Location: Type Location Name Here ***Business Unit: Type Business Unit Name Here***

ENVIRONMENTAL: (NC-Noncompliance, PNC-Potential noncompliance, PP-Alcoa Policy and Procedure, LF-Location Focus)

1. (NC) **The facility has followed Alcoa's self reporting procedures for environmental incidents and identified the following issues which are listed in the Alcoa Corporate Compliance database**. The following information is a status update of those outstanding issues:

   a) Case # CRES000076 Monthly reports are required by the Grasse River historical consent order. Inconsistent submittals have occurred over time. After review of order and internal discussions corrective measures have resolved this issue. Reports are due by the 10th of each month.

   Status: All action items are complete. Reports are being submitted as required and a process has been developed and implemented to ensure future compliance.

   Recommendation: Close the case.

   b) Case # CRES000078 On June 8th a release to water of less than a 1/4 ounce of Mobil EAL 224H hydraulic oil (a vegitable oil based hydraulic fluid) producing a rainbow sheen was discovered in the Grasse River at a remediation dreding site down river of Massena West Outfall 001. The release from a Sevenson sediment dredge was the result of a pinhole leak in a hydraulic line. The release was totally contained and was absorbed by the oil absorbant booms. Due to the extremely small amount of oil released, the oil absorbant booms showed no signs of staining or discoloration and thus were allowed to remain in place attached to the dredge.

   Status: All action items have been complete. A robust process is in place to identify, notify, respond to, and report spill. The case should remain closed.

   Recommendation: All action items are complete. No further actions are required.

2. **The Grasse River remediation community relations program is recognized as a best practice.** Paragraph 111 of the EPA Administrative Order requires Alcoa to provide information relating to the project to the public. A key element of the program is the Grasse River Project web site www.thegrasseriver.com which provides a comprehensive, detailed means of providing up to date project information to stakeholders and the community at large. The web site is an effective means of providing information including a description of the project, current project status, progress reports, planned activities, frequently asked questions, community advisory panel meeting minutes, public presentations, and project contacts. In addition, observation platforms have been constructed at key points of interest to provide safe access to parties interested in observing the operations. These efforts have helped build an atmosphere of trust within the community and the stakeholders.

   Recommendation: Continue to maintain the web site.

3. (NC) **Some documents have been submitted to the EPA without proper signatory authority.** Section 89 of the Administrative Order requires that all reports and other documents submitted to

EPA (excluding monthly progress reports) be signed by a responsible corporate officer. Documents such as work plans, notices and other project reports may not have been signed by an employee with proper signatory authority.

Recommendation: Review the signatory requirements for submitting reports and documents. Ensure that proper signatory authority is in place for the person signing documents.

Response/Action Plan and Date:

- Start typing action task #1 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

- Start typing action task #2 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

4. (NC) **Landfill security does not meet the requirements of Section 4.16 of the multiple Agency approved Secure Landfill Operations and Maintenance Manual.** The Secure Landfill Operations and Maintenance Manual requires that a six-foot high fence be installed on the perimeter of the landfill and have durable warning signs placed every 300 feet along the fence. These signs must read "Danger Unauthorized Personnel Keep Out," in both English and French and have a PCB ML Mark. It is understood that this fence was once in place but subsequently removed and is not currently in place.

Recommendation: Re-install fence and signage or obtain alternative approval from the various Agencies.

Response/Action Plan and Date:

- Start typing action task #1 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

- Start typing action task #2 here starting with a bullet.
  Responsible: type name(s) Completion Date: Month/Year

5. (PNC) **Subcontractor, Blasland, Bouck, and Lee (BB&L), may not be decontaminating sampling equipment in accordance with TSCA PCB decontamination standards and procedures.** BB&L performs decontamination of sampling equipment, but the procedure for sampling sediments does not specify compliance with any of the following decontamination procedures for sampling equipment 40CFR761.79:

   a) Swabbing surfaces that have contacted PCBs with a solvent;
   b) A double wash/rinse as defined in subpart S of 40CFR761; or
   c) Another applicable decontamination procedure in this 40CFR761.79.

Executive Summary

Location: Type Location Name Here ***Business Unit: Type Business Unit Name Here***

Recommendation: Determine if the decontamination procedure was approved as part of the amended administrative order. If it was not approved the decontamination procedure and practice must be modified to meet one of the three decontamination procedures identified above.

Audit Information

AUDIT TEAM
Overall Team Leader:
Hollis R. Collier

Manager(s):
Laurie M. Shelby

HEALTH & SAFETY
Team Members:
Roland S. Simons
Richard H. Perry

ENVIRONMENTAL
Team Members:
Hollis R. Collier - Team Leader
Richard M. Tomicek
Christopher D. Powell

AUDITEE INSTRUCTIONS:

Response Date Due: **July 24, 2005**

All Audit responses are due 10 calendar days from the closeout meeting.

Distribution

To: *Please use complete and full name for all recipients*
Kevin McKnight – New York
Robert S. Bear- Pittsburgh
Kirk Gribben - Pittsburgh
Larry McShea - Pittsburgh
Robyn Gross – Pittsburgh
Bruce G. Cook – Massena

cc: Julie A. Caponi - Pittsburgh
Randall J. Killeen – Pittsburgh
Scot M. Anderson - Massena
Patrick R. Atkins - New York
Robert S. Bear – Pittsburgh
Karl M. Butz - Massena
Kevin A. Carter – Pittsburgh
Paul S. Catanzarite - Massena
Janet F. Duderstadt - Pittsburgh
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Peggy Novacky - Pittsburgh
Lawrence R. Purtell - New York
Haig G. Sakoian - Pittsburgh
Jake Siewert – New York
Robert A. Slack – Pittsburgh
Jeffery R. Stenlake - Massena
James C. Wesdock - Richmond
Rick Williams - New York
Environmental Compliance Group

ALCOA

Global Audit Team

Alcoa Audit Report

Minor Recommendations & Observations

DATE REPORT ISSUED: JULY 14, 2005

Grasse River Remediation Project

Remediation Work Group

Massena, New York

Dates Audit Conducted: July 12 – 14, 2005

In This Report:

Health & Safety
Environmental

Minor Recommendations & Observations

HEALTH & SAFETY:

1. **Material Safety Data Sheets were missing for two products used at the BBL storage shed.** MSDSs were not on file for spray paint and sulfuric acid in rechargeable batteries. **Recommendation**: Review products used on site and ensure MSDSs are available.

2. **Some respirators were not being properly stored in the decontamination room**. Six North respirators were observed stored on hooks and were exposed to airborne contaminants. One respirator was found improperly cleaned and improperly stored. **Recommendation**: Implement a process to ensure respirators are properly cleaned and stored.

3. **One mobile equipment operator was observed with an improperly adjusted seat belt.** The seat belt was fastened but adjusted out to the full length of the belt rendering the device ineffective. The operator was instructed on proper seat belt use, however, the same operator was observed the following day with an improperly adjusted seat belt. **Recommendation:** Implement a process to ensure that operators wear seat belts correctly.

4. **Mobile equipment pre-use checklist does not highlight essential safety items. Recommendation**: Revise pre-use inspection form to highlight essential safety items.

5. **Contractor's Lock out program does not address type of locks or tags used in the lockout program. Recommendation:** Revise written program to address all items required by Alcoa ASAT 5.6.

6. **One conveyor belt observed not equipped with an emergency stop cord. Recommendation:** Install emergency stop cord as required.

7. **Contractor reports removing a lock-out lock (7/13) without completing a "Lock Removal Form". Recommendation:** Review the lock removal procedure with contractor, Lock Removal Form "drives" lock removal process.

ENVIRONMENTAL:

1. **Proper preservation of wastewater samples cannot be verified at the automatic samplers.** The automatic samplers are controlled by a manual temperature adjustment which may not keep samples at 4 degrees Celsius as required by the Administrative Order. There is no method to verify the temperature in the samplers during collection. **Recommendation**: Place sampler thermometers in each automatic sampler so that proper sample preservation can be verified.

2. **Subcontractor, Blasland, Bouck, and Lee (BB&L), is storing Used Oil in unlabeled containers.** Used oil regulations require containers be labeled as "Used Oil." The used oil is being generated and managed by BB&L and therefore this is not a noncompliance for Massena RWG. **Recommendation:** Have BB&L label the container or take ownership of the waste and manage in accordance with used oil regulations.

Minor Observations & Recommendations

Location: Type Location Name Here **Business Unit: Type Business Unit Name Here**

3. **Alcoa Policy - TSCA PCB training incomplete.** TSCA training content was reviewed and it was determined that the content does not include the right of refusal to work for women of child bearing age as required by Alcoa's PCB Standard. **Recommendation:** Modify training content and provide revised training to any women currently working on-site.

4. **Lead acid battery storage is deficient.** Batteries are being stored/charged on the ground and on a pallet with no secondary containment provided, no spill clean-up materials were identified in the area, and the eye wash station was located approximately 20 feet from its designated location. **Recommendation:** Provide secondary containment for the lead acid battery storage area, provide appropriate spill clean-up materials and equipment, and place eye was station back in its designated area.

Alcoa Inc. Remedial Options Pilot Study (ROPS) Project
Corrective Actions Follow-up List
Inspections - Audits - Incidents - Injuries

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0001	05/18/05	Worker injured while utilizing a bottle cart on gravel.	1. Larger tires for bottle carts on process pad. 2. Two workers to move bottle carts. 3. Use equipment whenever possible to move bottle carts. 4. Identify and paint with orange spray paint trip hazards on process pad.	S. Allaire	05/20/05	05/20/05
0002	06/06/05	Worker installing a coupler injured finger requiring an amputation	1. Procedure is designated as a two worker operation 2. Place cribbing beneath position were coupler is to be placed 3. Coupling is lifted into position by both workers 4. Once in place one worker will hold coupler while other attaches bolts 5. Once bolt up is complete, workers will remove cribbing	S. Allaire	06/08/05	06/08/05
0003	06/30/05	30 amp electrical box on generator #1 needs to be placed on post.	Erik Rhoades and Nate Romeo to correct problem on 6/30/05	R. Kuhn	06/30/05	06/30/05
0004	06/30/05	Worker fell in boat and fractured hand	1. Weld stairs to dock and barges to allow better access from boat to work area (stairs onsite, target of Saturday 7/23 for installation) 2. Increase housekeeping on boats and barges 3. Workers to watch footing and take their time 4. Looking into lighter boots for the dredging operation	S. Allaire	07/23/05	07/23/05
0005	07/06/05	Improper lifting technique identified with BBL LPO Program	Reviewed proper lifting techniques with employee. Documented corrective action on BBL LPO form	R. Kuhn	07/06/05	07/06/05
0006	07/06/05	Identified the need for an additional flammable cabinet using Alcoa Weekly Scored Observation Report	Ordered additional cabinet. Will be on-site Monday, July 11th.	R. Kuhn	07/11/05	07/11/05
0007	07/06/05	No daily log (sign in/sign out) sheet at BBL trailer	Daily log to be maintained at BBL field trailer	R. Kuhn	07/11/05	07/11/05
0008	07/06/05	Weekly inspections of first aid kits not being performed as identified by BBL internal safety audit.	Weekly inspections of first aid kits added to weekly housekeeping list.	R. Kuhn	07/11/05	07/11/05
0009	07/06/05	BBL morning safety meetings identified as being routine by BBL internal safety audit.	Additional topics to be introduced at daily safety meetings. Using internet for options.	R. Kuhn	07/12/05	07/12/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0010	07/06/05	Float plan should have the day listed on the form	Date will be listed when the form is completed in the future.	R. Kuhn	07/11/05	07/12/05
0011	07/06/05	Sarah Hill's name should be removed from float plan as an emergency contact and replaced with Ron Kuhn	Sarah Hills name replaced with Ron Kuhn	R. Kuhn	07/11/05	07/11/05
0012	07/06/05	BBL Health and Safety Inspection Form is not being conducted weekly per HASP	Weekly Alcoa Scored Observation Report very similar to BBL H&S Inspection Form, will complete BBL H&S Inspection Form on a monthly basis.	R. Kuhn	07/11/05	07/11/05
0013	07/06/05	Near misses are being reported via the Sevenson Safety Observation Form	Future BBL specific forms will be sent to Chuck Webster for inclusion into the BBL LPS Database or those events will be called into the BBL Near-Miss Reporting hotline	R. Kuhn	07/11/05	07/14/05
0014	07/06/05	BBL LPO forms not being completed electronically	Copies will be brought to Chuck Webster for inclusion into BBL's database	R. Kuhn	07/11/05	07/14/05
0015	07/06/05	Site emergency plan needs to be developed and distributed/discussed among employees	Terry Lamar (CDM) working on development	T. LaParr	07/11/05	07/08/05
0016	07/06/05	GFCI's not currently being used on 30amp circuits on air monitoring generators	Chuck Webster to consult with Mike Currie (BBL electrical engineer)	C. Webster	07/15/05	07/19/05
0017	07/19/05	H&S 2a. A hazard assessment has not been completed on all confined spaces to determine if spaces are permit required for entry.	Scott Anderson is an Alcoa resource for SES. SES to revise program to address an assessment of Confined Space status, permit required non-permit required, identify and classify. SES to retrain all employees on revisions to plan.	S. Allaire	08/31/05	08/31/05
0018	07/19/05	H&S 2b. Numerous errors were noted on entry permits (54 errors on 34 permits). Some names on permits are unreadable.	SES to retrain Site Safety Officer on Alcoa permit requirements, clarity and consistency.	S. Allaire	07/18/05	07/25/05
0019	07/19/05	H&S 2c. Training process for confined space entrants/attendants/supervisor is weak. Proficiency testing is not required.	Review procedures with employees and specify the importance of signatures on permits, and consistency.	S. Allaire	07/25/05	07/20/05
0020	07/19/05	H&S 2d. Detailed procedures for entry have not been developed.	SPA has been reviewed prior to all entries	S.Allaire	07/25/05	07/20/05
0021	07/19/05	H&S 2e. Detailed pre-rescue plans have not been developed. Rescue plan developed for carbon tanks specify using mobile crane to extract victim from space with load line. Existing procedures are not clear on rescue procedures.	Rescue plan will be part of the Confined Space Entry permit.	S.Allaire	08/26/05	08/31/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0022	07/19/05	H&S 2f. Alarms on atmospheric monitoring equipment are not set for Alcoa standards.	Researched Alcoa alarm limits for monitoring equipment and reset low alarm level for Co to 25ppm	S.Allaire	0720/05	07/20/05
0023	07/19/05	H&S 3. The fall protection program does not meet Alcoa standards.	Identified access areas and location points. Fall protection equipment onsite, waiting on welding to be completed.	R. Richardson	09/16/05	09/15/05
0024	07/19/05	H&S 4. Access to medical records for Alcoa personnel is not restricted to licensed Health Care Providers (LHCP) or placed in secure storage	Robyn Gross to provide requirements. SES to implement agreed to action.	R. Gross	08/31/05	08/31/05
0025	07/19/05	H&S 5a. Acetylene tanks are being stored on racks by oxygen tanks - tank buggy in oxygen storage area with acetylene container.	Sevenson contacted HAUN welding supply and ordered plate steel to weld in place on carts.	S. Allaire	07/20/05	07/19/05
0026	07/19/05	H&S 5b. "No Smoking" signage missing in acetylene storage area.	SES to review storage practices for flammable liquids and gasses and place proper signage.	S. Allaire	07/20/05	07/20/05
0027	07/19/05	H&S 5c. Flammable cabinet with gasoline located by egress door to "Collins Hammond" office trailer.	Collins-Hammond to review storage practices for flammable liquids and gasses and place cabinet accordingly.	M. Frary	07/22/05	07/19/05
0028	07/19/05	H&S 6a. The contractor does not have a written "Assured Grounding Program" as required by OSHA Std. 1910.404(b)(iii).	Scott Anderson found documentation of exemption.	P. Hitcho	07/27/05	07/22/05
0029	07/19/05	H&S 6b. Two holes in side of a electrical disconnect panel by office trailers, one covered with tape, one open.	Collins-Hammond to provide proper electrical plugs.	M. Frary	07/28/05	07/28/05
0030	07/19/05	E4. Landfill security does not meet the requirements of Section 4.16 of the multiple Agency approved Secure Landfill Operations and Maintenance Manual.	Pursue a NYSDEC submittal by CDM Mike Schultz. A document stating how current perimeter fencing meets requirements currently. Agree to post signage at the site.	B. Cook M. Schultz	12/02/05	12/09/05
0031	07/19/05	E5. Subcontractor, Blasland, Bouck, and Lee (BB&L) may not be decontaminating sampling equipment in accordance with TSCA PCB decontamination standards and procedures.	To resolve this item, from this point forward, BBL will store all equipment used to collect these samples (i.e., shovels and 5-gallon pails) in the exclusion zone with proper labels throughout the project duration. Once the project is complete, this equipment will be placed in a red Alcoa drum for proper disposal	R. Kuhn	07/27/05	07/25/05
0032	07/19/05	MO H&S1. Material safety data sheets were missing for two products used at the BBL storage shed. MSDSs were not on file for spray paint and sulfuric acid in rechargeable batteries.	BB&L to review products used onsite and ensure MSDSs are available. Item identified during audit on 7/14 and corrected immediately.	R. Kuhn	07/14/05	07/14/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0033	07/19/05	MO H&S2. Some respirators were not being properly stored in the decontamination room. Six north respirators were observed stored on hooks and were exposed to airborne contaminants. One respirator was found improperly cleaned and improperly stored.	SES instructed all workers in proper care of respirators at safety meeting. All required cleaning equipment has been supplied, along with proper bags for storage. A laminated copy of SES and OSHA respiratory care has been hung in the CRZ.	S. Allaire	07/14/05	07/20/05
0034	07/19/05	MO H&S3. One mobile equipment operator was observed with an improperly adjusted seat belt. The seat belt was fastened but adjusted out to the full length of the belt rendering the device ineffective. The operator was instructed on proper seat belt use, however, the same operator was observed the following day with an improperly adjusted seat belt.	Sevenson discussed incident with operator and entire crew at safety meetings. Workers were instructed to were there seat belts properly.	S. Allaire	07/15/05	07/20/05
0035	07/19/05	MO H&S4. Mobile equipment pre-use checklist does not highlight essential safety items.	To be evaluated	P. Hitcho S. Allaire	08/01/05	07/22/05
0036	07/19/05	MO H&S5. Contractor's Lock Out program does not address type of locks or tags used in the lockout program.	Sevenson will update the HASP with the lock details.	P. Hitcho	07/27/05	07/27/05
0037	07/19/05	MO H&S 6. One conveyor belt observed not equipped with an emergency stop cord.	Install emergency stop cord as required. Evaluate 7' option of rule. Sevenson installed guarding around the conveyor.	S. Allaire	07/28/05	07/27/05
0038	07/19/05	MO H&S 7. Contractor reports removing a lock-out lock (7/13) without completing a "Lock Removal Form"	SES is utilizing Alcoa's form.	S. Allaire	07/20/05	07/20/05
0039	07/19/05	MO E1. Proper preservation of wastewater samples cannot be verified at the automatic samplers.	A fridge thermometer was installed to monitor temperature of samples.	D. Etkin	07/15/05	07/14/05
0040	07/19/05	MO E2. Subcontractor, Blasland, Bouck, and Lee (BB&L) is storing Used Oil in unlabeled containers.	Label the container or continue to manage waste in accordance with used oil regulations.	R. Kuhn	07/20/05	07/20/05
0041	07/19/05	MO E3. Alcoa Policy - TSCA PCB training incomplete. TSCA training content was reviewed and it was determined that the content does not include the right of refusal to work for women of child bearing age as required by Alcoa's PCB Standard.	Modify training content and provide revised training to any women currently working onsite.	B. Moon	08/05/05	08/05/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0042	07/19/05	MO E4. Lead acid battery storage is deficient. Batteries are being stored/charged on the ground and on a pallet with no secondary containment provided, no spill clean-up materials were identified in the area, and the eye wash station was located approximately 20 feet from its designated location.	Sevenson has placed secondary containment at battery charging station. Eye wash was moved at the request of CDM and new signage was hung. Spill kit (properly Labeled) was located within fifty feet of area. Discussed moving charging station but due to electrical source we determined it best to leave it as is.	S.Allaire	07/18/05	07/20/05
0043	08/03/05	Batteries on pallet at processing pad had no 2nd containment or signs on eyewash.	Batteries have been taken offsite. Signs up.	K. Thibodeaux	08/26/05	08/18/05
0044	08/03/05	Mobile equipment operator left forks up and lifted pallet by one fork.	Spoke with operator and reviewed equipment procedures.	S. Allaire	08/04/05	08/04/05
0045	08/03/05	Cell 3 debris left behind by contractors needs to be removed/picked up.	Direct S&L and Perras to clean up this area that they left behind.	B. Moon	08/31/05	08/31/05
0046	08/03/05	Cell 3. Hose on fuel tank needs to be longer to avoid outside spillage of diesel .	SES corrected hose length.	S. Allaire	08/10/05	08/10/05
0047	08/03/05	River Area. A bottle of rubbing alcohol was in a Konex box instead of a flammable cabinet.	Rubbing alcohol moved to proper cabinet.	T. LaParr	08/04/05	08/04/05
0048	08/03/05	River Area - stakes for snow fence on loading dock is missing rebar caps	Rebar caps were added to stakes.	M. Schade	08/06/05	08/06/05
0049	08/03/05	River area - some standing water in fuel containment area.	Vac truck has been scheduled for visual inspections and removal if necessary.	M. Elia	08/04/05	08/04/05
0050	08/04/05	Welding unit dropped in river. Two employees were lifting a gas powered Miller welding machine from a boat to a barge, inside the work zone of the remediation work on the Grasse River. Boat shifted and welder was dropped into water.	Speak to all workers, make sure they understand all the procedures being read at safety meetings. Corrective actions included review of the following: lifting limits, emergency notification, right to stop work, and working safely over quickly.	S. Allaire	08/17/05	08/17/05
0051	08/09/05	Spill- Dirt haul road going to the 001 outfall. SES trailer carrying the gear housing of a crane spilled oil on a hard dirt surface road.	Spoke with workers about inspecting equipment prior to use and restricting sub-contractors access to site without SES supervision.	K. Thibodeaux	08/12/05	08/10/05
0052	08/11/05	Spill- Air monitoring location #2. Oil spill from a generator.	Double check oil filter installation for single gasket on future changes. Review incident at Tailgate Safety meeting and inform employees of double gasket potential.	R. Kuhn	08/12/05	08/17005
0053	08/15/05	Spill- from hydraulic line break on fast feed pump.	Continue to inspect equipment and hoses prior to use and during operations. Report any deficiencies to Superintendent.	K. Thibodeaux	08/17/05	08/17/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0054	08/16/05	Boat capsized. Auger dropped into water, worker dropped into water. Direct causes of incident were poor planning, overloading boat by 470lbs, workers did not evaluate situation to determine that the boat was overloaded, auger was not secured in boat causing the boat to list when the auger shifted.	SES writing plan for procedure. Form will be in place for operator to complete and sign before moving any equipment. SES, ARP, and Alcoa working in conjunction to be proactive to prevent future incidents.	K. Thibodeaux	08/31/05	08/31/05
0055	08/17/05	Spill- Subcontractor truck left idling leaked diesel fuel.	Pre inspection of all vehicles now done by Gate 4 guards who complete Offsite Truck Inspection form which will stay on file.	B. Moon	08/17/05	08/23/05
0056	09/01/05	Exclusion Zone on landfill has no sign in / sign out sheet.	Sign in / sign out sheet has been posted.	P. Boland	09/09/05	09/01/05
0057	09/01/05	Break areas should be cleaned daily or more than once a week.	Workers have been assigned to perform daily clean up every other day.	P. Boland	09/09/05	09/06/05
0058	09/01/05	The orange fence on the north end of the perimeter needs to be repaired.	Repairs to fence complete.	L. Williams	09/09/05	09/01/05
0059	09/01/05	Housekeeping issue: V sander shovel against electrical box, debris on walkway	Debris was cleaned up; communications w/workers regarding hazards of leaving items near electrical box	L. Williams	09/09/05	09/01/05
0060	09/01/05	High voltage signs on presses need to be replaced for work zones.	Replacement of signs complete.	L. Williams	09/09/05	09/02/05
0061	09/01/05	The yellow extension cord near Calgon tank needs to be re-routed.	Cord was re-routed to higher elevation so as not to cause tripping hazard.	L. Williams P. Boland	09/09/05	09/01/05
0062	09/01/05	Hazard stickers on gas cans need to be replaced.	Stickers have been replaced.	P. Boland L. Williams	09/09/05	09/01/05
0063	09/01/05	Signs hanging on gate at dock area not properly adjusted so that signs are visible.	Daily inspection of gate and adjust as necessary so that signage is visible.	M. Elia	09/16/05	09/09/05
0064	09/08/05	Fall protection for barges.	Installation of anchors at two points at end of barge, along with 5/16 air craft cable, with two clamps per eye with 3/8" shackle across a 25 foot span from end to end. Welded to 3/8" steel 2"x2"x 3/8" angle bars as support. Total fall protection with harness and double lanyard.	P. Boland	09/16/05	09/09/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0065	09/08/05	Lift gate requirements for mix tank on pad.	Approval letter from CDM (Chandrakant) and Alcoa (Greg Rutherford) on file w/SES.	R. Richardson	09/16/05	09/14/05
0066	09/15/05	PPE requirement for North nearshore capping.	Written plan for PPE requirement. Letter distributed site-wide, barge SPA current w/SES.	P. Boland	09/16/05	09/16/05
0067	09/15/05	PPE requirement for armored capping.	Written plan for PPE requirement and submitted to site team members.	B. Moon	09/23/05	09/22/05
0068	09/15/05	Review of ideas on better managing work hours/shifts/extended time to reduce safety hazards.	SES to list possible over-working solutions to avoid extended work hours. On-going reduction in work hours; maintenance on Friday afternoon shift, max Saturday shift - 4 hours.	M. Mahar	09/30/05	09/26/05
0069	09/15/05	Review of ideas on better managing work hours/shifts/extended time to reduce safety hazards.	BBL is implementing a rotating type scheduling so that no one is being over extended. On-going communications w/workers will continue.	Ron Kuhn	09/22/05	09/22/05
0070	09/15/05	PEHSR Geotubes: 5b. Fall Prevention. All working surfaces with fall potential protected with guardrails, gates and ladders consistent with AES 33.013.	SES placed a wingged type 6' step ladder for access to top of filled Geotubes.	B. Moon P. Boland G. Rutherford	09/30/05	09/29/05
0071	09/15/05	PEHSR Geotubes: 17h. Environmental. Install or reusing existing tanks.	Poly Tank installed (9/2/05) and inspected.	P. Boland	09/12/05	09/10/05
0072	09/15/05	PEHSR Geotubes: 19b. Training. SOP/JSA written/modified and employees trained.	SSOP for gesture operation needs to be generated and employees trained.	S. Allaire	09/12/05	09/08/05
0073	09/15/05	PESHR Geotubes: 21e. Piping protected and appropriately and labeled.	Use paint markers to label piping.	P. Boland	09/12/05	09/12/05
0074	09/15/05	Fall prevention recommendation from Steve Frost (verbal)	Use of walkway from docks to barges.	P. Boland	09/15/05	09/10/05
0075	09/15/05	Fall prevention recommendation from Steve Frost (verbal)	Install and implement fall prevention plan on barges.	P. Boland	09/15/05	09/09/05
0076	09/15/05	Fall prevention recommendation from Steve Frost (verbal)	Fabricate and install fixed ladders on clean material barges.	M. Elia	09/22/05	09/20/05
0077	09/15/05	Geotubes: over pumping of Geotubes can cause tube to burst.	Visual measurement (line installed) at 5 1/2 ft so as not to exceed the 6 ft limit.	L. Williams	09/12/05	09/10/05
0078	09/15/05	Employee injury (broken ankle) climbing down ladder of mix tank.	Platform installed.	P. Boland	09/10/05	09/09/05
0079	09/15/05	Employee injury (broken ankle) climbing down ladder of mix tank.	Sitewide audit for slip/trip/falls.	B. Moon P. Boland G. Rutherford	09/29/05	09/22/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0080	09/15/05	Employee injury (broken ankle) climbing down ladder of mix tank.	Ladder has arrived onsite and is currently awaiting inspection before use. Inspection complete.	R. Richardson P. Boland G. Rutherford	10/06/05	09/30/05
0081	09/15/05	Employee injury (broken ankle) climbing down ladder of mix tank. Evaluate the ROPS project boots.	A number of different boots were evaluated, the recommendation was to not make a boot change.	S. Allaire	10/28/05	10/27/05
0082	09/16/05	Steve Frost recommendation: (written) Fixed ladders	Fixed ladders should be installed on the sides of the hopper barges to allow the tug crews access to the barges without having to use extension ladders.	B. Moon	SEE #076	09/19/05
0083	09/16/05	Steve Frost recommendation: (written) Fall protection	Federal OSHA requires that fall protection be used when there is a possibility of falling six feet or more to the lower deck of a dock or vessel moored to a barge.	B. Moon	SEE #064	09/09/05
0084	09/16/05	Steve Frost recommendation: (written) Stability of excavator barges	US Army Corps of Engineers recommends that floating crane platforms not list more than 5 degrees.	P. Boland G. Rutherford	Not applicable to existing and present operations @ the ROPS site	
0085	09/16/05	Steve Frost recommendation: (written) Stability of excavator barges	Verify that excavators are securely latched to the barges.	B. Moon P. Boland G. Rutherford	Not applicable to existing and present operations @ the ROPS site	
0086	09/16/05	Steve Frost recommendation: (written) Heat stress hazard	When there is no reasonable possibility of coming in contact with contaminated sediments the use of protective clothing is not necessary.	B. Moon P. Boland G. Rutherford	SEE #67	09/22/05
0087	09/16/05	Steve Frost recommendation: (written) Onsite accidents POR: "Systematic Cause Analysis Technique" by the DNV Foundation	In order to determine if there are systematic failures in the loss control program it is important that ALL basic causes for an incident be identified.	B. Moon	09/23/05	09/20/05
0088	09/29/05	Cold weather issues for ROPS project workers on river, processing pad, and SLF.	Safety professionals to complete a sitewide safety audit (worker perspective) to capture list of items necessary to "winterize" ROPS. Audit complete - some items already on order.	B. Moon S. Allaire R. Kuhn	10/14/05	10/13/05
0089	10/13/05	Cutterhead dredge	SSOP needs to be written for maintenance on new dredge (suspended loads).	K. Thibodeaux	10/21/05	10/13/05

ID	Date		Corrective Action Taken	SPA	Target Date	Date Completed
0090	10/13/05	SES and BBL want to move one of their air monitors at the SLF due to safety concerns/weather issues.	ECN submitted and approved.	Ron Kuhn	10/28/05	10/26/05
0091	10/13/05	Schedule vs. inclimate weather regarding river activities	Investigate what activities will be occuring that may be able to be done "sooner than later" in order to minimize water/exposure (ie: divers/anchors)	T. LaParr S. Allaire K. Thibodeau	10/21/05	10/20/05

ACTIVITY HAZARD ANALYSIS		
Project Identification: Grasse River Site	Location: Massena, NY	
Activity/Phase of Work: Operation of Hydraulic Dredging System	Analysis Performed By: Date: Mark Nicklas (Signature)	Analysis Reviewed By: Date: Paul Hitcho (Signature)

Tasks	Potential Hazards	Control Measures
Start up and Shut down of Hydraulic Dredge 1) Boarding Dredge 2) Starting the diesel engine 3) Engaging the auger 4) Starting the booster pumps	Slip/Trip/Fall	▪ Work Areas and means of access shall be maintained safe and orderly. ▪ Tripping and poor footing hazards will be repaired as they are discovered or clearly identified. ▪ Boats, barge & dredge will be properly secured before personnel attempt boarding
	Inclement Weather	▪ Personnel will be instructed in heat stress/cold stress recognition and prevention. ▪ Personnel must notify the SHSO if symptoms of cold/heat stress are perceived in any member of the crew, including self. ▪ Cold/Heat stress management will be conducted in accordance with Sevenson Cold/Heat stress program (Temperature Extremes). ▪ Work/rest regimes and personnel monitoring for workers will be instituted per the SHSO based on ambient conditions and condition of personnel. ▪ Air temperature, humidity and wind will be monitored; controls will be implemented per ACGIH guidelines as necessary. ▪ Drinking liquids will be available and used for rehydration during breaks. ▪ Work will be conducted during warmer/cooler hours of the day, if necessary and feasible.
	Back Injuries	▪ Site personnel will be instructed in and use proper lifting techniques including stretching prior to lifting. ▪ Mechanical devices will be utilized when possible to reduce manual handling of materials. ▪ Team lifting will be used when mechanical devices are not appropriate for use. ▪ Proper paths of travel will be noted and followed during manual material handling.
	Dropped Objects	▪ Steel toe boots meeting ANSI Standard Z-41 will be worn. ▪ All personnel in the work area will wear hard hats meeting ANSI Standard Z-89. ▪ Personnel will not climb ladders while carrying equipment in hand.
	Overhead Hazards	▪ All overhead hazards will be identified prior to commencing work operations. ▪ Personnel will wear hard hats that meet ANSI Standard Z-89.1.
	Noise	▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85dBA (ear muffs or plugs). All equipment will be equipped with manufacturer's required mufflers
	Eye/Face Injury	▪ Safety glasses with side shields meeting ANSI Standard Z-87 will be worn.
	Struck By/Against	▪ Personnel will understand and review hand signals. ▪ All personnel will wear ANSI type II high visibility vests. ▪ Workers will be made aware of potential pinch-points during operation of equipment and keep hands free from potential pinch points.
	Electrical	▪ All electrical tools and equipment will be equipped with GFCI

ACTIVITY HAZARD ANALYSIS		
Project Identification: Grasse River Site	Location: Massena, NY	
Activity/Phase of Work: Operation of Hydraulic Dredging System	Analysis Performed By: Date: Mark Nicklas (Signature)	Analysis Reviewed By: Date: Paul Hitcho (Signature)

Tasks	Potential Hazards	Control Measures
	Fire	▪ All flammable and combustible liquids will be stored in appropriate metal containers with self-closing lids. ▪ Fire extinguishers will be inspected at least monthly and re-certified annually. ▪ Proper flammable storage areas will be utilized. ▪
	Spills	▪ Secondary containment will be utilized for all fuel/chemical storage areas. ▪ Appropriate spill kits will be available; consideration and training will be taken for spills on water. ▪ All spills will be reported to the SHSO or appropriate designee and the ARP. ▪ Spills will be promptly controlled, contained and cleaned. Contaminated materials will be properly containerized and labeled while awaiting disposal. ▪ Disposal will be in accordance with appropriate Alcoa, local, state and federal regulations.
	Potential Exposure to Site Contaminants	▪ Air monitoring (Real-time: VOCs, H_2S, 0_2, CO, LEL, Integrated: PCBs) ▪ Modified Level D (D+) personal protective equipment, with PFD, will be worn as a minimum. Level C will be worn if conditions exist for the need for Level C, respiratory protection based on air monitoring ▪ HAZWOPER training ▪ Hazard communication program

ACTIVITY HAZARD ANALYSIS		
Project Identification: Grasse River Site	Location: Massena, NY	
Activity/Phase of Work: Operation of Hydraulic Dredging System	Analysis Performed By: Date: Mark Nicklas (Signature)	Analysis Reviewed By: Date: Paul Hitcho (Signature)

Task	Potential Hazards	Control Measures
Dredging of impacted sediments 1) Operation of Hydraulic Dredge 2) Operation an d repositioning of Dredge Travel Control System 3) Fuel Transfer 4) Towing or Pushing Vessels 5) Oversized debris removal	Falling Overboard and/or Stranding	All persons on board will remain seated, except when working. All personnel shall wear United States Coast Guard (USCG) Approved Personal Flotation Devices. ▪ Non-slip surfaces will be provided on all working decks, stair treads, ship ladders, platforms, catwalks, and walkways. ▪ All means of boat access shall be properly secured, guarded, and maintained free of slipping and tripping hazards. ▪ An adequate number of throw rings will be maintained on each watercraft and will be U.S. Coast Guard approved. ▪ Maximum weight capacity for watercraft will not be exceeded. ▪ Dredges and barges will be equipped with perimeter guardrails. ▪ Watercraft will not be used without shore support personnel. ▪ Personnel on board watercraft must be in radio contact with shore personnel. ▪ All personnel working on watercraft will be trained in man overboard emergencies. Drills will be conducted to verify personnel are aware of their responsibilities.
	Water Craft Operation	▪ All dredge and boat pilots shall be familiar with the "Rules of the Road" that regulate movement of boat traffic. ▪ Locations of rocks, ledges and manmade surface obstructions will be noted within the work area. ▪ All watercraft must have required Coast Guard approved lighting and signaling devices.
	Sinking Boat/Dredge Damage	▪ The load ratings of dredges/boats will be strictly adhered to; overloading of vessels is prohibited. ▪ Oil absorbent booms will be kept on board in the event of a spill. No unnecessary fuel cans will be onboard.
	Struck By/Against	▪ Personnel will understand and review hand signals. ▪ Watch for other boats in area, avoid close calls or collisions. ▪ Watch for wake from other boats. ▪ Watch for (know their locations or mark with buoys) objects hidden under water at higher levels, i.e., pilings, islands, anchor lines. ▪ Never pitch-pole or broach any waves. ▪ Ensure the air horn on each boat used is in proper work order. ▪ Properly mark all equipment (floating pipe, etc) to minimize likelihood of watercraft striking installed equipment. ▪ Personnel operating positioning winches will be protected from whip-back in the event of line failure

ACTIVITY HAZARD ANALYSIS		
Project Identification: Grasse River Site	Location: Massena, NY	
Activity/Phase of Work: Operation of Hydraulic Dredging System	Analysis Performed By: Date: Mark Nicklas (Signature)	Analysis Reviewed By: Date: Paul Hitcho (Signature)

Task	Potential Hazards	Control Measures
	Severe Weather	▪ National weather forecasts will be monitored daily for predicted inclement weather. The field team lead will call for local conditions and forecast each morning. ▪ All personnel shall be aware of the forecast and keep an "eye to the sky." ▪ Work will be postponed and dredge secured in the event of strong winds, rough water, or at times of very poor visibility. ▪ In the event of lightning in the area, work will cease at the direction of Sevenson's Supervisor or SHSO, and will not proceed further until return to work permit is issued.
	Spills	▪ Appropriate spill kits will be available; consideration will be taken for spills on water. ▪ All spills will be reported to the SHSO or appropriate designee and ARP. ▪ Spills will be promptly controlled, contained and cleaned. Contaminated materials will be properly containerized and labeled while awaiting disposal. ▪ Disposal will be in accordance with appropriate Alcoa, local, state and federal regulations.
	Medical Emergencies	▪ Medical emergencies will be handled as they are onshore ▪ Emergency skiff will be available for transport
	Potential Exposure to Site Contaminants	▪ Air monitoring (Real-time: VOCs, H_2S, 0_2, CO, LEL, Integrated: PCBs) ▪ Modified Level D (D+) personal protective equipment, with PFD, will be worn as a minimum. Level C will be worn if conditions exist to warrant Level C protection. Respiratory protection as indicated by air monitoring ▪ Material Safety Data Sheets reviewed by site personnel ▪ HAZWOPER training ▪ Hazard communication program

ACTIVITY HAZARD ANALYSIS		
Project Identification: Grasse River Site	Location: Massena, NY	
Activity/Phase of Work: Operation of Hydraulic Dredging System	Analysis Performed By: Date: Mark Nicklas (Signature)	Analysis Reviewed By: Date: Paul Hitcho (Signature)

Equipment To Be Used	Inspection Requirements	Training Requirements
Dredge Railing Systems	▪ Daily inspections will be conducted unless damage is suspected	▪ Personnel will be informed of the rail systems requirements.
Dredge	▪ Daily inspection checklist thereafter.	▪ Personnel will be trained in inspection checklist use. ▪ Personnel will have successfully completed the boating safety course.
Spill Control materials	▪ Daily Safety inspection of spill control materials will be conducted.	▪ Personnel will be given training on how to respond to spilled materials.
Dredge Deck/Working Surfaces	▪ Daily inspections for oil/grease buildup will be conducted	▪ Requirements for house keeping will be reviewed
Tender Boat Engines	▪ Daily maintenance (fueling, oil, grease) will be conducted.	▪ Operators/pilots will be trained in engine maintenance.
Lighting/Signaling Sys.	▪ Daily inspections will be made.	▪ Operators will be trained in proper use of these safety systems.
Tender Boats and Skiffs	▪ Initial review/training prior to commencement of field activities.	▪ Operators will be familiar with Coast Guard regulations for watercraft. ▪ Personnel will have successfully completed the boating safety course.
Excavator & scow	▪ Inspections will be performed on equipment prior to each use	▪ Qualified operators will be used for equipment operation
Fire Extinguishers	▪ Monthly inspections will be performed and site tagged. ▪ Annual re-certification will be performed.	▪ Personnel will be given instructions on proper use of fire extinguishers.
Rigging	▪ Daily inspections for all rigging. Hoisting chains must have a documented inspection at least annually	▪ Personnel will be trained in proper rigging techniques and rigging inspection protocol

JOB HAZARD ANALYSIS

ALLEN MARINE SERVICES

LOCATION: Grasse River Remedial Options -Alcoa	DATE: 11/8/05	PAGE 1 OF 1	NEW: [X]	REVISED: [ ]

JOB OR TASK: underwater welding of steel plates to seal holes at bottom of work barges

#	BASIC JOB STEPS	POTENTIAL HAZARDS	RECOMMENDED SAFE PROCEDURES/PROTECTION	RESPONSIBILITY
1.	Equipment setup	falls, trips, crushing injuries, electrical hazards	follow normal and established company and federally mandated safety procedures for work with high and low pressure air and use GFI protection of electrical equipment in a wet environment	Dive Supervisor and individual crew members
2.	Diving - general	drowning, entanglement, Delta P, barotrauma, dive entrapment equipment failure	follow normal safe diving procedures, be attentive to Delta P conditions, be aware of diving environment, i.e river current, debris, boats, barge, use dive flag to alert others	Dive Supervisor, and individual diving crew members
3.	Diving - underwater welding operations	Electric Stock, Ultraviolet Light, Explosive Gases, Burns	Knife-switch is to be used to break current when diver is not welding. Dive Supervisor will be at knife-switch at all times. Set welder to Direct Current (DC) only, never use AC. Separate welding and ground cables at all times Use two sets of latex gloves to protect from shock	Dive Supervisor, diver and diver's tender
4.			Observe any pockets of Hydrogen and Oxygen forming at bottom of barge Use welding lens to protect eyes from ultraviolet light. Be alert of Divers umbilicals during all welding activities	
5.			Ground welding machine frame to deck of barge follow normal safe diving procedures, be attentive to all welding activities and equipment under and above water	
6.	Equipment break down	Same as # 1	Same as # 1	Same as # 1

PREPARED BY: John Bordner

REVIEWED BY: Thomas Bush

APPROVED BY:

DISTRIBUTION: all concerned

Job Safety Analysis – Water Column Sampling

BBL

JSA Type: ☒ Env. Operations ☐ Transport ☐ Office ☐ Construction	X New Revised	Date: 02/22/05
Co: Alcoa Inc. Dept: Div: BBL Org Unit:		Loc: Massena, NY
Work Type: Environmental	**Work Activity: Water Column Sampling**	

Personal Protective Equipment (PPE):

Minimum PPE is Modified Level D with Personal Floatation Device (PFD) including: safety glasses or goggles, ANSI approved steel-toed safety shoes, hard hat, hearing protection (based on task), and gloves (type dependent on job-specific requirements). BBL personnel working over, adjacent, or near water, where the danger of drowning exists, must wear a United States Coast Guard (USCG)-approved life jacket or buoyant work vests (PFD). Prior to and after each use, the PFD must be inspected for defects, which would alter their strength and buoyancy.

Additional PPE may be required if site conditions change. Also refer to the Health & Safety Plan (HASP) for required traffic control, air monitoring, and emergency procedures.

Development Team	Position/Title	Reviewed By	Position/Title	Date
Sarah Hill	Task Manager	Chuck Webster	Safety Manager	2/23/05
Heather VanDewalker	Project Manager			
Todd Merrell	Site Supervisor			

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). Two tailgate safety meetings must be performed and documented – one at the beginning of each work day and one in the afternoon. Safe Performance Self Assessment (SPSA) procedures must be used throughout the project. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Potential Hazards	❸ Critical Actions/Controls
Gather equipment/supplies for water column [e.g., necessary personnel protective equipment (PPE), water column sampler, water quality meter, sampling jars, cooler, etc.].	Slips/trips/falls, hand/eye/foot injuries from use of hand tools, and lifting hazards (sprains/strains).	Inspect all equipment and tools prior to use. Utilize proper lifting techniques and equipment.
Working outdoors	Environmental hazards (sun, heat, cold), biological hazards (insects and plants), temperature-related illnesses (sun exposure, heat, cold), weather (extreme weather, lightning, may apply).	Check local weather forecasts daily prior to commencement of work. Avoid work in extreme weather conditions, stop work if extreme weather is imminent, and inspect area for hazardous plants and insects. Wear appropriate clothes for the area: long sleeves and gloves in overgrown areas, use sunscreen and hat. Apply insect repellant containing deet during insect season. Monitor for heat and cold stress. Take breaks and consume fluids as necessary.
Inspect work boat, pre-work preparation.	Unseaworthy boat, system failure, drowning, fire hazard from gasoline on board, employees unfamiliar with work	A complete boat inspection must be conducted by the boat operator and the Sediment Surface Water Sampling Checklist must be completed prior to sampling. This inspection shall be conducted in accordance with accepted USCG and applicable state boating safety inspection procedures. The inspection must verify that necessary safety equipment is aboard, functioning properly, and all members of the crew are aware of proper procedures that are to be followed upon the water. All powerboats shall have a valid state registration. This registration shall be maintained on the boat, and as necessary be made available for USCG or Marine police inspection. At a minimum, each powerboat shall be equipped with a Type 4-A, 10-B, C rated fire extinguisher, proper stowage of flammable materials. Boats shall not be operated at night without proper lighting and the capability for making visual distress signals, personal beacons will be worn by all individuals on boat. Each employee working from a boat is required to

		participate in a boating safety training session conducted during the daily safety meeting. The training session shall provide instruction on proper boat and safety equipment inspections; content and frequency of equipment safety inspections; proper use of on-board safety equipment, including fire extinguisher, radio or cellular phone, flares, horn, etc.; proper procedures on the completion and filing of a float plan; appropriate boating "rules-of-the-road"; emergency procedures in the event of capsizing or being thrown overboard; different types of PFD and their proper inspection and use.
Launch boat for sampling/monitoring activities.	Slips/trips/falls, physical hazards (caught between, struck-by), drowning.	Use buddy system for directing trailer into launch point. Keep hands away from pinch points as boat is being launched. Wear PFD when within 15 feet of the water. Wear appropriate footwear for working around water.
Operate boat and travel to sample locations.	Slips/trips/falls, physical hazards (struck-by construction equipment), drowning, housekeeping.	Follow safe boat handling procedures. Keep all surfaces clear of debris to prevent slips, trips, and falls. Do not overload boat, file a float plan if required. Use caution when working around construction equipment (e.g., dredges, barges, tugboats, silt curtains, etc.). Maintain eye contact and notify construction operators of your presence.
Collect samples in accordance with sampling plan.	Cross-contamination, slips/trips/falls, hand/eye/foot injuries (cuts/lacerations), lifting hazards (sprains/strains), inhalation or dermal exposure to chemical hazards, and improper labeling or storage.	Use proper lifting techniques. Use PPE in accordance with HASP. Label samples in accordance with sampling plan. Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.
Package and deliver samples to lab.	Slips/trips/falls, hand/eye/foot injuries from broken bottles (cuts), lifting hazards (sprains/strains), and traffic hazards (vehicle accident on route to lab or courier).	Handle and pack bottles carefully (bubble wrap bags are helpful). Avoid contact with tape cutter, or cut away from the hand and body if using knife. Use proper lifting techniques, limit weight of each cooler. Follow safe driving procedures, obey traffic laws and signs, and maintain safe distances. Obey Alcoa-specific traffic and parking requirements when on Alcoa property.
Place boat on trailer.	Slips/trips/falls, physical hazards (caught between, struck-by), drowning.	Use buddy system for directing trailer into launch point. Keep hands away from pinch points as boat is being hoisted onto trailer. Wear PFD when within 15 feet of the water.

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

Date PEHSR Initiated: 10-12-05 Date Project Released for Production: _____

PEHSR Worksheet			Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
1.	**Lock/Tag/Try**		X			X		
	a.	Is potential for stored energy minimized through design?	X			X		
	b.	Are all isolation points labeled and lockable?	X			X		
	c.	Have the LO/TO procedures been written?	X			X		
	d.	Are lockout panels easily accessible and minimum distance from work area?	X			X		
	e.	Have employees (Prod.&Maint.) been trained and informed of Lockout / Tagout procedures?	X			X		
2.	**Machine Guarding**							
	a.	Are belts, gears, and wheels properly guarded?	X			X		
	b.	Are rotating shafts properly guarded?	X			X		
	c.	Are pinch points properly guarded?	X			X		
	d.	Are Points-of-Operation area(s) properly guarded?	X			X		
	e.	Are saw blades properly guarded / interlocked?			X			X
	f.	Have operators entering automated or energized areas been protected?			X			X
	g.	Have sharp edges been rounded or padded?	X			X		
	h.	Have safety interlocks been installed for frequently accessed moving parts?			X			X
	I	Has maintenance access been provided?	X			X		
	j	If Safety Devices were installed, were they added to the pre-shift inspection list?			X			X
3.	**Electrical**							
	a.	Are switches and control boxes accessible?			X			X
	b.	Are electrical items labeled per ALCOA Eng. Stds?			X			X
	c.	Are drawings and schematics available and up-to-date?			X			X
	d.	Is there a minimum of 36” access to the control panels / boxes? 42” if there is a conductive surface behind where the electrician will be working?			X			X
	e.	Are new electrical installations installed according to NEC code and AES 32.60?			X			X
	f.	GFCI’s provided where necessary?			X			X
	g.	Sufficient number of outlets identified and installed in locations to limit extension cord use?			X			X
	h.	Proper grounding installed?			X			X
	i.	Have Arc Flash issues been considered? Has and Arc Flash Analysis been conducted?			X			X

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

PEHSR Worksheet			Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
4.	**Controls and Displays**							
	a.	Are controls accessible to task, readable and labeled?	X			X		
	b.	E-stops are provided in sufficient number and location?			X			X
	c.	All controls and E-stops have been functionally tested and operate properly before release?			X			X
	d.	Fail-safe controls are provided as needed?			X			X
	e.	PLC logic has been reviewed for needed control?			X			X
	f.	Appropriate levels of redundancy are provided as needed?			X			X
	g.	Limits, proximity switches and other sensors have been provided and tested as needed?			X			X
	h.	Controls and displays positioned so operator maintains visual contact with operation when appropriate?	X			X		
5.	**Fall Prevention**							
	a.	Has the need to access heights been minimized or eliminated by design?	X			X		
	b.	All working surfaces with fall potential protected with guardrails, gates and ladders consistent with AES 33.013?	X			X		
	c.	Rail, ladder and stair are designed to meet AES 33.013?	X			X		
	d.	A Roof Plan has been developed for jobs on any roof?			X			X
	e.	Engineered anchorage point have been provided when needed?			X			X
	f.	Floor obstructions have been eliminated or covered?	X			X		
	g.	Retractable reels are provided for cords and hoses?			X			X
	h.	Open floor holes are properly protected?			X			X
	i.	Damaged floors are isolated until repaired?			X			X
	j.	Are floors and aisles clear?	X			X		
	k.	Steps built of non-skid surface?			X			X
	l.	Walkways are at least 22” wide and unobstructed?	X			X		

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

		PEHSR Worksheet	Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
6.	**Mobile Equipment**							
	a.	Will the location of equipment or processes increase pedestrian and vehicle interface?	X			X		
	b.	Is some form of physical segregation provided for pedestrians and vehicles?	X			X		
	c.	Walkways are clear of vehicular traffic and protected from other hazards?			X			X
	d.	Operators will not have to work in aisle ways?			X			X
	e.	Are blind spots created by the placement of equipment?			X			X
	f.	Walkways and vehicle traffic patterns have been defined and marked?			X			X
	g.	Stop signs and other visuals are provided as needed?	X			X		
	h.	New equipment meets Alcoa Engineering Standard: 30.20, 30.3.2, 30.36.1, 35.4.5?			X			X
	i.	Vehicle has capacity to perform job?	X			X		
	j.	Pre-operational inspections have been developed?	X			X		
	K	Training for equipment has been developed and deployed to operators?	X			X		
7.	**Confined Space**							
	a.	Are no confined spaces created by this installation / modification (Permit or Non-Permit)?	X			X		
	b.	Has an SOP been created and training provided to affected employees (Prod.&Maint)?			X			X
	c.	Are all Permit Required Confined Spaces labeled?			X			X
	d.	Have the Confined Spaces, both Permit & Non-Permit, been added to plant's Confined Space List?			X			X
8.	**Ergonomics**							
	a.	Have tasks and workstation been reviewed for potential ergonomic hazards?	X			X		
	b.	Any lifting of materials 35 lbs.or greater? If yes, plans to mitigate?	X				X	
	c.	Has work & workstation been designed to minimize/eliminate need for pushing, pulling, lifting, bending, twisting, reaching, carrying, dragging, stooping, etc?	X			X		
	d.	Has work and work station been designed to minimize excessive walking?	X			X		
	e.	Have manual lifts of materials, products, tools, etc. from the floor been eliminated?	X			X		
	f.	Are workstation heights adjustable? (ie. are lift tables needed?)		X			X	
	g.	Can anticipated tool changes, set-ups and maintenance activity be performed without awkward body postures (ie. good access, right tools, etc.)?			X			X
	h.	Have repetitive tasks been minimized, reduced or automated?			X			X
	i.	Do hand tools allow for neutral hand position and have their weights been minimized?	X			X		

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

PEHSR Worksheet			Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
9.	**Noise, Lighting, Ventilation Levels**							
	a.	Are noise levels of the item installed <=85dBA?	X			X		
	b.	Have engineering methods been used to reduce noise levels?	X			X		
	c.	Is lighting and ventilation in area sufficient?	X			X		
10.	**Combustion Systems**							
	a.	System designed to current Alcoa standards?			X			X
	b.	Insurance/Third Party review/approval obtained?			X			X
	c.	Manual gas valve installed and labeled?			X			X
	d.	Vent line installed off regulator?			X			X
	e.	Start-up and shutdown procedures developed/posted?			X			X
	f.	Proper system operation verified?			X			X
	g.	Employee training conducted and documented?			X			X
	h.	Gas lines installed in a protected area not subject to damage?			X			X
11.	**Overhead and Pendant Operated Cranes**							
	a.	Is there sufficient crane clearance around proposed equipment			X			X
	b.	The equipment will not limit crane visibility of operators or walkways			X			X
	c.	Is crane capacity sufficient to lift or position equipment			X			X
	d.	Ample room is provided for operators to work in area free of crane hazards			X			X
	e.	Are pendant buttons labeled per Alcoa standards			X			X
	f.	Load tests are conducted and documented as required			X			X
12.	**Radio Frequency Cranes**							
	a.	Frequencies are unique to the crane?			X			X
	b.	Controls on remote box labeled?			X			X
	c.	Remote box identified for crane it controls?			X			X
	d.	Trolley and bridge brakes set when remote power or frequencies are lost?			X			X
	e.	Operable range of remote is kept as small as possible?			X			X
	f.	A pre-op process is developed and implemented?			X			X
	g.	Operators are trained and medically cleared?			X			X
	h.	Consideration has been given to pre-start warnings?			X			X
	i.	Load tests are conducted and documented as required?			X			X

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

		PEHSR Worksheet	Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
13.	**Hoists**							
	a.	Hoist is rated for anticipated use and load tested & documented?						
	b.	Hoist is located so as not to interfere with other equipment, roadways or cranes?	X			X		
	c.	Limits have been tested?	X			X		
	d.	Are pendant buttons labeled per Alcoa standards?			X			X
	e.	Pre-shift checklist provided?	X			X		
14.	**Fire Prevention**							
	a.	Are fire extinguishers provided to meet the need?	X			X		
	b.	Have fire extinguishers been mounted, identified and added to monthly inspection list ?		X			X	
	c.	Has the need for fixed fire protection been reviewed?			X			X
	d.	Has the fixed system been tested and verified?			X			X
	e.	No smoking areas identified and marked?	X			X		
	f.	Are Hot Work Permits necessary for work area or task?	X			X		
	g.	Proper disposal containers have been provided when needed?	X			X		
	h.	Evacuation routes are identified and are not restricted?	X			X		
	i.	Approved storage cabinets are provided for flammable materials?	X			X		
	j.	If phones are provided or replaced, are emergency stickers in place?	X			X		
	k.	Has Insurance/Third Party reviewed modifications?			X	X		X
15.	**Hazardous Chemicals / Materials**							
	a.	MSDS for new chemicals has been approved by IH and Environmental using the “New Material Request Form” before chemical is brought onto plant property?	X					X
	b.	Is a TSCA import/export notification needed? If yes, was it submitted?			X			X
	c.	Will construction disturb lead paint or asbestos?		X			X	
	d.	Proper labels have been provided for chemical containers?	X			X		
	e.	Employee training has been provided for new chemical hazards?	X			X		
	f.	Least hazardous chemical has been selected for job?	X			X		
	g.	Eyewash/safety showers provided and identified, if needed?	X			X		
16.	**Chlorine/PSM/RMP**							
	a.	Does the process or equipment change impact any aspect of the chlorine system? If so, a Management of Change Review must take place. (Contact Environmental Air Engineer)			X			X
	b.	Has a Process Hazard Analysis taken place for the change in the chlorine process?			X			X
	c.	Have all affected people been train on any changes to the chlorine process?			X			X

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

PEHSR Worksheet			Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
17.	**Environmental**							
	a.	Is there a new or a change to an environmental aspect of the process (eg. air emission, wastewater discharge, waste generation, potential spill and/or energy/fuel/water use)?		X			X	
	b.	Has the need for new or revised air, water or other permits been reviewed?	X			X		
	c.	Have old drains been sealed or removed?	X			X		
	d.	Are hazardous wastes properly handled and disposed?	X			X		
	e.	Is drainage adequate, appropriate and controlled as needed?	X			X		
	f.	Are spill containment materials provided?	X			X		
	g.	Quantity of chemical is limited to that needed, will there be changes in the waste stream?	X			X		
	h.	Will new storage tanks be install or existing tanks re-used?	X			X		
	i.	Is a form of secondary containment provided?	X			X		
	j.	Are there cleaning, decontamination or disposal requirements for removed equipment?	X			X		
18.	**Personal Protective Equipment: (PPE)**							
	a.	Are current PPE requirements adequate and has an assessment been completed?	X			X		
19.	**Training:** (Have employees received training in the following items):							
	a.	Emergency procedures written?	X			X		
	b.	Has an SOP / JSA been written/modified and employees trained?	X			X		
20.	**Housekeeping**							
	a.	Has the area been cleaned?	X			X		
	b.	Has the new equipment been painted?	X			X		
	c.	Are shadow boards provided for tool storage?			X			X
	d.	Is the equipment designed to be cleaned and housekeeping maintained?	X			X		
	e.	Have Housekeeping responsibilities been assigned?	X			X		
	f.	Material stored in racks has been properly labeled?			X			X

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

PEHSR Worksheet			Design Review			Start-Up Review		
			Yes	No	NA	Yes	No	NA
21.	**Other**							
	a.	Have all potential pressure hazards (pneumatic, hydraulic & steam) been designed with safety relief devices and positioned such that blowouts / vents discharge in a safe direction?	X			X		
	b.	If new equipment, has it been added to the PM schedule with a form?			X			X
	c.	If altered, has the PM form been updated to reflect changes?			X			X
	d.	Are potential hot surfaces or piping protected or guarded?	X			X		
	e.	Is piping protected appropriately and labeled as needed?	X			X		
	f.	If project involves use of contractor personnel, the Contractor Safety Program has been reviewed for requirements?	X			X		
	g.	Does the project involve the use of lasers, Xray equipment or radio isotopes? If Yes, contact the Radiation Officer. (Scott Anderson x4186)?	X			X		
	h.	Does the project involve modifications to an existing loading dock or the installation of a new dock facility? If so a review of **Alcoa Engineering Standard 30.37 Loading Dock Safety** is required to ensure compliance with this mandatory standard.		X			X	

Project Environmental, Health & Safety Review Checklist

(For New and/or Altered Equipment & Process Change)

Project Title: Grasse River ROPS Ladder`Dredge Project Tracking Number: __ Project Leader: _____

Item No.	PEHSR Punch List Item To Be Corrected	Whom	Date Needed	Date Corrected
8-B	No Lifting over 35 lbs. Will be required			
8-G	Space was not filled in until discussed at PEHSR			
14-K	Dredge was Insured prior to arrival			
15-A	No change in Chemicals for this operation.			

NYSDEC#05-05723
NRC#

WEST PLANT RELEASE RESPONSE AND NOTIFICATION FORM

ALCOA MASSENA OPERATIONS
PARK AVENUE EAST
MASSENA, NY 13662
EPA ID# NYD002232304

Facility latitude and longitude: 44°56'27" N, 74°52'48" W
Facility oil storage capacity: 4,274,875 gallons (total)
NRC and NYS Spill Hotline Call Back Number 315-764-4128

PART A - GENERAL INFORMATION

1. Material Released: Gear oil
2. Amount Released: 2 gallons
3. Date of Release: 08/09/05 Time of Release: 1817
4. Release Medium (choose one from drop down menu): Land
5. Source or Cause: SEE NOTE BELOW Container Type: None Capacity:NA
6. Incident Description: Located: Dirt haul road going to the 001 outfall. Sevenson trailer carrying the gear housing of a crane spilled oil on a hard dirt surface road. Reportable.
7. Nearest Municipality: Village of Massena County: St. Lawrence State: NY Zip Code: 13662
8. Distance and Direction from City: In northeast section of Village of Massena

ITEMS 9 THROUGH 15 TO BE COMPLETED BY ENVIRONMENTAL CONTROL

9. Is it an Extremely Hazardous Substance?	☐Yes ☒No (See List of Lists)
10. If yes, did it exceed its RQ?	☐Yes ☒No
11. Is it a CERCLA Hazardous Substance?	☐Yes ☒No (See List of Lists)
12. If yes, did it exceed its RQ?	☐Yes ☒No
13. Is it a Hazardous Waste?	☐Yes ☒No
14. Is it on the NYS 597 CBS List?	☐Yes ☒No
15. If yes, does it exceed the RQ?	☐Yes ☒No

16. Release discovered by: Scott Allaire Phone: cell 716 628-0339
17. Time and date release called into main guard at 4500: 1817 08/09/05
18. Name of QI Responding (ERT): Troy Rathbun Time: 1817

PART B - ACTION ITEMS

1. Health Risks: None
2. Precautions (including evacuations): None
3. Number of Injuries and Deaths: None
4. Root Cause identified (for reportable spills): NOTE: The trailer was going down the road to the outfall at a angle causing the oil to spill out. Approx. 1 inch wide by about 100 ft strip on the road way

5. Immediate Corrective Action Taken: Trailer was stopped that was carrying the gear housing for the crane. Call was placed to # 1 clockhouse 4500. Notified Alcoa Enviromental pager. Jordan Parent answered pager 1831.

6. Clean-up Performed: Removed containmented soil with a bobcat loader and placed it in a green drum, spill cleanup completed at 2100.

7. Disposition of material from cleanup (if placed in 55-gallon drum, list bar code number of each drum below): Clean-up was completed @ and placed in barrel Numbers...05-0598-G/ 05-0599-G/ 05-0597-G/ 05-0543-G/ 05-0568-G/ 05-0353-G.
8. Preventive Action Taken (for reportable spills):

RELEASE RESPONSE NOTIFICATION FORM (cont'd)

PART C - NOTIFICATION - TO BE COMPLETED BY ENVIRONMENTAL CONTROL

1. Agencies Notified
   If the answer to questions #10 and/or #12 of Section A are yes, then the National Response Center (NRC) must be contacted. If a local community is affected, the appropriate (Local Emergency Planning Committee (LEPC) must be contacted, (SRMT or St. Lawrence County). Note that the NYSDEC hotline is the State Emergency Response Commission (SERC).

NYSDEC Hotline (800) 457-7362	Yes ☒ No ☐	Date 8-9-05	Time 6:45 PM
Mike Cox (NYSDEC) 315-265-3090	Yes ☒ No ☐	Date 8-10-05	Time 7:30 AM
NRC (USCG) (800) 424-8802	Yes ☐ No ☒	Date	Time
EPA Hotline (732) 548-8730	Yes ☐ No ☒	Date	Time
LEPC St. Lawrence County 379-2240	Yes ☐ No ☒	Date	Time
LEPC SRMT Central Dispatch (613) 575-2000	Yes ☐ No ☒	Date	Time
Massena Fire Department 769-2464	Yes ☐ No ☒	Date	Time
Massena Memorial Hospital (Emergency Room) 769-3790 (Switchboard) 764-1711	Yes ☐ No ☒	Date	Time
OP-TECH Environmental Services (Guy Griffin) 764-1917	Yes ☐ No ☒	Date	Time
Perras Environmental 769-5900	Yes ☐ No ☒	Date	Time
SRMT Environment Division	Yes ☐ No ☒	Date	Time
SRMT Police Department: (518) 358-9200			

2. Remarks, etc.:

3. Form completed by:

Jordan Parent Env. Engr. /**Alcoa Inc.** 315) 764-4737 (day phone)
(title and company)

8-10-05 315) 764-4128 (evening phone)
(date)

cc: **ALL SPILLS**

Mike Cox – NYSDEC	P. Catanzarite	T. Long	Guards
D. Krause	R. Bathelt	L. Truax	
J. Stenlake	R. Cloutier	File – O :Drive	

Pot Rooms	**Carbon/Electrode**	**Cast House**	**PM Maintenance**
T. Sheets	T. Willson	S. Rombough	J. DiNapoli
	A. Amo	B. Welsch	K. Bellor

GCFP	**Central Maintenance**
A. Dion	D. Debellis
S. Swan	S. Barr

Previous Versions: July 14, 1993, March 7, 2001, April 18, 2002, March 17, 2003, April 29, 2004, August 26, 2004

Current: August 4, 2005

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

Location: Massena NY
Project: Grasse River Project
Contractor Being Audited: BBL
People Present During Audit: Ron Kuhn & Heather VanDewalker
Auditor(s): Greg Rutherford
Date of Visit :04/20/2005

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
A. Accident/injury records(Check files & OSHA 300 Log)	☐	☑	☐	Not located at site at this time	R. Kuhn	5/13/2005	Trailer to be in place and setup week of 5/9/05.
B. Accident investigation/follow up (Investigation Report?)	☐	☑	☐	Not located at site at this time	R. Kuhn	5/13/2005	Trailer to be in place and setup week of 5/9/05.
C. Asbestos Training Documents (Check Files & dates)	☐	☐	☑				
D. Competent Person (Check documentation)	☐	☐	☑				
a. Excavations (Check Documentation)	☐	☐	☑				
b. Fall Protection (Check Documentation)	☐	☐	☑				
c. Scaffolding (Check Documentation)	☐	☐	☑				
E. Confined Space Entry Training (Check files& dates)	☐	☐	☑				
F. Contractor Safety Policy/ Commitment (HASP)	☑	☐	☐				
G. Emergency Plan (required in HASP)	☑	☐	☐				
H. Government Regulation log & posting (Is it posted?)	☐	☑	☐	No postings at this time as they do not have an office trailer on site	R. Kuhn	5/13/2005	Trailer to be in place and setup week of 5/9/05.
I. Hazardous Material Release Plan (Written Plan Required)				In BBL HASP ?			
J. Operator certification (Fork Truck required every 3 years)	☐	☐	☑				
K. Orientation (Site Specific & Required OSHA Subjects)	☑	☐	☐				
L. Permit Program (lock/Tag, Hot Work, Confined Space etc)	☐	☐	☑	Will use Massena program for L/T & V	R. Kuhn	5/13/2005	BBL to use Alcoa/Sevenson program; program necessary for generators to be setup for air monitoring program
M. Toolbox meetings (Documented Daily)	☑	☐	☐				
N. Training records(First Aid, HazWoper, Respirator,Asbestos, etc)	☐	☑	☐	Not located at site at this time	R. Kuhn	5/13/2005	Trailer to be in place and setup week of 5/9/05.
2. INDUSTRIAL HYGIENE/ENVIRONMENT							
A. Air Quality Control (Best management practices)	☑	☐	☐				
B. Container Labeling (In use & properly stored?)	☐	☑	☐	Will need to label containers of Acetone, Hexane, etc. per OSHA Haz Com labeling requirements	R. Kuhn	4/29/2005	
C. Hazard Communication (Training Date)	☐	☑	☐	Have not covered how to read an MSDS, Labeling and other employee right to know issues with their workers	S. Hill/R. Kuhn	5/9/2005	Training for BBL personnel to be involved with site completed 5/9/05; additional personnel will be trained by R. Kuhn on-site
D. Health Safety Plan On site & Workers Trained?	☑	☐	☐				
a. Asbestos (Training Date, right state?)	☐	☐	☑				
b. Lead (Training Date)	☐	☐	☑				
c. Refractory Ceramic Fibers Training Date)	☐	☐	☑				
d. Petroleum Volitals(Training date)	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
e. Florine/Chlorine **(Training Date)**	☐	☐	☑				
f. Leachates **(Training Date)**	☐	☐	☑				
E. Heat Stress **(In training plan ?)**	☐	☐	☑	Have not done Heat Stress training as yet but will do so this summer	S. Hill/R. Kuhn	5/9/2005	Training for BBL personnel to be involved with site completed 5/9/05; additional personnel will be trained by R. Kuhn on-site
F. MSDS Check **(Are they current for what's on site?)**	☑	☐	☐				
G. Noise Thresholds **(Monitoring results above 85dB ?)**	☐	☑	☐	I was told Sevenson would do this monitoring, does BBL have some responsibility for noise monitoring for the Village of Massena?	R. Kuhn	5/20/2005	Sevenson will be conducting noise monitoring for workers in vicinity of equipment and community along shore adjacent to closest receptors per CHASP; BBL will also conduct noise monitoring near Sevenson operations and air monitoring equipment to assess/document need for hearing protection
H. PCB/Caustic/etc. controls	☐	☑	☐	Have sent a power point presentation for PCB Awareness training that they can do with their employees	S. Hill/R. Kuhn	5/9/2005	Training for BBL personnel to be involved with site completed 5/9/05; additional personnel will be trained by R. Kuhn on-site
I. Proper Lumination **(Minimum 5 Candle Power, work areas)**	☐	☐	☑	No an issue at this time, again Sevenson is supposed to supply ?			It is not anticipated that BBL will be working at night; if work at night is necessary, BBL will provide adequate lighting for work to be conducted (e.g., flashlights, etc.)
J. Radiation Control **(Rad plan and Badges)**	☐	☐	☑				
K. Secondary Containment **(Fuel tanks, etc)**	☐	☐	☑				
3. COMPRESSED AIR							
A. Authorized use **(Training Documentation)**	☐	☐	☑				
B. Condition of hose & fittings/connections **(Pinned)**	☐	☐	☑				
C. Excess flow check valves **(30 PSI for Blow down attachment)**	☐	☐	☑				
D. Tripping hazards **Hoses not on ground or clearly marked**	☐	☐	☑				
4. CONFINED SPACE							
A. Air monitor on site **(Yes or No)(Required)**	☐	☐	☑				
B. Confined space entry kit **(Inspection dates retrieval/harness)**	☐	☐	☑				
C. Outside observer/communications **(Required)**	☐	☐	☑				
D. Permit developed and not displayed **(Required)**	☐	☐	☑				
E. Rescue provisions **(In HASP)**	☐	☐	☑				
5. BARRICADES **(6' back from hole or must withstand 200 lb side deflection)**							
A. Appropriate Flags **(Barricade tape right color & language)**	☐	☐	☑				
B. Appropriate for hazard **Leading edge requires guardrail**	☐	☐	☑				
C. Around holes/edges **(top Rail 42", 200lb side deflection)**	☐	☐	☑				
D. Casual pedestrian protection **(Safe zone)**	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
E. Holes covered if not barricaded **(Marked with hole)**	☐	☐	☑				
F. Work Zones **(Safe distance & correct signage)**	☐	☑	☐	BBL needs to come up with buoys and signage when they are not working within Sevensons Buoyed area	R. Kuhn	5/10/2005	BBL to place buoys upstream and downstream of sampling areas if outside of Sevenson's work area
6. HIGH WORK							
A. Barricades **(6' from edge, anchorage & 42" high)**	☐	☐	☑				
B. Communications process	☐	☐	☑				
C. Confined space entry	☐	☐	☑				
D. Daily inspection of hoist cables **Documentation required**	☐	☐	☑				
E. Engineered anchorage system **(5,000 lb per person)**	☐	☐	☑				
F. Fall protection **(Training Documentation)**	☐	☐	☑				
G. Pre-job safety plan **(Required above 10' in Washington)**	☐	☐	☑				
H. Properly designed hoist system	☐	☐	☑				
I. Properly designed work platform	☐	☐	☑				
J. Work zone protection **(Monitor & barricades set back 6')**	☐	☐	☑				
7. TOOLS							
A. Grounding of power tools, extension cords	☐	☐	☑				
B. Cords inspected/GFCI in place **(GFCI Required)**	☐	☑	☐	BBL needs to get their cords and GFCI's on a quarterly inspection	R. Kuhn	ongoing	BBL to modify Sevenson's Electrical Equipment Inspection Log and perform inspection quarterly
C. Correct tool for application	☐	☐	☑				
D. Double insulated or 3 prong	☐	☐	☑				
E. General condition	☐	☐	☑				
F. Guards in place	☐	☐	☑				
G. Powder actuated tool training **(Check Documentation)**	☐	☐	☑				
8. WELDING							
A. Adequate ventilation	☐	☐	☑				
B. Condition of welding lead's insulation	☐	☐	☑				
C. Fire protection **(Fire Extinguisher Inspected?, date)**	☐	☐	☑	Was not able to check this item, it needs to be on a monthly inspection form	R. Kuhn	ongoing	Fire extinguishers located at trailer, Outfall 001 shed, and boats; BBL to modify Sevenson's Fire Extinguisher Checklist and perform inspection monthly
D. Hot work permit issued **(Check date & Filled Out Properly)**	☐	☐	☑				
E. Proper grounding	☐	☐	☑				
F. Protective equipment- flash screen, hood, clothing	☐	☐	☑				
G. Surface Prep, (lead, etc.) **(Proper Respirator)**	☐	☐	☑				
9. EXCAVATION							
A. Adequate access/egress **- Ramp or ladders every 25'**	☐	☐	☑				
B. Barricades (tape/solid) **6' Back or 200lb side deflection**	☐	☐	☑				
C. Competent person involved **Check documentation**	☐	☐	☑				
D. Digging permit issued and accessible	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
E. Excav. Shored, benched or sloped	☐	☐	☑				
F. Excavated material set back 2 ft. from edge	☐	☐	☑				
G. Preshift inspection **(Daily Inspection Required)**	☐	☐	☑				
H. Properly designed hoist system	☐	☐	☑				
I. Shoring **Worker protective system**	☐	☐	☑				
J. Traffic considerations	☐	☐	☑				
10. FUEL/FLAMMABLES							
A. Bonding/grounding	☐	☐	☑				
B. Containers properly labeled	☐	☑	☐	Told them that boat gas container must be properly labeled	R. Kuhn	4/29/2005	
C. Fire protection **Check fire extinguisher inspection date**	☐	☐	☑	Was no able to check this item	R. Kuhn	ongoing	Fire extinguishers located at trailer, Outfall 001 shed, and boats; BBL to modify Sevenson's Fire Extinguisher Checklist and perform inspection monthly
D. No smoking	☐	☐	☑				
E. Proper containers	☐	☐	☑				
F. Proper storage **Secondary Containment - flammable unit**	☐	☐	☑				
G. Refueling outside	☑	☐	☐				
H. Transportation	☐	☐	☑				
11. GAS CYLINDERS/BURNING RIGS							
A. Caps on unused cylinders	☐	☐	☑				
B. Condition of hoses & torches	☐	☐	☑				
C. Condition of regulators & gauges	☐	☐	☑				
D. Cutting rigs have anti-flashbacks	☐	☐	☑				
E. Cylinder in vertical/secured position	☐	☐	☑				
F. Cylinder not placed in confined spaces	☐	☐	☑				
G. Fire protection **(Inspection date on Fire Extinguisher)**	☐	☐	☑				
H. Protective screens	☐	☐	☑				
I. Permits **Check date & properly filled out**	☐	☐	☑				
J. Proper Transportation **(Properly Secured To Carrier)**	☐	☐	☑				
K. Storage (flammable away from oxygen) **(25' or 5' wall)**	☐	☐	☑				
L. Ventilation	☐	☐	☑				
12. HOUSEKEEPING				Comment: General: BBL does not have a housekeeping inspection. They need to develop this for their storage area, office trailer and boat.			BBL will develop inspection form by 5/20/05
A. Disposal chutes used	☐	☐	☑				
B. Floor around saw areas	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
C. Material storage	☐	☐	☑	Was not able to check this item their storage area was locked	R. Kuhn	ongoing	BBL cleaned shed at Outfall 001 and organized all materials and equipment on 4/6/05; housekeeping activities will be performed as needed throughout project
D. Multi-shift inspection of cords/hoses	☐	☑	☐	Need to start quarterly inspection of cords etc.	R. Kuhn	ongoing	BBL to modify Sevenson's Electrical Equipment Inspection Log and perform inspection quarterly
E. Nails clinched/removed	☐	☐	☑				
F. Proper illumination	☐	☐	☑				
G. Proper tool/material storage	☐	☐	☑	Was not able to check this item	R. Kuhn	ongoing	BBL cleaned shed at Outfall 001 and organized all materials and equipment on 4/6/05; housekeeping activities will be performed as needed throughout project
H. Spill containment	☑	☐	☐				
I. Trash/scrap disposal & separation	☐	☐	☑	Was not able to check this item	R. Kuhn	ongoing	Ongoing coordination between BBL and Alcoa Massena personnel regarding disposal; hazardous materials placed in Alcoa-provided drums and non-hazardous materials placed in trash barrel and taken by BBL to plant facility dumpster
13. LADDERS				If BBL plans to have a ladder on site this too needs to be set up on an inspection program	R. Kuhn	ongoing	BBL to modify Sevenson's Portable Ladder Inspection Form and perform inspection
A. Base protected for secure position	☐	☐	☑				
B. Climbing procedure (3 point contact)	☐	☐	☑				
C. Condition of job fabricated ladders	☐	☐	☑				
D. Ladder pitch (4 to 1)	☐	☐	☑				
E. Ladder storage	☐	☐	☑				
F. Non-metallic	☐	☐	☑				
G. Non-skid feet	☐	☐	☑				
H. One person at a time on ladder	☐	☐	☑				
I. Sound footing	☐	☐	☑				
J. Sound physical condition	☐	☐	☑				
K. Step ladder not used as extension ladder	☐	☐	☑				
L. Top 3 ft. above elevation change	☐	☐	☑				
M. Top tied off **Work above 6' on ladder requires fall protection**	☐	☐	☑				
N. Top two steps of ladder not used	☐	☐	☑				
O. Working off ladder properly	☐	☐	☑				
14. FREE MOVING MOBILE EQUIPMENT							
A. Backup warning **Operative?**	☐	☑	☐	If BBL plans to use a company pickup on the site they need to have a backup alarm	R. Kuhn	4/15/2005	BBL installed backup alarms on all vehicles on-site; any new vehicles to the site will have a backup alarm installed
B. Crane certification**(Also operator license in Oregon)**	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
C. Falling object protection **(Modifications can't be made)**	☐	☐	☑				
D. Fire extinguisher **In place?**	☑	☐	☐				
E. Hand signals posted	☐	☐	☑				
F. High voltage clearances **(10' or ground equipment)**	☐	☐	☑				
G. Inspection sheet current	☐	☐	☑	Was not able to check this sheet as boat was out in the river	S. Hill/R. Kuhn	ongoing	BBL daily vehicle and boat inspection checklist emailed to G. Rutherford on 5/6/05; checklist to be completed daily for each boat used on river
H. Lights/mirrors **Working ?**	☐	☐	☑				
I. Load chart	☐	☐	☑				
J. Operation training **Training documentation**	☐	☐	☑	Don't know if any of BBL employees took a boating safety course from the Coast Guard Prior to Launching their craft.	R. Kuhn	ongoing	Training for BBL personnel to be involved with site completed 5/9/05; additional personnel will be trained by R. Kuhn on-site; BBL personnel will complete USCG training program; all BBL personnel operating boats have been trained by experienced BBL field crew leader in boating safety
K. Pre-operation checklist **(Check dailys and past pre-ops)**	☐	☐	☑	Was not able to check the pre-launch check list, BBL also needs to have a daily pre-op for any pickup they use on site.	S. Hill/R. Kuhn	ongoing	BBL daily vehicle and boat inspection checklist emailed to G. Rutherford on 5/6/05; checklist to be completed daily for each boat used on river
L. Refuel outside	☑	☐	☐				
M. Rigging hook w/safety latch	☐	☐	☑				
N. Rollover protection **(Modifications can not be made)**	☐	☐	☑				
O. Safety flags or flashers	☐	☐	☑				
P. Seat belts **- Are they used as required?**	☐	☑	☐				
Q. Swing radius clearance/protection **(Cones or barricades)**	☐	☐	☑				
15. JOB SAFETY PLAN				Waiting to review these plans			BBL's HASPs emailed to G. Rutherford on 4/28/05
A. Completed **(Audit work by written JSP/JSA)**	☐	☐	☑				
B. Effectiveness of implementation	☐	☐	☑				
C. Evidence of use	☐	☐	☑				
16. ROOF WORK							
A. Clean-up	☐	☐	☑				
B. Materials secured	☐	☐	☑				
C. Opening/skylight protection	☐	☐	☑				
D. Perimeter/work zone protection	☐	☐	☑				
E. Proper access - roof permit **(WA. Fall Protection Plan)**	☐	☐	☑				
F. Protection from hot pitch	☐	☐	☑				
G. Warning lines **6' back from edge**	☐	☐	☑				
17. PERSONAL PROTECTIVE EQUIPMENT							
A. Breathing (respirator) **(Correct filters for work?)**	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
B. Eye protection face shield/goggles(Safety Glasses)	☑	☐	☐				
C. Fall protection Harness & Lanyard inspected	☐	☐	☑				
D. Foot protection(Steel toed and Met. Guards if required)	☑	☐	☐				
E. Hard hat Required all work areas	☑	☐	☐				
F. Hearing protection Used as required?	☑	☐	☐				
G. Gloves	☐	☐	☑				
H. Personal clothing/jewelry(Check ring policy)	☐	☑	☐	They were not aware that Massena has a ring policy	R. Kuhn	ongoing	BBL personnel will remove all jewelry prior to work
I. Personal flotation devices	☐	☑	☐	At this time they do not have a documented inspection sheet for personal flotation devices, but am sure they will generate one.	S. Hill/R. Kuhn	ongoing	BBL daily boat inspection checklist emailed to G. Rutherford on 5/6/05; checklist to be completed daily for each boat used on river; checklist includes inspection of PFD
J. Protective clothing Check JSA/JSP for what's required	☐	☐	☑				
18. SCAFFOLDING							
A. All braces in place w/pins	☐	☐	☑				
B. Competent person erection(Daily Written Inspection)	☐	☐	☑				
C. Hoisting procedures	☐	☐	☑				
D. Loading restrictions	☐	☐	☑				
E. Personal Tie-Off	☐	☐	☑				
F. Proper design & materials	☐	☐	☑				
G. Proper work platforms	☐	☐	☑				
H. Secure footing (level and plumb)/anchorage	☐	☐	☑				
I. Toprail, midrail and toeboard required	☐	☐	☑				
J. Wheels locked	☐	☐	☑				
19. SIGNS/WARNING							
A. Construction area signs Correct for hazards ?	☐	☐	☑	Need to look at this for river work	R. Kuhn	ongoing	BBL to work with Sevenson regarding placement of buoys upstream and downstream of work area
B. Containers labeled as required	☐	☐	☑	Need to label containers	R. Kuhn	4/29/2005	
C. Fire explosion hazard	☐	☐	☑				
D. Flag person/ground person(Required for backing trucks)	☐	☐	☑				
E. Flashers	☐	☐	☑				
F. Health hazards - Correct signage for hazard	☐	☑	☐	Not aware that they have any signage for samples being stored etc. prior to being taken to the Lab.			Samples will be submitted to the laboratory the day they are collected; if samples must be held on-site, samples will be placed in refrigerator located in shed at Outfall 001 labeled with "Environmental Samples"
G. Physical hazards	☐	☐	☑				
H. Railroad isolations Derailers & blue flag used	☐	☐	☑				
I. Traffic Control Traffic flow signed	☐	☐	☑				

SAFETY AND HEALTH EVALUATION OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

	OK	Not OK	NA	Comments	Person Responsible	Date Completed	BBL Comments
1. ADMINISTRATIVE CONTROLS							
J. Work overhead **(Signage & Barricades)**	☐	☐	☑				
20. STEEL ERECTION							
A. Fall Protection Plan	☐	☐	☑				
B. Power line clearance	☐	☐	☑				
C. Proper work platforms	☐	☐	☑				
D. Sling maintenance	☐	☐	☑				
E. Storage areas	☐	☐	☑				
F. Tag lines	☐	☐	☑				
21. ELECTRICAL/OTHER ENERGY SOURCES							
A. Air/fluid system at zero energy state	☐	☐	☑				
B. Assured grounding	☐	☐	☑				
C. Condition of extension cords	☐	☐	☑				
D. Hi Voltage Standard 32.60 requirements	☐	☐	☑				
E. Lockout/tagout system in place	☐	☐	☑				
F. Proper working clearances	☐	☐	☑				
a. Appropriate Switchgear access	☐	☐	☑				
b. Approach distances	☐	☐	☑				
c. Overhead lines **10' from lines or ground equipment**	☐	☐	☑				
G. Stored mechanical energy secured	☐	☐	☑				
H. Temporary Lighting	☐	☐	☑				
22. ADDITIONAL ITEMS							
A. Supervisor First Aid Trained	☑	☐	☐				
B. Modification to mobile equipment	☐	☐	☑				
C.	☐	☐	☐				
D.	☐	☐	☐				
E.	☐	☐	☐				
F.	☐	☐	☐				
G.	☐	☐	☐				
H.	☐	☐	☐				
I.	☐	☐	☐				
J.	☐	☐	☐				
K.	☐	☐	☐				

ALCOA

WEEKLY SCORED OBSERVATION REPORT FOR MASSENA GRASSE RIVER ROPS PROJECT

Date: 6-23-05 eve. shift Work Location(s): ROPS – River Pad area

Name of Observer: W. Moon (ARP), Jack Morrison (SES), Sam Travelstis (SES)

☐ Alcoa ☑ Contractor: SES ☐ Subcontractor:

Contractor: Contractor

Project: **Massena Grasse River ROPS Project**

Item No.	Item	N/A	Action Needed See Note (1)	Points Available	Points Awarded
	GENERAL REQUIREMENTS				
1	Are deficient items from previous inspections corrected or resolved? (If not, give reason on attached comment page.)			~~4~~ WOM	~~3~~ 4 WOM
2	Current AHAs and attached documents (such as permits) required for covering work are signed and available at worksite being observed or are located at office trailer.			4	4
3	Hot Work (welding, cutting, etc.): A current permit is in place and requirements are being followed (daily log sheet filled out, PPE, firewater, fire extinguisher, welding screens, compressed gas cylinders stored and used properly).	N/A		4	
4	Confined Space: Current permit is in place and requirements are being followed (competent person designated, confined space training met, daily entry log filled out).	N/A		4	
5	Hoisting and Rigging: Requirements are being followed, equipment is inspected and in good condition, dunnage is used properly, training/certifications are current and documented, etc.	N/A		4	
6	Excavations: A current permit is in place and requirements are being followed (competent person designated; underground utilities identified, marked, and protected; properly sloped or shored; barricaded/guarded properly; proper access and exits provided; daily inspection logs current).	N/A		4	
7	Fall Protection: Current JSPs are in place and requirements are being followed (floor openings protected, elevated platforms, training requirements met, equipment inspected and in good condition).	N/A		4	
8	Scaffolds and Ladders: Tagged, inspected, and properly used (handrails, toe boards, and base plates)	N/A		4	
9	Tools and Equipment: Correct for the work being performed				

Item No.	Item	N/A	Action Needed See Note (1)	Points Available	Points Awarded
	PERSONAL PROTECTIVE EQUIPMENT				
10	Hard hats are worn except where the JSA allows otherwise.			4	4
11	Proper footwear is worn as addressed in the JSA.			4	4
12	Eye and face protection are used as required.			4	4
13	Proper gloves are used as required.			4	4
14	PPE is adequate, stored properly, and clean.			4	4
15	Decontamination areas correctly set-up and supplied			4	4
16	Eye washes are stationed near work areas			4	4
	INDUSTRIAL HYGIENE				
17	Hazard Communication Program: MSDSs are current and accessible at the work site.			4	4
18	There is adequate lighting for the work areas observed.			~~4~~	3.5
19	Cold/heat stress procedures are followed.			4	4
20	Respiratory protection is used as required.	N/A		4	
21	Ventilation systems are used as required.	N/A		4	
22	Hearing protection is used as required.			4	4
23	The Lead/Asbestos Program is in place and being followed as required.	N/A		4	
24	Sanitation (drinking water, wash water, and toilets).			4	4
25	Personnel appear to be following established procedures for personal hygiene.			4	4
26	Facility showers are clean and well maintained.	N/A		4	
27	Break areas are clean and well maintained.			4	4
	ELECTRICAL				
28	Lock and tag procedures are followed as required.			4	4
29	GFCIs are inspected and in use as required.	N/A		4	4
30	Electrical installations and equipment are in safe working condition and grounded as required; cords are protected from damage.			4	4
	MISCELLANEOUS				
31	The work sites observed are properly barricaded and warning signs are in place.			4	4
32	Housekeeping: Walkways and work areas are clear of material and debris.			~~4~~	3.5
33	Proper lifting techniques are observed.			4	4
34	Mechanized Equipment: Daily logs and signoffs are completed; seat belts, lights, brakes, and horns are in place and operational.			4	4
35	Fire Protection: Flammables are labeled and stored properly.			4	4

Item No.	Item	N/A	Action Needed See Note (1)	Points Available	Points Awarded
	WASTE MANAGEMENT				
36	Drums and waste containers are properly labeled.			4	4
37	PPE is properly disposed.	N/A		4	
38	Maintenance area wastes are properly stored and labeled.			4	4
39	Waste Streams properly separated, characterized and placed in appropriate containers.	N/A		4	
40	Daily environmental inspections are being performed and documented.			4	4
41	Weekly inspections are being performed and documented			4	4
42	Monthly inspections for storage areas are being performed and documented.	N/A		4	
	River Work/Equipment				
43	All dredges & boats have completed pre-operational inspections in place			4	4
44.	All workers on river are wearing approved personal floatation devices.			4	4
45.	Perimeter safety rails are in place and used properly on dredges and barges.			4	4
46.	All working surfaces and on dredges, barges, and man boats are open, clear and clean from oil and other debris.			~~4~~ WOM	~~3.5~~ 4 WOM
47.	All safety equipment (horn, ring buoy, lights, fire extinguisher, etc) are in place on all vessels as required.			4	4
48.	Is there a life saving skiff dedicated for this project and does it have required emergency equipment on board.			4	4
49.	Required PPE is worn in this work area			4	4
	Processing Pad Work/Equipment N/A				
50.	E-stops are in place for moving equipment such as but not limited to conveyor belts etc.			4	
51.	All tanks are marked appropriately as potential confined spaces.			4	
52.	Only training and qualified personnel operate desanding plant, filter press and other equipment within Processing Pad area.			4	
53.	Procedures are written for the safe shut down/lockout of equipment when maintenance work is performed.			4	
54.	32.60 procedures are followed, equipment grounded as necessary if operating within potential 15' reach.			4	
55.	Cranes are inspected are inspected daily, swing radius is barricaded.			4	
56.	Process Pad working area is properly signed and barricaded.			4	
57.	Segregation of pedestrians and mobile equipment is in place in this work area.			4	
58.	Walking and working surfaces are free of debris, hoses, cords, etc that might present a trip, slip, fall, potential			4	
59.	Required PPE is worn in this work area.			4	

WEEKLY SCORED OBSERVATION REPORT
FOR DECONTAMINATION & DEMOLTION

Landfill Site Work/Equipment N/A					
Item No.		N/A	Action Needed See Note (1)	Points Available	Points Awarded
60.	Competent person is on site for excavation work.			4	
61.	Confined Space procedures are written and followed for any work involving manholes etc.			4	
62.	Mobile equipment pre-operational checks are pre-formed at the start of each shift for all equipment operated.			4	
63.	High voltage procedures are followed in this area.			4	
64.	Approved containers for gas etc. are used and they are properly labeled.			4	
65.	Manual work is minimized as possible and equipment is used to roll out liner fabric etc.			4	
66.	Cords are inspected before use and on a quarterly frequency.			4	
67.	Means of egress, and worker protection are used for those doing trench/ditch work.			4	
68.	Traffic patterns are in place and followed for equipment hauling to the landfill.			4	
				Total Points Possible	144
				Total Points Awarded	143
				Total Score (%)	99.3

Notes:

(1) Document the following on last page: Observation/deficiency, responsible supervisor/organization, and date corrected (observations/deficiency verified to be corrected by project safety.)

(2) The following ratings are a guide for the team performing the inspection. Upon completion, each inspected item should be rated as:

4 = Excellent 3 = Good 2 = Fair 1 = Poor 0 = Fail

Points will be deducted for severity of noncompliance items found in each category.

WEMOM, CDM ARP
Project Safety Signature

6/24/05
Date

WEEKLY SCORED OBSERVATION REPORT
FOR DECONTAMINATION & DEMOLTION

Responsible Manager/Supervisor Signature

WOMoon, ARP

Date

6/24/05

WEEKLY SCORED OBSERVATION REPORT
FOR DECONTAMINATION & DEMOLTION

Item No. (*)	Observation/Deficiency	Responsible Supervisor/Organization	Date Corrected
18	will add an additional to shine towards heater pump	Jack M.	6/30/05
32	continual improvement on housekeeping	Jack M.	ongoing
~~46~~ (WOM)			

(*) Indicate number of the inspection item found to be deficient (such as Item No. 3, Hot Work)

Comments:

DAILY SAFETY LOG

Sevenson Grasse River ROPS

DATE: 09/28/05

WORK PERIOD COVERED: 0700/ 1730 TOTAL MANHOURS: 83,890

WEATHER CONDITIONS: Partly Sunny 47°F/70 °F Wind NW@ 8 mph.

SUMMARY OF DAY'S WORK ACTIVITY: Continued Dredging and capping. Capping operation and Barges were inspected today and operation was excellent. All safety items were in place. Continued to process material at the process pad. All filter presses were on line. Continued processing material with Geo Tube system. Continued to haul material from scows at river material was stockpiled at the process pad. Continued to haul material from process pad to land fill. Landfill operation was inspected today and operation and housekeeping were excellent. Continued mobilization of Hopper for use with quick Lime. Divers were on site today and continued work on silt curtains.

MONITORING EQUIPMENT UTILIZED BY HEALTH & SAFETY:
5- MULTI RAE PGM-50 gas meters
7- Dust Trak 8520 monitors
5- Air Check-52 Personal pumps

PROTECTIVE CLOTHING AND EQUIPMENT BEING USED BY TASK: Level D protection for all work out side of exclusion zones including hard hats, safety glasses, safety vests, rain jackets, PFD's, and steel toe/ metatarsal work boots. Modified Level D protection utilized for work inside exclusion zones including TYVEK coveralls, over boots, Nitril gloves, cotton gloves, taped at the wrist and ankle (except the river crew due to the possibility of falling into the water and being trapped). Level C full-face respirator in combination with D modified protection utilized for dumping D.E. into the feed storage tanks. Leather gloves utilized for maintenance activities. Continued to run water truck as needed throughout the day.

PHYSICAL CONDITION OF WORKERS (any heat or cold stress or other medical problems): No heat stress or any other medical problems reported.

ACCIDENTS OR BREACH OF PROCEDURES: No accidents or breaches of procedure were observed or reported.

DESCRIPTION OF MONITORING AND AIR SAMPLES TAKEN: Multi Rae monitors were placed on the Filter Press, Shaker Tank, and Dredge. Upwind and Downwind Dust monitoring was performed at the Process Pad, Landfill and SLF CRZ. (NIOSH Method 5503)Personnel pumps were run at the land fill Shaker Tank and Dredge.

MISCELLANEOUS: Continued HASP training.

NAME: Scott Allaire TITLE: Health & Safety Officer

SIGNATURE: Scott Allaire

Sevenson Environmental Grasse River Project

Safety Observation Report (SOR)

Date: ~~4-29~~ 5-2 Time: 17:20

Person Submitting This Report: Mike Crystal

Observation: Running on PAD

Action Taken:

Immediate Corrective Action: Informed SSO; LABOR NO Running

Action to Prevent Recurrence: SAFety meeting Discussed

Indirect Cause: seemed Pressure to Hurry

Corrective Action: Informed crew & Individual

Commitment?

Further Action or Help Needed? NA

Signature: [signature]

SAFE STANDARD OPERATING PROCEDURE -			Page
Subject: ROPS	**Title: Dredging**		**No: 1 of 2**
Date: September 30/05, 2005	**Supersedes: n/a**	**Written by: S. Allaire**	**Approved by: M. Mahar**
Audited By: Scott Allaire		***Date: _____ 2005***	***Shift:***
Reviewed by: Matt Sceusa			

Black Text = Procedure Red Text = Safety Green Text = Environmental

Purpose: This procedure supplements the approved ROPS operation plan.

SAFE STANDARD OPERATING PROCEDURE -			Page
Subject: ROPS	Title: ALTERNATIVE DREDGE –SWINGING LADDER HYDRAULIC PIPELINE DREDGE		No: 2 of 2
Date: SEPT. 30, 2005	Supersedes: N/A	Written by:	Approved by:
Audited By:		*Date: _Sept 30, 2005*	*Shift:*
Reviewed by			

Black Text = Procedure Red Text = Safety Green Text = Environmental

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:	Followed Procedure? Yes	No
1. Level Modified D PPE to be worn by all workers including Tug Boat Captain.		
2. Hard Hat, Safety Glasses, Steel Toe Boots, and Safety Glasses.		
3. 100% Fall Protection, Waist worn PFD (Inclusive to Deck Personnel on Barges)		
4. Hearing Protection (if applies) 5. Maintenance of Cutter Head and Swinging Ladder Assembly (Visual Inspection of Cutter Head & Ladder Assembly) 1. Cutter Head is intact, and has limited or no damage to cutter blades (No Action Required) 2. Swing ladder assembly is intact, and has no damaged or loose elements (No Action required) 3. Cutterhead and/or ladder assembly has damaged blades Upgrade of PPE Modified Level C Tyvec, Cotton, Latex, Nitril Gloves, Over boots)		

PROCEDURE: Normal Operations	Yes	No
1. Dredged material will be captured at the suction mouth, and will be transported to the disposal site through the suction line on the swing ladder assembly, the pump and the discharge pipe line. A booster will be required.		
2. The dredge will move along the cut using the synchronous use of the two spud barges and the walking (pushing) spud. When longer moves from one dredge area to the next is required, the dredge will be moved by the Tug Boat.		
3. The active cutterhead at the end of the ladder and the suction pipe will be approximately 2.5 feet in diameter. The cut thickness will not exceed 80% of the cutter diameter to limit and avoid excessive turbidity release in the water column.		
4. The dredge positioning will be accomplished using Dredge Pak or equivalent electronic monitoring system.		
5. Visual inspection of the cutterhead and ladder assembly will be accomplished on a routine basis. The ladder and cutter will be lifted out of the water for the visual inspection. This frequency can and will be increased based on judgement of the operator when working in large boulder areas.		
Environmental: Possible Release into River From Dredge (Tug Boat and Dredge Will be Equipped with Oil Boom, Diapers) And all Emergency Notification will be followed.	Yes	No
1. Spillage will be handled as part of the established spill control plan.		

Stephen Frost, MSPH, CIH
Occupational Health and Safety Consultant
155 Aloha St., Suite 303
Seattle, WA 98109
Office: (206) 284-8857 / Cell: (206) 214-8990

August 14, 2005

Alcoa USA
P.O. Box 150
Massena, New York 13662

Subject: Health and Safety Inspection of Grasse River Dredging Project

INTRODUCTION

On Aug. 31 through Sept. 1, 2005, I conducted a health and safety inspection of Alcoa's dredging operations on the Grasse River, Massena, New York. The purpose of this inspection was to identify any significant deficiencies in the nature or implementation of required health and safety controls for the dredging work which may have been overlooked by the resident contractors. There was also an intent to identify opportunities to improve the safety performance of the dredging operations through the application of industry-specific loss control techniques that may not have otherwise been applied to the project. And finally, senior management requested that a review of Coast Guard and federal safety and health regulations applicable to dredging be conducted to ensure compliance on current and future dredging projects. The results of this regulatory review, however, will be presented in a separate report. This discussion addresses the observations that were made during my visit and includes recommendations for correcting any health and safety deficiencies noted during the inspection.

INITIAL SITE VISIT

When I arrived at the jobsite on Wednesday morning, Aug. 31, I met with Alcoa's Program Manager, Larry McShay, and Blasland, Bouck & Lee's (BBL) Site Construction Manager, Dan Casey, to discuss the purpose of my visit and my planned inspection activities for the day. We agreed that I would limit my inspection efforts to the on-water dredging work, as well as, other marine support activities (i.e. debris removal, silt curtain maintenance by divers, small boat operations, etc.). It would also be important for me to have an understanding of overall site operations in addition to required safety and health protocols for accessing the site. And to this end, I was directed to Camp Dresser & McKee's (CDM) Senior Project Manager, William Moon, and CDM's Safety Manager, Terry LaPaar, for an on-site safety and health orientation.

Mr. Moon and Mr. LaPaar provided a very comprehensive overview of site operations, contractor relationships, and site safety program requirements. They also discussed several significant safety incidents which had occurred at the site within recent weeks including the partial amputation of a worker's index finger, a trip and fall incident resulting in a fractured hand, dropping a welding machine into the water, and the

capsizing of a work boat that was overloaded with equipment. Not only were these incidents noteworthy because of their severity but they also provided an impetus, in part, for looking at site operations from a broader perspective to see if any systematic problems existed at the site which could be contributing to these adverse events.

After completing the site orientation, Dan Casey took me on a tour of the dock area where I was able to view the staging of a large, land-based, mobile crane and the layout of the site control zones on the dock and work barges. A barge with a small excavator was moored to the dock. Temporary fencing had been erected around the perimeter of the barge to establish a decontamination area and access corridor for those barge workers handling contaminated debris removed from the water by the excavator. I also noted the conspicuous placement of an emergency eyewash in the work area, a portable fire extinguisher near a flammable storage locker, and the establishment of well demarcated and segregated walkways for workers transiting between the main office and dock area. It was apparent, too, that housekeeping in and around the dock area was very good. Unfortunately, because of severe weather, all dredging work for the day had stopped and I was not able to observe any work activities or on-water operations. I spent the remainder of the day reviewing contractor health and safety plans and incident reports.

RETURN VISIT

When I returned to the site on Wednesday morning, Sept. 1, I met with Sevenson's Safety Supervisor, Scott Allaire, who provided me with a visitor orientation of their operations and discussed the main features of Sevenson's site safety and health program. We then joined a CDM representative for a boat tour of the dredging operations. Prior to boarding the tour boat, Scott and I signed a boat passenger log and were issued personal flotation devices. We boarded the boat and were taken to the dredging area, staying just outside of the silt curtain. I observed a barge-mounted excavator removing submerged debris from the near-shore that was loaded into a small scow moored to side of the excavator barge. There was a significant forward list (>5 degrees) to the barge and it was not apparent from my view angle if the excavator was secured to the barge. I also noted the operation of a small, auger-head suction dredge that was working very close to shore. Two large anchor buoys were located at each end of the silt curtain to provide a base of attachment for the curtains and to secure the winch lines needed to move the dredge. The majority of stationary support cables had warning flags fastened to them. All personnel involved in these operations were wearing Tyvek coveralls, hard hats and safety glasses, and personal flotation devices.

Some time was also spent observing work activities at the dock area. I noted a small work crew moving equipment on an excavator barge that was moored to the dock and observed others boarding a small work skiff. Two very large hopper barges were moored side-by-side at the dock that were to be used to transport clean capping material to the remediation area. An extension ladder was being used to access the deck of the hopper barges from the dock. I did not find anything unusual in the condition of this equipment or in the work practices of the site personnel. After completing our visit to the dock area, we ended our tour of the dredging operations and returned to the office.

FINDINGS AND RECOMMENDATIONS

I did not find any significant health and safety deficiencies, in terms of unsafe conditions or work practices, during my inspection of the dredging project. In fact, the opposite was predominantly true. I was impressed with the efforts that were being made by the contractors and their safety organizations to implement needed safety controls at the jobsite by, most notably, establishing regulated areas, enforcing personal protective requirements, erecting vehicle traffic lanes and posting speed limits, staging portable fire extinguishers and emergency eyewashes in the work area to name a few. It was apparent too, that both CDM and Sevenson had systems in place for tracking jobsite hazards, communicating findings to the site workers (i.e. Tailgate safety meetings, ROPS), investigating accidents, conducting regular inspections of the jobsite, training workers, and ensuring site personnel were medically qualified to do their work. These are the key elements of a successful safety program required by Hazwoper and undoubtedly by Alcoa's contractor safety program. Because of my limited time on-site, I was not able to conduct a records check of the aforementioned programs to evaluate record keeping completeness and quality. Nonetheless, it was clear that these programs were in place and all levels of site management were aware of them.

The recommendations that I have to offer are minor in nature and are presented with the intent of simply highlighting certain site conditions, which may develop into real hazards as work progresses. In some cases, my judgements are based on incomplete information and may not be valid. In other cases, there are regulatory drivers underlying the assessment. For the sake of complete disclosure, though, I have mentioned all of them with the understanding that the resident safety organizations will evaluate my claims and determine which ones are worth pursuing.

I recommend, for example, that fixed ladders be installed on the sides of the hopper barges to allow the tug crews access to the barges without having to use extension ladders. Also, fall hazards on board the barges should be evaluated, as Federal OSHA requires that fall protection be used when there is a possibility of falling six feet or more to the lower deck of a dock or vessel moored to a barge. I would also evaluate the sizing and stability of the excavator barges. The US Army Corps of Engineers recommends that floating crane platforms not list more than 5 degrees. I think this standard should also apply to the excavator barges. And be sure to verify that the excavators are securely lashed to the barges. There may also be some job functions on-site where there is no reasonable possibility of contacting the contaminated sediments and, as such, the use of protective clothing in these cases would not be necessary. Given the heat stress hazard associated with wearing protective clothing, this issue may be worth looking at.

The last point to be made concerns the significant incidents that have occurred on-site as disclosed during my initial site visit. In reviewing the incident reports I noted that roughly half (4), failed to mention immediate and basic causes of the accident. In other reports, primary causes were listed but not secondary (basic). In all cases, though, corrective actions were recommended. In order to determine if there are systematic failures in the loss control program, it is important that all basic causes for each incident be identified. All corrective measures should address the basic causes first and foremost.

It is helpful to use standard categories for describing immediate and basic causes so that different incidents can be compared and trends identified. There are many different systems available in the safety industry for doing this. The one I prefer is called the "Systematic Cause Analysis Technique" developed by the DNV Foundation. They offer a flow chart that categorizes immediate causes into substandard acts and substandard conditions (with associated subcategories) and basic causes into personal factors and job factors. It may be helpful to adopt this causal analysis system on this project.

I hope you find my comments helpful. Kudos to site management for being so diligent in implementing such a comprehensive safety and health program on this project. Please call if you have any questions or concerns about my comments or recommendations.

Respectfully Submitted By:

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September 19, 2005

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Subject: Review of Dredging Requirements and Agency Jurisdictions

During my visit to the Grasse River dredging project on August 31, 2005, I was asked to research the primary agency responsible for enforcing worker health and safety requirements on marine dredging projects, determine who has primary responsibility for reporting spills on a multi-employer jobsite, and identify other health and safety regulations applicable to dredging that may apply not only to this project but to future projects as well. It is important to note that my research was limited to health and safety requirements only and does not include a discussion of the many environmental regulatory requirements normally associated with environmental remediation projects.

With regard to the primary agency responsible for enforcing worker health and safety requirements, there are three government agencies that share responsibility for this matter - New York State L&I, Federal OSHA, and the US Coast Guard. In New York State, the Department of Labor and Industry has a very limited role in enforcing worker safety regulations. Their primary mission is to advise small businesses (< 250 employees) on how to comply with Federal OSHA requirements. Federal OSHA is the lead enforcement agency in New York State. They promulgate and enforce Federal OSHA worker health regulations, most notably, 29 CFR 1910 and 1926. Their jurisdiction includes all land-based operations and all waters in-shore of the Outer Continental Shelf.

With respect to OSHA enforcement of maritime operations, the extent of OSHA jurisdiction on maritime vessels depends upon whether the vessel has been classified and documented by the US Coast Guard as “inspected” or “uninspected.” Coast Guard regulations for uninspected vessels are limited and inspection responsibility is shared with OSHA. With regard to inspected vessels, the Coast Guard and OSHA entered into a Memorandum of Understanding (MOU) in 1983 in order to avoid a duplication of effort. The MOU states that OSHA will not enforce the OSH Act with respect to the working condition of seaman aboard inspected vessels. To determine which vessels must be inspected and certified, it is necessary to reference a table of “Vessel Types and Classes” found in Title 46, Chapter I, Section 2.01-7.

On multi-employer jobsites where one or more subcontractors may be working, there is no simple answer as to who has primary responsibility for reporting a spill to the Department of Environmental Conservation (DEC). The requirement in New York State is that spills be reported within 2 hrs. of the event. If there is a failure to report within this time frame and the DEC decides to pursue the matter, they will consider all potentially responsible parties liable. This could include the subcontractor who created the spill, the

general contractor overseeing their work, and possibly the property owner or company who hired these contractors for the project. The DEC will rely on the Attorney Generals Office to determine who is ultimately responsible for spill reporting in each situation. The important thing to remember is that the 2 hr. reporting deadline must be met and any of the potentially responsible parties can make the initial call. To avoid confusion on the matter, project management should establish a spill reporting procedure for their own project that specifies a line-of-authority and protocol for spill notification and communicate this procedure to all project personnel. Keep in mind too, that other government agencies, such as, the National Response Center and US Coast Guard, may also require separate notification in a particular spill situation. Notification to one agency does not necessarily satisfy the reporting requirements of the others.

In terms of other health and safety regulations that apply to dredging operations, in general, the vast majority are covered by Federal OSHA. In certain situations, the client may impose their own safety requirements. The US Army Corps of Engineers, for example, requires their contractors to incorporate all applicable sections of their "Health and Safety Program Manual, EM 385-1-1" into their site-specific safety programs when working on their projects. In other cases, specific parts of the OSHA standard may take precedence on a given project. This is typically the case if the dredging work is also part of a superfund cleanup action. Under these circumstances, OSHA's Hazwoper standard (29 CFR 1910.120) would prevail. If the remediation work also involves contact with certain substances regulated by OSHA vertical standards, such as with arsenic, cadmium, and lead, then the project must accommodate the additional exposure control requirements required by these regulated substances.

For work on the water, numerous US Coast Guard rules apply that cover such issues as vessel right-of-way, safe boat operations, required safety equipment, vessel registration, crew certification, navigation, and fire protection systems, to name a few. The experienced boat operators who are typically contracted to support marine dredging work, however, usually know these rules. To verify compliance, though, most of these Coast Guard rules can be found in the Code of Federal Regulations, Titles 33, 46 and 48. For certain marine vessels that carry certain quantities of petroleum fuels or engage in certain fuel transfer operations, the Oil and Pollution Act of 1990 may apply. This Act requires that vessel operator carry spill response equipment and have personnel trained in oil spill response.

I sincerely hope the above discussion addresses the jurisdictional, reporting liability, and regulatory requirement questions raised during my initial visit to the Grasse River dredging project. If you have any question about this regulatory review or you need additional information, please don't hesitate to call.

Respectfully Submitted by:

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Stephen Frost, CIH

Sevenson Environmental Services
Safety Observation Report (SOR) Tracking Report

No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected By
001	3/27/05	Fred Rose	Potential incident with grease and grit on gages of cutting torches	When changing bottle stand to the opposite side of the gauges	Discussed at safety meeting with entire crew. Instructed workers to inspect gages prior to installing	Scott Allaire	NA	3/28/05	NA
002	4/13/05	Mike Crystal	Workers installing fence posts	Use of Hammer to install fence post	Workers were using pneumatic driver. Two Man crew	Kelly Thibodeuax	NA	4/13/05	Mike Crystal
003	4/15/05	Scott Allaire	Operator observed breaking 15" rule	Safety Meeting	Discussed with worker and entire crew. High Voltage training Spotter and buddy system	Scott Allaire	NA	4/15/05	Scott Allaire
004	4/18/05	Scott Allaire	Un stable set of wooden stairs left from previous contractor.	Tagged out and Destroyed	Stairs were tagged out of service and latter dismantled	Kelly Thibodeaux	4/18/05	4/18/05	Scott Allaire
005	4/19/05	Dave Hina	High winds during liner installation	Cease project temporarily	Checked weather and wind speed and Suspended operation until the following day	Kelly Thibodeaux	4/18/05	4/18/05	Kelly Thibodeuax
006	4/20/05	Scott Allaire	Liner crew moving Generator	NA	Two workers carrying generator, generatoror was placed in secondary containment and fire extinguisher was in place.	Safe Plan Of Action was followed	NA	4/20/05	Scott Allaire
007	4/20/05	Scott Allaire	Road Crossing (Equipment)	Assistance in crossing the road	Operator requested assistance crossing. Purchased Stop paddles	Mike Elia	4/22/05	4/27/05	Scott Allaire
008	4/26/05	Mike Crystal	Person in water without PFD	Inform person to wear proper PFD w/in 5 ft. of water	Informed worker to wear PFD within 5" of the water. Notified Supervisor	Kelly Thibodeaux	4/26/05	4/26/05	Mike Crystal
009	4/27/05	Scott Allaire	Worker using ladder incorrectly	Stop work and review ladder safety	Stopped Work. Reviewed ladder safety with the worker and entire crew at following days safety meeting	Kelly Thibodeaux	4/27/05	4/27/05 4/28/05	Scott Allaire
010	4/28/05	Terry LaParr	Loader left running with bucket elevated and a load of stone in it	Equipment to be properly stored	Notified ground foreman. Spoke with entire crew	Mike Elia	4/28/05	4/28/05	Kelly Thibodeuax
011	5/2/05	Mike Crystal	Worker observed running on pad	Informed employee of no running rule	Informed individual that there is to be no running on site. Informed entire crew that there is no running on site	Mike Elia	5/2/05	5/2/05 5/3/05	Kelly Thibodeuax
012	5/3/05	Mike Crystal	4 Alcoa electricians on process pad 1 individual was smoking	Asked individual not to smoke on pad	Asked individual not to smoke on process pad. Alcoa informed plant personnel of Sevenson policy	Mike Crystal	5/3/05	5/3/05	Kelly Thibodeuax
013	5/3/05	Jack Morrison	Crane operating to close to high Voltage Line	Stop crane and contact Alcoa authorities	Alcoa De Energized line during mobilization	Jack Morrison	5/3/05	5/3/05	Kelly Thibodeuax
014	5/3/05	Mike Crystal	Vision of fork truck operator impaired due to load.	Ask laborer to guide operator til end	Operator stopped and instructed laborer to spot for him	Steve Fountain	5/3/05	5/3/05	Kelly Thibodeuax
015	5/4/05	Mike Crystal	Wearing Hard Hat Backwards	Ask laborer to adjust his hard hat	Workers were talked to, surveyor was told he could wear hard hat backwards while surveying all others to were hard hat regular	Mike Elia	5/4/05	5/4/05	Kelly Thibodeuax
016	5/5/05	Jack Morrison	Relocate And Block Crane due to unstable conditions	Stop and reset crane	Stopped work, Relocated and blocked cranes.Two and a half hours	Mike Elia	5/5/05	5/5/05	Jack Morrison
017	5/5/05	Fred Rose	Frustrated driver speeding on site	Report dangerous driver	Reported incident to Alcoa. Incident was brought up at morning safety meeting and workers were told to get a licence plate #	Jack Morrison	5/5/05	5/6/05	Scott Allaire
018	5/5/05	John Wheaton	Spotter prevented tractor trailer driver from hitting power pole	Notify truck of potential danger	Spotters for all trucks backing up. Drivers need to be aware of surrounding conditions	Jan Lennox	5/5/05	5/5/05	Scott Allaire
019	5/6/05	Scott Allaire	Heavy Equipment from separate contractor leaking hydraulic fluid.	Place something to soak up leak	Ses placed diapers under leak and notified contractor. Inspect all equipment upon arrival at site	Mike Elia	5/6/05	5/6/05	Scott Allaire
020	5/7/05	Scott Allaire	Communication between ground crew with tag lines and crew receiving load	NA	Praised workers at safety meeting for the use of tag lines and excellent communication	Scott Allaire	5/7/05	5/7/05	Scott Allaire
021	5/7/05	Sam Tavelaris	Proper PPE while using chain saw	NA	Used right PPE for job No short Cuts	Sam Tavelaris	5/10/05	5/10/05	Sam Tavelaris
022	5/10/05	John Paliemeri	Surveyor felt in danger due to work being performed by Alcoa electricians	NA	Alcoa was made aware of the situation and talked to the electricians	Mike Elia	5/10/05	5/10/05	Scott Allaire
023	5/10/05	Doug Pike	Worker observed nylon strap being cut on as load was being suspended	Notify safety officer	Notified operator to set load down prior to it breaking. Changed rigging for the load (Cabled Chocker)	Doug Pike	5/10/05	5/10/05	Kelly Thibodeaux
024	5/12/05	Steve Fountain	Delivery truck driver Without proper PPE	Stopped operation and changed procedure	Notified driver of proper PPE for being outside of his truck. Posted signage at guard shack for PPE requirements	Scott Allaire	5/12/05	5/13/05	Mike Crystal
025	5/10/05	Teamster	1 flagman at road crossings at times. If there were 2 flagmen, one should be posted at gate 4 and one flagman at river entrance	Need at least one more flag man	One flagman sufficient for road crossing area. Traffic is not substantial for two flagmen. Operator needs to wait for community traffic to pass	Kelly Thibodeaux	5/13/05	5/13/05	Scott Allaire
026	5/14/05	Larry Williams	Corner of break trailer contains jagged edges on metal siding.	Notify Health and Safety Officer	Duct taped edging to prevent workforce from being cut	Mike Elia	5/14/05	5/14/05	Kelly Thibodeaux
027	5/17/05	Greg Bailey	Missing swing gate/ safety chain at top of access top	Install Safety Chain	Installed chain prior to swing gate arrival	Kelly Thibodeaux	5/17/05	5/17/05	Scott Allaire
028	5/20/05	James Jones	Berm to process pad slip, trip, fall hazard	Instruct workers to not climb berms	Workers were instructed at safety meeting not to climb berms due to slips, trips, falls. Further instructed to walk around to ramped areas	Kelly Thibodeaux	5/20/05	5/21/05	Scott Allaire
029	5/20/05	Anynomous	Operator backing up towards water truck without hearing horn signal	Sound air-horn to notify Operator	Operators need to be more attentive to work surroundings	Kelly Thibodeaux	5/20/05	5/21/05	Scott Allaire
030	5/21/05	Scott Allaire	Observed worker inspecting electrical cord prior to use.	Review at health and safety meeting, put on daily SPA	Positive reinforcement to workers for inspection of all tools	Kelly Thibodeux	5/21/05	5/22/05	Scott Allaire
031	5/21/05	Scott Allaire	Observed workers following protocol for CSE	Follow SPA's and SOP's	Positive reinforcement for workers to follow SPA	Sam Tavelaris	5/23/05	5/24/05	Scott Allaire

Grasse River ROPS Project
Massena, New York

Sevenson Environmental Services
Safety Observation Report (SOR) Tracking Report

No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected By
032	5/23/05	Sam Tavelaris	Worker observed nylon strap being cut while being ratcheted tight.	Instruct worker on proper techniques	Utilizing appropriate strapping and appropriate methods for tasks	Sam Tavelaris	5/23/05	5/23/05	Scott Allaire
033	5/23/05	Scott Allaire	Robin Gross observed Lull operating with out back up light	NA	Went down and checked the equipment. That piece of equipment does not have a rear light from the manufacturer	Robyn Gross	5/23/05	5/23/05	Scott Allaire
034	5/23/05	NA	Cluttered work area prior to filling carbon tanks inhibiting work	Better housekeeping organization within the work areas	SES supervision to coordinated daily housekeeping of work area	Larry Williams	5/23/05	5/23/05	Kelly Thibodeax
035	5/23/05	Paul Jung	No GFIC protection on generator in use on pad	Provide GFI Equipment and inform employees	Applied GFIC to generator and discussed GFI protection at safety meeting	Paul Jung	5/23/05	5/23/05	Scott Allaire
036	5/24/05	Jack Morrison	Truck driver wondering around process pad without proper PPE	Have guards direct drivers to remain in trucks until an escort is available	Sent him to his truck. Spoke with his supervisor after driver became belligerent. Discussed with workers that they need to be more aware of drivers	Scott Allaire	5/23/05	5/24/05	Mike Crystal
037	5/24/05	Kelly Tribodeaux	Alcoa employee reported improper LTT at building 56	Discuss with SES trades and supervision	Valve was locked out and workers reviewed Lock Tag Try procedures at safety meeting	Kelly Thibodeaux,	5/24/05	5/25/05	Scott Allaire
038	5/24/05	Steve Fountain	Cluttered area by Mod. Tank	Better organization / Better house keeping	House Keeping. Moved and organized pallets	Steve Fountain	5/24/05	5/24/05	Kelly Thibodeuax
039	5/24/05	Scott Allaire	Laborer setting up oxy/act. Torches within 50 feet of fuel storage tank	Relocate hot work activities / H&S to add signage near fuel tanks	Notified H&S H&S instructed worker to relocate work further away from fuel storage. Awareness of surroundings. Discussed in safety meetings	Jack Morrison	5/24/05	5/24/05	Kelly Thibodeaux
040	5/26/05	Scott Allaire	Fork lift inspection sheet had not been completed. Yet equipment was in use	Discussed the importance of equipment inspection sheets with operators	Discussed importance of pre use inspection with all operators at the end of the day and again in the morning safety meeting	Kelly Thibodeaux	5/26/05	5/27/05	Scott Allaire
041	5/26/05	Scott Allaire	Worker observed without PFD on while in wheel house of tug	Discussed using the buddy system to check each other for proper PPE that is requested to be used	Posted signs at foot of dock. Discussed buddy system with workers	Mike Elia	5/26/05	5/26/05	Scott Allaire
042	5/26/05	Robyn Gross	Subcontractor loading truck with ring on	Follow HASP, SOP	Informed Forman. Discussed subject at safety meeting watching out for others	Mike Elia	5/26/05	5/27/05	Kelly Thibodeaux
043	5/27/05	Greg Washburn	De-sander and feed tanks need safety chain	Rope or Temporary barricade to be replaced by chains and snaps	Order and installed chain on all tanks	Jack Morrison	5/27/05	5/30/05	Kelly Thibodeaux
044	5/30/05	Martin Parker	Worker suggested including new lock out tag in each piece of equipment. (Especially for shift change)	Re-asses need for tags for equipment	Tags were ordered and placed in equipment upon arrival	Jack Morrison	5/30/05	6/6/05	Scott Allaire
045	5/31/05	Fred Rose	Worker turned in extension cord that was defective	Inspection regularly and inform workers	Cord was tagged out of service. Reinforced that safety meetings topics are being heard	Kelly Thibodeaux	5/31/05	5/31/05	Scott Allaire
046	6/1/05	James Jones	Softeners needed for sharp corners to protect rigging	Apply Softeners to sharp Corners	Ordered softeners from I&I sling	Jack Morrison	6/1/05	6/3/05	Scott Allaire
047	6/1/05	Jack Morrison	Person entering Mod. Tank without ladder	Require workers to use a ladder while entering and exiting the tank	Stopped work and instructed workers to use two ladders to access tank	Jack Morrison	6/1/05	6/1/05	Scott Allaire
048	6/4/05	Tony Moselle	Community driver to not yield to traffic control personnel when flagging traffic	Worker gave safety officer license plate number and company name and H&S contacted drivers employee. Company sent driver	Report license plate number to safety personnel	Tony Moselle	6/4/05	6/4/05	Scott Allaire
049	6/6/05	Bruce Cook	Broken pallet by office trailers with nails protruding	Remove broken Pallet	Pallet was removed and nails bent over	John Wheaton	6/6/05	6/6/05	Kelly Thibodeaux
050	6/7/05	Ken Summerfield	Gate number 4 signage not clear and ambulance had difficulty finding gate	Install Better Lighting and signage	New signs were ordered for gate.	Ken Somerfield	6/7/05	6/15/05	Scott Allaire
051	6/9/05	Larry Williams	No emergency stop switch on stacking conveyor	Install Emergency Stops Switches	Switch was ordered the following day and installed upon arriving on site	Jack Morrison	6/9/05	6/13/05	Scott Allaire
052	6/9/05	Larry Williams	Concern of eye wash station water causing a burn to the face or eyes on hot days	May need to place in cooler area	Install tarp to place in cool area	Jack Morrison	6/9/05	7/7/05	Mike Crystal
053	6/10/05	Romeo Nathan	Steel cable from dredge ended up in battery compartment and caused a spark	Installed straps and cover batteries	Cover needs to be installed over battery box	Mike Elia	6/10/05	6/10/05	Jack Morrison
054	6/13/05	James Jones	Worker observed nuts and bolts from canopy of filter press had come loose	Worker informed supervisor and all nuts were checked and tightened	Tighten all bolts	Doug Pike	6/13/05	6/14/05	Larry Williams
055	6/14/05	Scott Allaire	Worker communication between dredge, booster pump, shaker tank, and Presses was excellent.	NA	Continue with good communication throughout the site	Kelly Thibodeaux	6/14/05	6/14/05	Scott Allaire
056	6/16/05	Brad Day	No E-Stop on Press #2 The E- Stop Button is in place.	Install E Stop	Ordered and installed cable and clamps on Press #2.	Larry Williams	6/16/05	7/6/05	Kelly Thibadeaux
057	6/17/05	Brad Day	Trip Hazard on Shaker due to valve handle and poor lighting.	Need additional lighting around shaker	Installed better lighting for shaker and repainted handle	Sam Tavelaris	6/17/05	6/22/05	Jack Morrison
058	6/17/05	Sam Travelaris	Securing PPE Bins During Rain	Installed new CRZ	Put sheds at each CRZ	Sam Tavelaris	6/25/05	6/27/05	Scott Allaire
059	6/17/05	Jeff Boulden	Tripping hazard on Bag Filter Platform	Install Grating	Put grating in void	J Morrison	6/25/05	7/6/05	Scott Allaire
060	6/17/05	James Jock	Handrail on V-Tank Ladder too short	Extend Handrails	Added Extensions	T Jeziorski	6/25/05	6/25/05	Kelly Thibodeaux
061	6/17/05	Keith Brossett	Handles on spud pins on Debris Barge	Add Handles to pins	Added handles to pins	Kelly Thibodeaux	6/25/05	7/6/05	Mike Elia
062	6/18/05	Ralph Cree	Lifting fuel tank for marine equipment.	Required Better Lifting Device	Dedicated 2-4" Nylon straps dedicated to fuel tanks	Mike Elia	6/25/05	6/27/05	Scott Alaire
063	6/18/05	Pete Pesaresi	Broken office chair	Remove Chair From Service	Replaced with new chair	P Pesaresi	6/18/05	6/18/05	Scott Alaire
064	6/20/05	Brad Day	Eye washes on Presses and Shaker	Revisited number of eye was stations and locations	Eye washes in appropriate locations per drawing	S Allaire	NA	N/A	Mike Crystal
065	6/21/05	Robert Crites	Install fans in press areas for air flow	None	Determine fans could cause unacceptable air borne dust with potential PCB particles	S Allaire	6/23/05	6/22/05	Mike Crystal

Sevenson Environmental Services
Safety Observation Report (SOR) Tracking Report

No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected By
066	6/21/05	Terry LaPar	Reaching into dredge auger w/out gloves	Enforce the use of Proper PPE	Employee counseled and written up	K Thibodeaux	6/21/05	6/21/05	Scott Allaire
067	6/22/05	Scott Allaire	Worker standing on scow while moving	Discussed with workers acceptable Boat SOP	This is standard marine operation. Requested get in boat when possible	K Thibodeaux	6/22/05	6/22/05	K Thibodeaux
068	6/23/05	James Jones	Proper PPE before entering work zone	Proper PPE discussed in Daily Safety Meetings	Installed signs	S Allaire	6/23/05	6/23/05	Scott Allaire
069	6/24/05	Martin Barker	Loose panel on Mud Cat Engine Compartment	Reinstalled Panel	Secured panel so it would not vibrate loose	Keith Brossett	6/26/05	6/27/05	Jack Morrison
070	6/24/05	Bruce Cook	Trash can was not labeled	Label trash can	Labeled Trash Can	Bill Moon	6/27/05	6/24/05	Kelly Thibodeaux
071	6/24/05	Bruce Cook	Manhole covered by pallet.	Fabricate plywood manhole cover	Removed pallet. Installed plywood. Placed cones.	John Wheaton	6/24/05	6/24/05	Kelly Thibodeaux
072	6/27/05	James Jones	Safety clip vibrated out of camlock	Inspect and Replace pins	Worker wiring clips in to prevent vibrating out	LT Williams	7/9/05	7/9/05	Kelly Thibadeaux
073	6/27/05	Dan Wessel	Oil sheen visible in Work Zone 2	When sheen present deploy oil booms	Capturing floating oil with workers in boats. Safety Meetings	M Elia	6/27/05	6/28/05	Scott Allaire
074	6/27/05	James Jones	Removing grating on Mix Tanks while dumping DE	Leave grating on tanks while dumping DE	SOP to leave grating in place	Larry Williams	6/27/05	6/27/05	Scott Allaire
075	6/28/05	Dan Wessell	Workers taking additional breaks due to heat	Instruct crew to take more breaks	More breaks given and instructed to drink more fluids	Larry Williams	NA	N/A	Scott Allaire
076	6/28/05	Jack Morrison	Fuel nozzles need back pressure shutoffs	Order fuel nozzles	Some on site, ordering more. Will Replace	Javk Morrison	7/11/05	7/9/05	Kelly Thibodeaux
077	6/28/05	Tom Jeziorrski	Help cool workers on extreme hot day	Install misting fans	Will be installed on pad	Jack Morrison	07/09/05		Scott Allaire
078	6/28/05	V Vari	Laborer telling another to take a break.	Buddy System. Emphasize breaks.	Emphasize regimented schedule and teamwork. Developed drinking logs.	Kelly Thibodeaux	6/29/05	6/29/05	Scott Allaire
079	6/29/05	R Kuhn	People talking. Vehicles blocking Gate 4.	Remove vehicles from blocking road, inform crew during safety meeting	Discussed in safety meeting and warned of dangerous situation	Mike Crystal	6/30/05	6/30/05	Scott Allaire
080	6/29/05	W Moon	Housekeeping in storage trailers	Remove trailers from site	Replaced trailers with sea boxes	Tom Jeziorski	7/11/05	7/8/05	Kelly Thibodeaux
081	6/29/05	B Cook	Cable w/broken safety latch tagged out	None SES already had out of service tag attached	None (previously completed)	Scott Allaire	NA	NA	Kelly Thibodeaux
082	6/29/05	D Wessel	Buckets of hydraulic oil not labeled	Label all containers	Labeled all containers	Jack Morrison	6/29/05	6/29/05	Kelly Thibodeaux
083	6/29/05	G Elliot	Excavator on dock blocking traffic	Swing cab parallel to tracks	Repositioned excavator so cab will swing parallel to tracks	Mike Elia	7//01/05	7/1/05	Kelly Thibodeaux
084	6/30/05	G Elliot	Dark areas at the end of the dock	Install lights	Install additional lights	Jack Morrison	7/7/05	7/7/05	Sam Tavelaris
085	6/30/05	E Rhodes	Tail light on CDM truck out	Replace Bulb	Bulb replaced	CDM	7/7/05	7/1/05	Terry LaParr
086	6/30/05	John Burnham	CRZ organization	None (CRZ much more better organized for workers)	Install wooden buildings	Jack Morrison	6/30/05	N/A	Scptt Allaire
087	6/30/05	Jan Lennox	Two people carrying DE bags unsafe.	Allow one person to carry each bag if they feel they can carry the bag safely	Inform crew, ordered carts	S Allaire	7/8/05	7/11/05	Kelly Thibodeaux
088	6/30/05	Jan Lennox	Splash hazard when blowing down presses	Rope off Area	Area roped off	LT Williams	7/8/05	6/30/05	Kelly Thibodeaux
089	6/30/05	Scott Allaire	Oil sheen near processing pad ramp	Pump down standing water from pad	Determined to be from asphalt or pollen. Deployed oil boom.	S Allaire	6/30/05	6/30/05	Kelly Thibodeaux
090	7/2/05	Jack Morrison	Catch chain on door hanging up on spring.	Support spring from hanging	Taped spring to keep it from getting hung up	Brad Day	7/2/05	7/2/06	Jack Morrison
091	7/2/05	Dan Wessel	Cables marked on river for visibility	Place warning ribbons on cables	Flagged all cables prior to long weekend.	G Elliot	7/2/05	7/2/05	F. Barnes
092	7/6/05	Chris Mayette	Loose bolts on agitated mix tank ladder	Inspect andTighten bolts down	Tightened all bolts and nuts	Brad Day	7/6/05	7/6/05	Jack Morrison
093	7/6/05	Kelly Thibodeau	Cutting slings on debris barge	Construct a lifting ring	Ordered steel to fab lifting rings for spuds	M Elia	7/9/05	6/24/05	Kelly Thibodeaux
094	7/6/05	Bruce Cook	Manhole cover not properly covered	Place wood cover over manhole and install fence	Placed wood cover over manhole and install fence	John Wheaton	6/24/05	6/24/05	Kelly Thibodeaux
095	7/6/05	James Jones	Is respiratory protection required the whole time the worker is on top of the tank	None	SSO review procedure, and believes no changes to SOP are required	Scott Allaire	7/6/05	7/6/05	Mike Crystal
096	7/6/05	Nathan Romeo	Observed Pressure washing with safety shield up, and safety glasses	SOP states that safety glasses under a full face shield deployed in the downward position must be worn at all times	Informed workforce of proper deployment of PPE	Larry Williams	7/11/05	7/11/05	Scott Alaiare
097	7/6/05	Mike Panebianco	f person carry outboard boat motor	Enforce 35 lb weight limit and buddy system	Informed workforce of proper lifting and weight restrictions for 1 man	Mike Elia	7/11/05	7/11/05	Scott Allaire
098	7/6/05	Dan Wessel	Housekeeping-Storage Pad	Keep Processing pad clean of dried sediment, organized, and piles covered	SES had all Actions required free of sediment needing attention	Larry Williams	7/6/05	7/6/05	Kelly Thibodeaux
099	7/7/05	Terry Laparr	Electrical distribution panel (trailer Area) requiring labels and isolation from unauthorized personnel	Install fence and proper signage	Installed fence and proper signage	Kelly Thibodeaux	7/11/05	7/6/05	Scott Allaire
100	7/8/05	Terry Laparr	Vehicle – Pedestrian separation required at employee parking needing additional work near gate 4	Install additional fence	Installed additional fence	Kelly Thibodeaux	7/11/05	7/9/05	Scott Allaire
101	7/11/05	Doug Pike	Power Washers used to wash filter cloths on Press Operations exhaust may be causing fumes in the workers breathing zone	Additional Air Monitoring with multi rae meter to determine exposure, Order longer hoses to keep power washers outside of the workers breathing zone.	Performed additional monitoring, also bought more hose in order to relocate pressure washer	Larry Williams	7/13/05	7/12/05 7/15/05	Scott Allaire

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No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected By
102	7/11/05	Larry Williams	Pressure washing personal equipment such as; face shield, respirators, work boots should NEVER be done. This was brought up by foreman that it has NOT been ever seen here, but has been done on other Non-Sevenson sites.	Enforce with work crew at safety meeting importance of not taking shortcut. Union Laborer onsite had personal expiernce when he cut his own hand by pressure washing a glove.	Informed crew that if anyone blatenly disregards Safety protocals, or does not use the PPE provided in a safe and proper mannor, they can be terminated immediatley and not eligable for re-hiring.	Mike Crystal	7/11/05	7/11/05	Scott Allaire
103	7/11/05	Terry Laparr	Polymer stored in Van Trailer requiring proper labels and lock.	Install Lock on Trailer and post proper labels on outside of van	Labels were placed in proper locations on van trailor	Kelly Thibodeaux	7/12/05		Scott Allaire
104	7/11/05	Heather VanDewalker	Lock on women's porter potty non-functional adjacent to SRMT trailor	Report to health and safety officer replace lock (same key to be used in new lock)	Lock replaced and corerect openig procedures reviewed	eather Van Dewalk	7/11/05	7/11/05	Scott Allaire
105	7/11/05	Jack Morrison	Personal was walking up the side of road without using the fenced in walkway	Inform workers that they must use the walkway	Workers now use the appropriate walkway. Covered in the SPA.	Fred Barnes	7/11/05	7/11/05	Jack Morrison
106	7/11/05	Willie Ransom	While operating 450 loader windows are filthy inside and out which makes it hard to see somebody or something which can be dangerous especially at night.	Take bottle of windex and 2 rolls of paper towels and also cleaned windows	Took towels and windex and cleaned windows	Steve Fountain	7/12/05	7/12/05	Doug Pike
107	7/12/05	Terry LaParr	SES to supply weatherproof sign board for riverside sign in.	Must supply weatherproof sign board for river work	SES went above and beyond and supplied a booth so that an individual can seek shelter whilesigning in, reading postings, during minimal incliment	Matt Sceuss	7/12/05	7/12/05	Kelly Thibodeaux
108	7/12/05	Terry LaParr	Power supply line for old parts trailor (removed) is still laying on ground approximately 25' of conduit with breaker box at end.	Notification to ground supervision Kelly Thibodeaux	Power line scheduled to be removed by electricians.	Kelly Thibodeaux	7/22/05	7/29/05	Kelly Thibodeaux
109	7/13/05	Doug Pike	Would like to have sugar free squincher in drinking area	Research product to determine whether it is possible to obtain	Ordered sugar free dietary squincher drink	Scott Allaire	7/15/05	7/15/05	Scott Allaire
110	7/13/05	Mike Crystal Jr.	Deck of debris removal barge slippery when wet and also unstable while operation is in process.	Need to lay grip tape to slippery surface	Laid grip tape along sides and over open area	Jesse Brossett	7/15/05	7/19/05	Sam Tavelaris
111	7/11/05	V Vari	Worker climbing over piping on south end of presses #1,#2,#3	Must notify the worker and the safety officer of the hazard	Workers informed of hazard instructed to walk around	Jack Morrison	7/15/05	7/15/05	Sam Tavelaris
112	7/11/05	Chris Mayette	No procedure for the washing or wiping of wet material generated from the spashing created by the dropping phase of the presses	Must be addressed at the health and safety meeting	Face shield procedures addressed in the health and safety meeting	Jack Morrison	7/15/05	7/15/05	Sam Tavelaris
113	7/14/05	Chris Mayette	Some of the seat belts in the machines are not retractable and limit the movement the operator needs to have a full safe visuals	Must be addressed at the health and safety meeting	Train and inform workers on seatbelt settings	Jack Morrison	7/15/05	7/15/05	Matt Schade
114	7/14/05	James Jones	Concrete anchor weight holding manifold #4, #5, and #6 which conveys water from the presses to the modulator tank has a broken erod forklift eye resulting in a 2 5/8 spikes of steel sticking straight up, possibly impailing anyone who fell on them	Either grind or burn the rerod spikes off	Grind off and remove	Jack Morrison	7/16/05	7/16/05	Sam Tavelaris
115	7/13/05	Doug Dumont	Excavator used during debri removal travels over topof the spotters on the way to drop load in scow.	Instruct operator and workers of dangers of being under load	Crew was instructed on dangers of standing under or to close to a load	Scott Allaire	7/15/05	7/15/05	Scott Allaire
116	7/15/05	James Jones Will Ransom	The placement of wind direct socks to the pad and maybe the river site. When checking mix tanks for liquid levels we need to know wind direction for correct body placement when over open hatch so as not to be overcome by harmful fumes	Must install and wind sock or any wind direction detection device.	Installed wind sock	ScottAllaire	7/15/05	7/15/05	Scott Allaire
117	7/16/05	Robert Crites	Possibility of material transfer from feeder pumps to filter press when washing presses	Must lockout/ tag out when washing filter presses	Addressed in safety meeting	Kelly Thibodeaux	7/16/05	7/16/05	Scott Allaire
118	7/20/05	M. Castiglione	While pressure washing, the wand was pulled out of my hand, and sucked into a conveyor.	Inform crews at safety meeting of proper operation of pressure washer and operator's surrounding	Crew was informed in health and safety meeting on proper safety procedures for pressure washer and surrounding	Scott Ailaire	7/21/05	7/21/05	Jim Atkins
119	7/20/05	Steve Lanning	Need cabinet in support zone for respirators so we don't have to get respirator in the middle of shift.	Order cabinet and place inside EZ	Cabinet Arrived 2/9/05	Peter Boland	8/10/05	8/10/05	Peter Boland
120	7/21/05	Nathan Romeo	Excessive speed and wak in "No Wake Zone" outside silt curtain.	Advise workers of no wake zone in safety area	Advised workers of no wake zone in safety area	Scott Allaire	7/25/05	7/25/05	Matt Schade
121	7/21/05	John Paliemeri	The orange saftey fence delineating the clean walkway on the dock from the dirty area where trucks are loaded and the excavator sifts is slack and protrudes into the walkway area.	Must tighten up fence and weld fence post to dock	Tighten up fence and weld fence post to dock	Brad Day	7/23/05	7/23/05	Matt Schade
122	7/22/05	Terry LaParr	Worker on the water working alone. No other workers on water at all. All others were at the luncheon.	Must reinforce topic of "buddy system" at safety meeting	Reinforced topic of "buddy system" at safety meeting	Mike Elia	7/25/05	7/25/05	Matt Schade
123	7/21/05	Anynomous	Vehicles not yieiding right of way to trucks hauling hazordous waste	Must address in safety meeting	Addressed in safety meeting	Kelly Thibodeaux	8/2/05	8/2/05	Scott Allaire

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No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected By
124	7/21/05	Anynomous	Garbage should be in clear bags, PPE garbage in black bags so there is no PPE thrown in waste stream dumpster dumpster ame dark colored bags get mixed up.	Must oreder clear bags	Ordered clear bags	Larry Williams	7/27/05	7/26/05	Matt Schade
125	7/28/05	Bruce Cook	The access steps for the guard shack does not have the proper landing, both front and back doors	Investigate OSHA requirements on safe landings for stairs and have Paros come to fix	Ordered and installed stairs, deck, with handrails	Kelly Thibodeaux	8/8/05	8/8/05	Matt Schade
126	7/27/06	Anynomous	480 volt line and conduit in path to suction pump	Place sign "tripping hazard"	Placed "tripping hazard"sign	Steve Derouchie	8/10/05	8/10/05	Matt Schade
127	7/28/05	James Jones	Two vehicles traveling towards eachother at a blind corner. Personally owned vehicles traveling into and out of administration area have had few close calls, nearly hitting eachother. Properly placed traffic mirrors may reduce the chance of an accident.	Will address at safety meetings with people using parking area	Discussed at safety meeting	Mike Crystal	8/5/05	8/5/05	Matt Schade
128	7/28/05	Dan Wessel	ladder extensions on the feed tanks are thin and a little "flimsy". They are not convenient to grip.	Must investigate extensions	Extended bolts were tightened install locknuts	Larry Williams	8/8/05	8/6/05	Scott Allaire
129	7/29/05	Jan Lennox Jim Jones	Observed two people entering zone without hearing protection at the same time. Jim Jones motioned and they went back for ear protection. They then went to mix tank area where Jim Jones stopped them from going in because DE was being put in the tanks	Proper PPE will be discuss daily in Safety Meetings daily	Discussed at PPE at safety meetings buddy systems and checks	Larry Williams	8/8/05	8/8/05	Jim Jones
130	7/30/05	Nate Romeo	Diver was floating in water near rear of their boat at the same time the motor was running and the prop engaged	Speak to diving crew on issue	Spoke to diving crew and addressed in daily safety meeting	Mike Elia	8/2/05	8/2/05	Scott Allaire
131	7/28/05	Ron Kuhn	Material from press filter on the pad is slippery.	Address Slips, trips, and falls in daily safety meeting	Addressed slips, trips, and falls in daily safety meeting	Mike Crystal	NA	NA	NA
132	8/4/05	Chris Mayette Matt Schade	Emergency stop for flat conveyor does not work	Fix emergency stop on flat conveyor	Fixed emergency stop	K. Thibodeaux	8/5/05	8/5/05	Scott Allaire
133	8/3/05	Tery Laparr	S.E. corner of SLF burm is extending into prior roadway visibility for traffic around the corner is limited.	Special instruction to drivers potential hazard	instructed drivers on potential hazard	Kelly Thibodeaux	8/4/05	8/4/05	ScottAllaire
134	8/4/05	Erik R. Rhodes	Diving crew working on the gate for the silt curtain had a diver in the water without the "Diver in the water" flag up (Red or White flag)	Discuss infraction with dive crew @ morning safety meeting	Discussed infraction with dive crew @ morning safety meeting	Mike Elia	8/5/05	8/5/05	Matt Schade
135	8/8/05	Terry Laparr	Sweeping off of loaded haul trucks with a broom before truck leaves the pad for SLF. No organized plan of attack, workers brushing contamination from elevation toward eachother	mention at safety meeting/ revise SPA	mentioned at safety meeting not to spread materials at or towards one another/ revised SPA	Kelly Thibodeaux	8/10/05	8/10/05	Scott Allaire
136	8/8/05	Terry Laparr	Decon. Pressure washer worker walking between elevated dump box & open tailgate, truck was running, no blocks in either tailgete or wheels	Revise SPA	Revised SPA	Kelly Thibodeaux	8/10/05	8/10/05	Scott Allaire
137	8/8/05	Terry Laparr	2 workers climbing in back of haul trucks to set tail gate seals entering using two ladders	Revise SPA/ Ordered scaffolding	Removal truck from site	Kelly Thibodeaux	8/10/05	8/12/05	Scott Allaire
138	8/1/05	Dino Zach	informed by two motorists that the sign used for person controlling traffic for dump trucks crossing street is difficult to see. The green safety vest blends in with the foilage on the sides of the road.	Will supply orange vest to traffic control person	Supplied vest at crossing location	Kelly Thibodeaux	8/12/05	8/12/05	Scott Allaire
139	8/2/05	Dino Zach	Obstruction in auger head, laborer used gunlets while removing obstruction. A second boat was present while obstruction were removed. Operator properly locked-tagged checked dredged prior to removing obstruction.	not required	not required	NA	NA	NA	NA
140	8/2/05	Dino Zach	Laborer clearing obstruction in auger head without face protection. Back pressure in dredge line is released, spraying water /sediment, while obstruction is being removed.	Revise SPA	Revised SPA	Kelly Thibodeaux	8/11/05	8/11/05	Scott Allaire
141	8/10/05	Erik R. Rhodes	Noticed someone sampling soil with bare hands and trowel into a jar. Peson should have nitrile gloves on when sampling (sample was being taken on 001 out fall road)	Discuss at safety meeting	Discussed at safety meeting	Kelly Thibodeaux	8/15/05	8/15/05	Scott Allaire

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No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected BY
142	8/11/05	Erik R. Rhodes	Loaded skow broke free from dock and proceded toward the main channel while excavator operator noticed he moved the excavator boom and bucket over the water dropping a 2'x1' clump of contaminated sediment into the water, BBC pushed skow back to the back of the dock for sevenson.	Sample location	Sample by BBL/ sample returned clean	Kelly Thibodeux	8/11/05	8/11/05	Scott Allaire
143	8/11/05	Scott Allaire	Top rails of of trucks transporting material to landfill were not wiped clean leaving debris on top of rail	counsel workers	counseled workers	Kelly Thibodeaux	8/11/05	8/11/05	Scott Allaire
144	8/11/05	Jeffrey Boulden	Guard on wwtp pump #2 has gap big enough to put hand into shaft	will modify guard	guard modified	Kelly Thibodeaux	8/18/05	8/17/05	Scott Allaire
145	8/12/05	Peter R. Deshane MacGregor Crane	Woods and shrubs on river's bank are obstructing visability to a barge from crane seats, slowing down operations	clear shrubs	shruds cleared visability restored	Mike Elia	8/18/05	8/18/05	Scott Allaire
146	8/12/05	Allen Reeves	To alleviate heavy lifting from small boats to barges , erect jib poles on barges to lift and swing up to 1000 lbs	Use equipmen inwork zone	not required	Mike Elia	8/12/05	8/12/05	Scott Allaire
147	8/11/05	Thomas J. O'Rourke (BBL)	After starting generator, oil was squirting out of oil filter. Lost about 1 to 1.5 quarts of oil.	Call 4500 clean up	Called 4500 cleaned up oil, placed in green draw	Mike Elia	8/9/05	8/9/05	Scott Allaire
148	8/11/05	Ed Stevens	Cones by ditch just north of decon. Pad	Order cones	Ordered cones	Kelly Thibodeaux	8/18/05	8/18/05	Scott Allaire
149	8/13/05	Mark Van Patton	Horizontal conveyor exhaust on ground need to be up to head height	SES will evaluate	SES evaluated and determined that pipe had been moved from higher elevation due to high readings on the gas meter and locaton of pipe is safest at it's current	Steve Derouchie	8/18/05	8/18/05	Pete Boland
150	8/12/05	Tom Baker	CDM employee without safety glasses, hard hat on and not using the proper PFD	Discuss proper PPE with CDM employee	Proper PPE discussed with CDM employee	Mike Elia	8/15/05	8/15/05	Pete Boland
151	8/16/05	Bill Brazie	The unhooking of crane cables from clam buckets. Buckets can spin angerously when unhooked	spoke with crane operator	This is an awareness issue to be brought up @safety meeting / SPA	Mike Elia	8/25/05	8/25/05	Scott Allaire
152	8/17/05	Nate Romeo	CDM employee started backing up with pickup without looking, also crossed roadway with excessive speed, almost resulting in collision with another CDM pickup driving down roadway	Place Mirror , Speak to work crew	Terry LaPare spoke to workers , SES placed Mirror	CDM	8/25/05	8/23/05	Scott Alliare
153	8/20/05	John Paimieri	New Barge Located at dock should have traction tape applied to areas where there are no mats. Dock is very slippery	Traction tape or Different type boots	Tape was placed on perimeter of barge	Mike Elia	8/25/05	8/25/05	Mike Elia
154	8/22/05	Tim Lucinski	When Diving on the baffle wall in the down stream side of the buffer zone the change in current (due to the release of water from the locks) will cause a shift in the curtains. The curtains will move up stream some times traveling at 40 to 50 feet this becomes a probiem to the divers. The water provides little visability and by the time the diver reconizes the situation it is usually to late. Most of the time it results in the divers being pinned to the river bed or any other structure in the way. This is a dangreous sitiation due to limited air to the diver.	Secure lock schedule and Speak with divers.	Had meeting with Divers, Scott Allaire, Bill Moon and Mike Elia. Made Emergency plan & Supplied lock schedule &SES Radio	Mike Elia	8/22/05	8/22/05	Scott Allaire
155	8/25/05	Chris Mayette	The op-tech trailer & the S+L electric equipment trailer are both not properly blocked up they both have the potential of falling off blocks.	Will Inspect and Evalute	We have addressed the sitiuation and has been talked with Grasse River team members even though this was a good observation it does not affect operations and will be taken care of by Alcoa	Kelly Thibodeaux	8/26/05	8/30/05	Pete Boland
156	8/25/05	Michael Brouillette	People using hand held lights, which can be replaced w/ head mounts. Gives person freedom to use his hands more efficient. Saves money on damaged lights.	Replace hand held with helmet mounted lights.	Replace hand held with helmet mounted lights.	Mike Elia	8/25/05	8/25/05	Sam Taveleris
157	8/25/05	Jan Lennox	On 8-10-05 during a lighting storm & heavy rain , John Wheaton& Todd Dumas wouldn't cross road without a flagman , it was payday peope were being sent home, it would have been easy to slip across road to get home. Lots of traffice a that time 6:30 PM	Not required	None Needed	None Needed	None Needed	None Needed	None Needed
158	8/25/05	Chris Mayette	I observed a power wire going to press 3 conveyor rubbing on a electreic motor drive shaft which wore though to bare wire.	Relocate wire	Electrician is fixing problem	LT Williams	8/25/05	8/25/05	Pete Boland
159	8/26/05	Michael Brouillette	Cable on north bank in zone #1. At night walking through trees and brush w/holes that are hidden, causes a potential hazard.	Use weedeater to make trail so path can be followed, do this during day shift so at night we can use it.	Day crew was instructed to clear path for night shift.	Mike Elia	8/26/05		Pete Boland

Grasse River ROPS Project
Massena, New York

Sevenson Environmental Services
Safety Observation Report (SOR) Tracking Report

12/7/2005

No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (RPA)	Estimated Date of Completion	Date Completed	Inspected By
160	826/05	Bill Brazie	Unable to hear radio messages when near loud enging without removing hearing protection .	Radio headset would cure this	Orderded Radio Headsets	Jack Morrison	9/23/05	9/9/05	Kelly Thibodeaux
161	8/31/05	Michael Brouillette	Used port-a-let and saw spider around seat area. Was able to get rid of it.	Always check area, especially at night. Have lights at night.	Covered in Safety Meeting	Kelly Thibodeaux	9/12/05	9/8/05	Scott Alliare
162	9/1/05	John Palmieri	Bags of Used PPE,curtain or any other combustrible material should not be placed in scows at river.	Erect Sign and Inforce to Employees	Discussed in meeting	Mike Elia	9/12/05	9/8/05	Kelly Thibodeaux
163	9/2/05	Steve Lanning	No reflective tape on hard hats in the zone	Purchase reflective tape.	Ordered Reflective Tape	Steve Derouchie	9/9/05	9/9/05	Pete Boland
164	9/2/05	Erik R. Rhodes	Good team work with the workers and Sevenson swaping on dredges in work zone 1.	not required	None Needed	None Needed	None Needed	None Needed	None Needed
165	9/6/05	Ron Kuhn	None ROPS Related, Noticed a erson walking on top of full truck load@ Alcoa Bldg. West of secure landfill w/out fall protection in light of recent deaths from falls	Alcoa facilities employees should be advised of fall protection requirements.	Passed along Info.	Ron Kuhn	9/6/05	9/8/05	Kelly Thibodeaux
166	9/7/05	Michael Brouillette	Someone on day shift left regulators on cutting torch bottles	Take them off and secure them , let everyone know the procedure.	Took them off and advised crew	Mike Elia	9/12/05	9/8/05	Kelly Thibodeaux
167	9/8/05	Ralph Cree	Electrical panal in break trailer at river has short - lights go on and off makes buzzing noise.	Reported to Safety	Talked to electrician and he took care of problem.	Mike Elia	9/8/05	9/8/05	Pete Boland
168	9/8/05	No Name	Tripping and Slipping hazzards when stepping over fast feedpump intake lines.	install catwalk and or wooden planks over intake lines	Evaluated , will barricade area. Not intended for walkway maintance issue with catwalk.	Steve Derouchie	9/9/05	9/9/05	Kelly Thibodeaux
169	9/8/05	Austin Doelger	I observed a man slip at the bottom of a ladder that does not have a ladder run within 12" of the bottom.	Install a stairway up to mixer tanks	installed Step down platform on last rung.	Larry Williams	9/9/05	9/9/05	KPT
170	9/9/05	Mike Brouillette	5 bags of clean trash left by CRZ from opposite crew. Later animals got in it and sprean trash everywhere.	Dispose of trash correctly by placing in dumpter.	Picked up trash and rebagged it. Remind the crew to do the same.	Mike Elia	9/9/05	9/9/05	Jack Morrison
171	9/9/05	Stephen Avery	Need for non slip strips to on ladder runs of v tank and mix tank	Apply sure grip on everything	Applied Sure Grip	Larry Williams	9/9/05	9/9/05	Pete Boland
172	9/9/05	Jeff Boulden	Ladder rungs on mix tank can be slippery	Sure grip on every rung	Applied Sure Grip	Steve DeRouchie	9/9/05	9/9/05	Peter Boland

Grasse River ROPS Project
Massena, New York

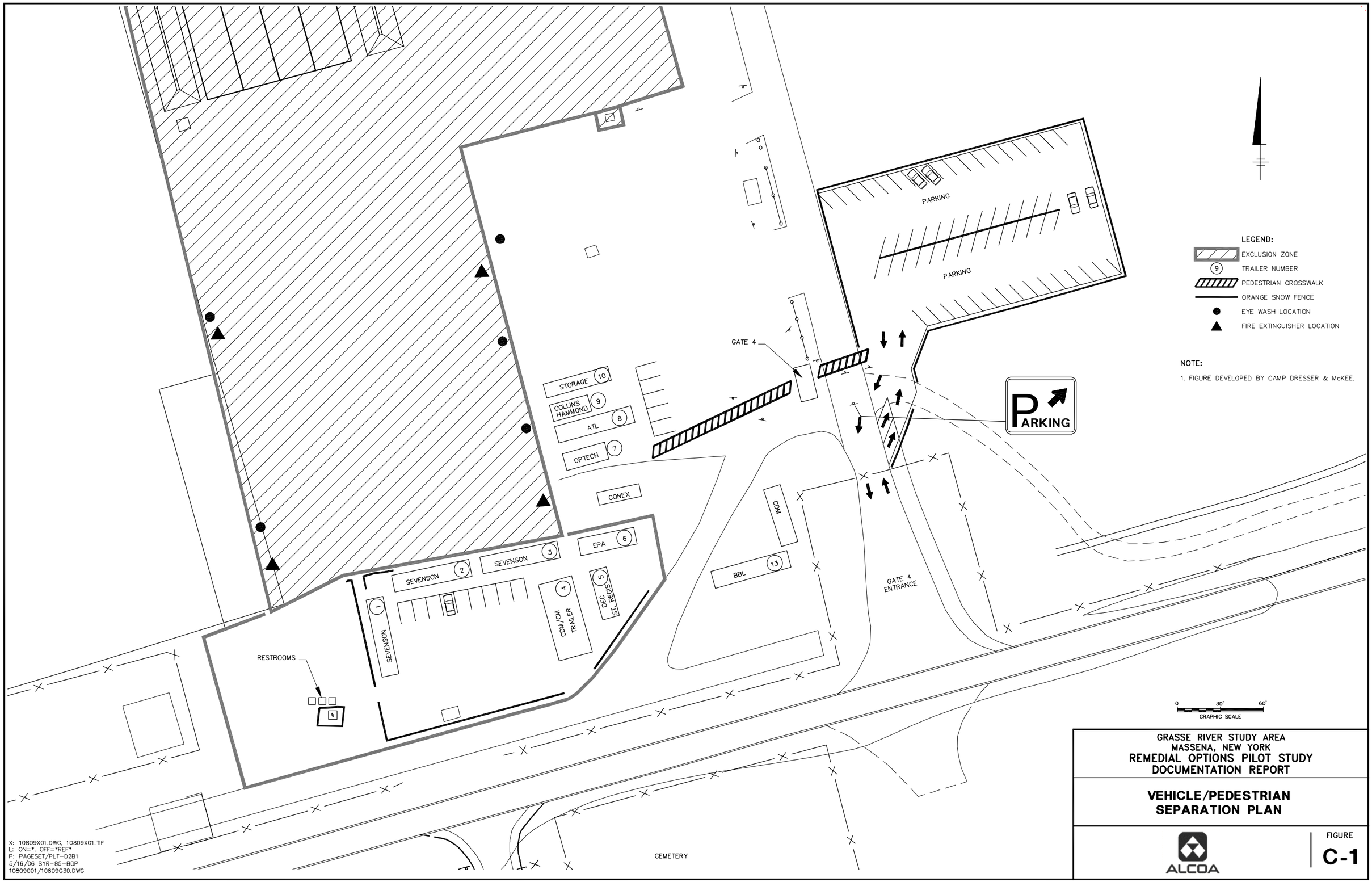
Sevenson Environmental Services
Safety Observation Report (SOR) Tracking Report

12/7/2005

No.	Date	Submitted by	Item	Corrective Action Required	Corrective Action Taken	Responsible Person (s/ss)	Estimated Date of Completion	Date Completed	Inspected By
173	9/9/05	Dan Wessel	Workers were not tieing off on cable strung along the capping material barges (fall protection).	Require workers to use a harness	Discussed with workers. Added cables or ends to avoid confussion.	Mike Elia	9/14/05	9/10/05	Kelly Thibodeaux
174	9/12/05	Terry LaParr	Tall brush (poison sumac) at riverside (Zone 2) access obstucting view with haul trucks.	Talked w/all H&S parties got O.K. from Alcoa (Bruce Cook) to have SES cut brush.	Cut Brush	Jack Morrison	9/17/05	9/13/05	Pete Boland
175	9/12/05	Terry LaParr	Standing water in battery containment at the river while battery in charging.	SOR Notification to SES/H&S Pump out water	pumped out water and covered with tarp	Jack Morrison	9/14/05	9/12/05	Pete Boland
176	9/12/05	Terry LaParr	Conex box at the river was emaculant,spotless best I have ever seen it. Everything had a place.	Spoke with SES ,H&S	None Required	None Required	None Required	None Required	None Required
177	9/12/05	Terry LaParr	Pieces of cut cable, rope & steel laying about the yard. (Possible trip hazards not to mention housekeeping).	Stressed housekeeping in Safety Meeting, Clean Up	Cleaned up loose cable cuttings	Jack Morrison	9/17/05	9/12/05	Pete Boland
178	9/12/05	Terry LaParr	Boat operators hung up on curtain & one individual steps out with leg&pushes off on curtain.	Talk about in meeting	Spoke with operators of danger of leaving boat and added to spa	Peter Boland	9/14/05	9/12/05	Pete Boland
179	9/13/05	Martin Parker	Having observed damage to boats,dredges,silt curtains,dockage,ect. I would suggest anyone assigned to the water be given a safe boating course-also an opportunity to practice on work boats which handle differently than dad's fishing boat. Also night shift personnel should be equipped with flashing beacon lights on PFD, reflective tape on hard hats, and knife with seffated edge; instuctions on "drown proofing" should one fall into the water.	Discuss boat operation and cautiousness in safaty meeting.	Discussed at Safety Meeting consisted of boating safety detail and added to SPA. Have lights reflective tape and knifes for PFD's.	Peter Boland	9/17/05	9/16/05	Pete Boland
180	9/13/05	Chris Mayette	There should be a gauge on the mixing tanks so it would put a limit to people going up and down the mixing tank ladder appx. 30 to 50 times a day, just to check to level.	Will explore options for gauges.	Stairs to mix tanks will make gauges unnessacary, continuing to explore stairwell options. Awaity CDM approval from Roy Richardson.	Kelly Thibodeaux	9/17/05	9/30/05	T LeParr/S.Allaire
181	9/13/05	Steve Lanning	Geo Bag burm ploy has holes in it from walking on it and very slippery when wet.	Discuss hazards in safety meeting	Discussed in safety meeting. Buit ramp was inspected and completed.	Peter Boland	9/17/05	9/17/05	Pete Boland
182	9/12/05	Nathan Romeo	Sevenson Employee was on cap material barge w/o wearing life jacket and was not tied off. He was wearing his fall protection but was not connected to anything.	Discuss and explore options with CDM, Alcoa and SES on PFD and harness avalability.	Ordered new PFD's, that will make wearing fall protection and PFD's together easier.	Peter Boland	9/23/05	9/21/05	Kelly Thibodeaux
183	9/14/05	Al Odendahl	Slips over berm to access geotube	Discuss hazards in safety meeting	Buit ramp please see SOR # 181	Peter Boland	9/23/05	9/17/05	Pete Boland
184	9/8/05	Dan Casey	Spun Barge #2 has steep lean w/ heavy block being held w/ nylon strap.	Secure block better	Moved block and resecured.	Jack Morrison	9/16/05	9/16/05	Kelly Thibodeaux
185	9/14/05	Chris Mayette	Small boat on river is not practical for all around use. It sunk to the bottom of river and ir should of stayed there. It is an accident waiting to happen again. Why hasent this been addressed -boat is very unstable.	Cover in meeting, boat only used for personnel transport.	Discussed in safety meeting letting everyone know that boat is only used for personnel tranport	Mike Elia	9/21/05	9/21/05	Scott Alliare
186	9/14/05	Chris Mayette	Cable to dredge is very dangerous to personnel due to lack of visibality exspecially at night	Mark cable so it can be seen better.	Marked with orange marker tape for better visibility	Mike Elia	9/23/05	9/17/05	Pete Boland
187	9/14/05	Chris Mayette	What is the fall protection on geo tubes and how will this be addressed they are over 51/2 feet tall and Alcoa requires 100% fall protection anything over 4feet.	Already Addressed	Lines painted on tubes for walking	Larry Williams	9/12/05	9/12/05	Kelly Thibodeaux

Sevenson Environmental Services
Safety Observation Report (SOR) Tracking Report

No.	Date	Submitted by	Item	Corrective Action required	Corrective Action Taken	Responsible Person (SPA)	Estimated Date of Completion	Date Completed	Inspected By
188	9/16/05	Al Odendahl	MX fuel delivery man climbing on top of fuel containment to refill containers inside of secondary containment also is speeding around work areas.	talk to driver about site rules.	Discussed with driver about speed limit and placed 3 ft step ladder at river staging area.	Peter Boland	9/23/05	9/17/05	Pete Boland
189	9/16/05	Stephen Avery	Tent for cover in CRZ for when it rains to suit up and put boots on.	Not Necessary	not required	not required	not required	not required	not required
190	9/29/05	Steve Derouchie	During rain/lightning event. Flooding of modular tank from GEO-tube pump. Due to shut down of water treatment.	Regulate pumps to handle flow	Spoke with WWT operators	Larry Williams	10/3/05	10/3/05	not required
191	9/29/05	James Jones	An engineering control to allow the press operator to check level of liquid of mix tanks while standing on the pad, to eliminate the hazard of climbing and to further ensure a release of liquid from overflow doesn't occur.	Install stairs to make access to mix tanks safer.	Installed new stairs	Steve Derouchie	10/3/05	10/3/05	Kelly Thibodeaux
192	9/29/05	Mike Colburn	Observed 2 drivers w/out safety vest. Discharge hose not safety pinned.	Talk with Teamsters about proper green shirts or vests.	Did Disguss with teamsters about the proper vests and green shirts, outside of trucks.	Peter Boland	9/5/05	9/5/05	Peter Boland
193	10/3/05	Ralph Cree	Life ring holder halfway down on left side of dock should be turned opposite way to stop trip bump hazard , it is right at hip height.	Repostion Holder	Removed obstacle from middle of dock, relocated to end of dock. (Flowtation Device)	Jack Morrison	10/8/05	10/10/05	Peter Boland
194	10/3/05	Scott Allaire	Excavation @ Landfill has everthing to make a castasthophy. The excavation is about 10 'deep, no shoring or sloping. The excavator was parked on the edge of the excavation and the excavated material was also placed on the edge.	Meet with CDM Health and Safety	Met with CDM H&S, Bill Moon	Scott Allaire	10/3/05	10/3/05	Kelly Thibodeaux
195	10/3/05	John Palmieri, Al Reeves,Al Neuroth, Greg Tucker,Kate Dorn	Spaces between sections of barge are open and a trip hazard. 1"x8" boards can be places in gaps to provide an even surface.	Install boards to eliminate hazard	Will evalutate to determine proper means to correct problem. Did evaluate,not pratical.	MCE	10/28/05	n/a	n/a
196	10/4/05	Todd Dumas	At 7:30pm shift change vehicle traffic is heavy at guard shack. Heavy pedestrain traffic, people in vehicles in hurry and not signing out.	Discuss at Safety meeting and on SPA	Discussed at Safety Meeting with all crafts	Peter Boland	10/12/05	10/12/05	Peter Boland
197	10/3/05	Bill Brazie	The air hoses for the large compressors have no retaining safety cables with them. Should have been supplied by vendor.	Was inspected.	Threaded fittings, so no safety cables required.	Mike ELia	10/21/05	10/12/05	Kelly Thibodeaux
198	10/4/05	Tony Moselle	Weather is changing will be getting cold, would be nice to have some kind of wind break on ends of presses and other areas on pad to get out of cold wind.	Hang tarps to help with wind and add wind barrier.	Tarps hung around filter presses and other process areas.	Larry Williams	10/21/05	10/13/05	Larry Williams
199	10/7/05	Mike Colburn	To have a flat bed to clean up the yard to ship things out of the yard after decon.	Bring in flat bed	Will place flatbed at time of demob	Larry Williams	10/17/05	10/10/05	not required
200	10/6/05	Terry LeParr	Trackhoe PC220 barge has 5 gallon gas can setting on its platform with no secondary containment.	Disguss at Safety meeting.	Discussed at Safety meeting that all gas cans have to placed in secondary containments.	Sam Tavelaris	10/7/05	10/7/05	not required
201	10/6/05	Terry LeParr	Fuel tank storage hose is laying outside of its secondary containment.	Place hose into secondary container	Placed hose into secondary container	Peter Boland	10/6/05	10/6/05	not required
202	10/6/05	Terry LeParr	Water jugs @ the SLF have not been changed out today or deconned(Cleaned) within 24 hr period	Disguss and assign proper personnal	Disgussed in management meeting, assigned personal to correct problem	Peter Boland	10/7/05	10/7/05	Peter Boland
203	10/6/05	Terry Leparr	Insufficient on capping material barge & one barrel blinker also the curtain downstream of it has no lights.	Purchase new lighting	Purchased new lighting and added to lighting to material barges	Peter Boland	10/10/05	10/5/05	Scott Alliare
204	10/6/05	Terry LeParr	Small john boat used for a cable support float,possible damage to boat. not what boat is supposed to be used for.	john boat no longer needed	No longer in need to support dredge cable do to new dredge.	Jack Morrison	10/10/05	10/10/05	Mike Elia
205	10/6/05	Terry LeParr	NE corner gate to the MPP is left open, no signs are even visible from the gate area to nearly the decon area north of it.	Disguss at Safety meeting.	NE gate has been roped off	Larry Williams	10/6/05	10/6/05	Pete Boland
206	10/6/05	Terry LeParr	NE corner gate ,4 gas cans sitting on the highest point of the berm without secondary containment.	Contain cans in secondary containment.	Contained cans in secondary containment	Larry Williams	10/6/05	10/6/05	Larry Williams
207	10/17/05	James Jones	No identification label on the Quicklime silo. Without label on silo, any emergency responder could not identify the contents in	Silo should be properly labeled as contents being Quicklime.	Silo has been labeled.	Larry Williams	10/17/05	10/17/05	Peter Boland
208	10/8/05	Alan Cole	2 men deconning without face shield	Discuss in Safety Meeting	Did disguss in safety meeting	Kelly Thibodeaux	11/1/05	11/1/05	Kelly Thibodeaux
209	10/27/05	Jan Lennox	Pulling up handrails on v-tank with forklift when braces on cat walk fell down. 2 out of 3 braces came down, no bolts holding braces from coming down.	Because the tank is being demobilized, no corrective actions will be taken at this time.	None. Future action will be bolts or pins at the top of the braces.	Kelly Thibodeaux	N/A	N/A	N/A
210	10/26/05	Ed Stevens	Crane boom sticking out over 4ft with no safety ribbon	Add to SPA and discuss	Discussed at Safety Meeting	Jack Morrison	11/4/05	11/7/05	Scott Alliare
211	10/26/05	Ed Stevens	Tarps on dump truck coming way up on windy days. Us aluminum frame over 13'6" high when up.	Use bungee cords or rope to hold down.	Spoke with truck drivers	Kelly Thibodeaux	11/1/05	11/1/05	Scott Allaire
212	11/5/05	Scott Allaire	Observed Operator shutting down crane operation ,but was not grounded	Attach grounding cable	Had workers attach grounding cable.	Scott Allaire	11/5/05	11/5/05	Scott Alliare



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
REMEDIAL OPTIONS PILOT STUDY
DOCUMENTATION REPORT

VEHICLE/PEDESTRIAN SEPARATION PLAN

ALCOA

FIGURE
C-1

Appendix D

Materials Processing Pad Photo Album

Processing pad area development
MPP1 4/15/05

Materials processing pad containment system liner installation
MPP2 4/22/05

Materials processing pad asphalt placement

MPP3 5/11/05

Carbon filters

MPP4 5/24/05

Bag filters
MPP5 5/24/05

Feed tanks
MPP6 5/24/05

Fast feed pumps

MPP7 5/24/05

Filter presses

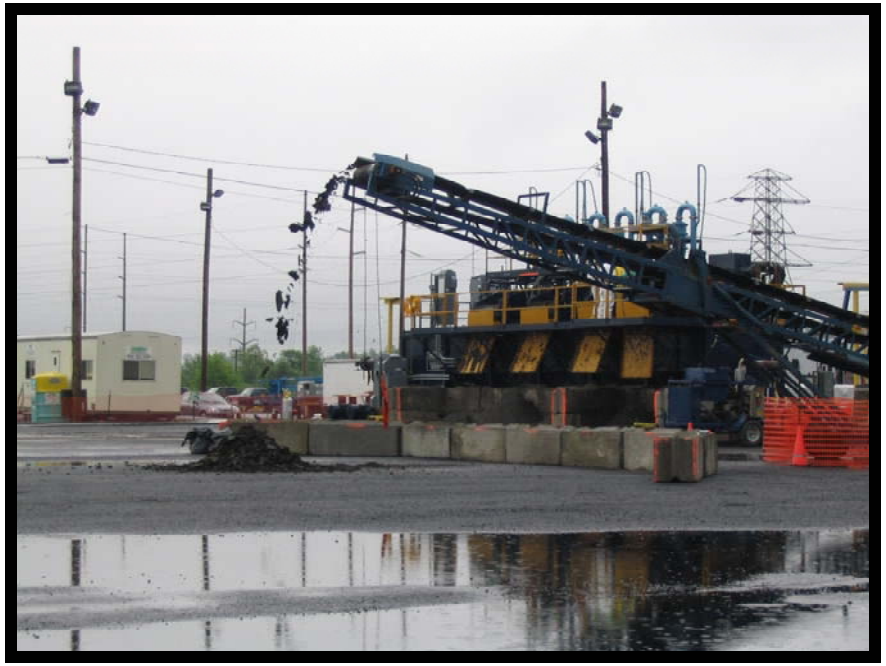
MPP8 06/06/05

V-bottom tank, shakers, w/ hydrocyclones

MPP9 06/06/05

Material from shaker

MPP10 6/08/05



First filter press cake drop

MPP11 6/14/05

Processed material staging area

MPP12 6/16/05

Sand fraction

MPP13 6/16/05

Filter cake

MPP14 6/16/05

Storm event

MPP15 6/17/05

River debris on pad

MPP16 06/17/05

Dust control

MPP17 6/29/05

Stockpiled processed material

MPP18 7/18/05

Geotubes polymer addition area
MPP19 9/9/05

Shaker material separation
MPP20 9/12/05

Geotube set-up

MPP21 9/13/05

Geotube operation

MPP22 9/16/05

Geotube dewatered solids

MPP23 10/26/05

Demobilization activities

MPP24 10/24/05

Geotube solids stabilization

MPP25 10/27/05

Demobilization activities

MPP26 10/31/05

Decontamination activities

MPP27 11/4/05

Final demobilization operation

MPP28 12/10/05

Final demobilization activities

MPP29 12/10/05

River Area
Photo Album

River staging area
RA1 4/22/05

Booster pump area preparation
RA2 5/23/05

ROPS floating dock

RA3 5/24/05

Silt curtain anchor placement

RA4 5/24/05

Deploying impermeable curtain

RA5 5/26/05

Water column monitoring at ROPS-WCT5

RA6 5/26/05

Dredge slurry piping

RA7 5/26/05

Booster pumps

RA8 5/26/05

Hydraulic auger head dredge

RA9 6/13/05

Public river observation deck along Route 42

RA10 6/14/05

Northern near shore mechanical dredging

RA11 6/21/05

Typical silt curtain damage

RA12 6/22/05

Work Zone 1 debris removal

RA13 7/11/05

Dredge repair activities

RA14 7/11/05

Diver curtain inspections

RA15 7/14/05

Work Zone 1 and 2 intermediate silt curtains

RA16 8/9/05

Field-fabricated debris removal rake

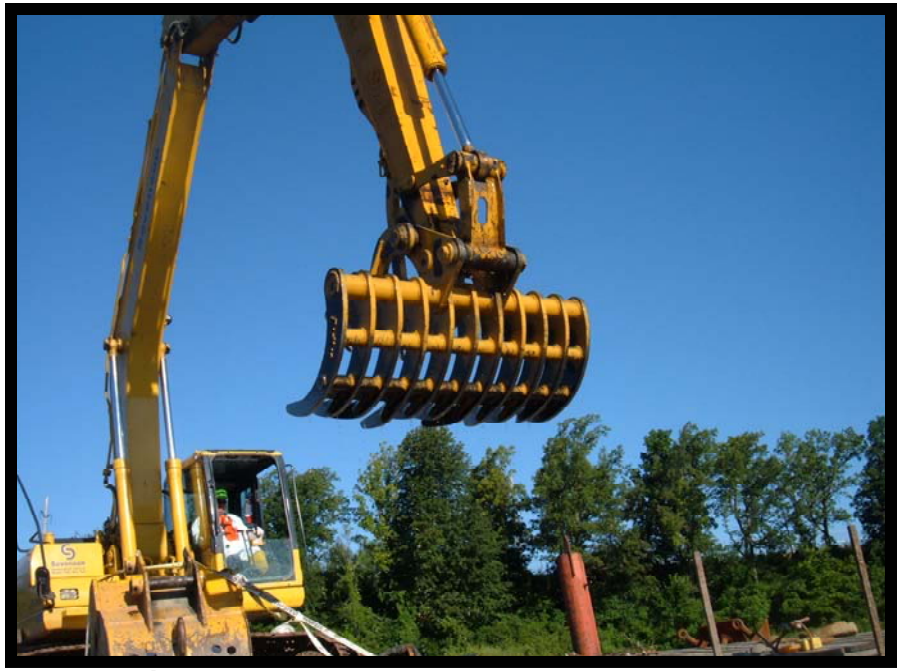
RA17 8/9/05

Silt curtain storm damage

RA18 8/9/05

Soft sediment from the northern near shore

RA19 8/17/05



2nd generation debris removal rake

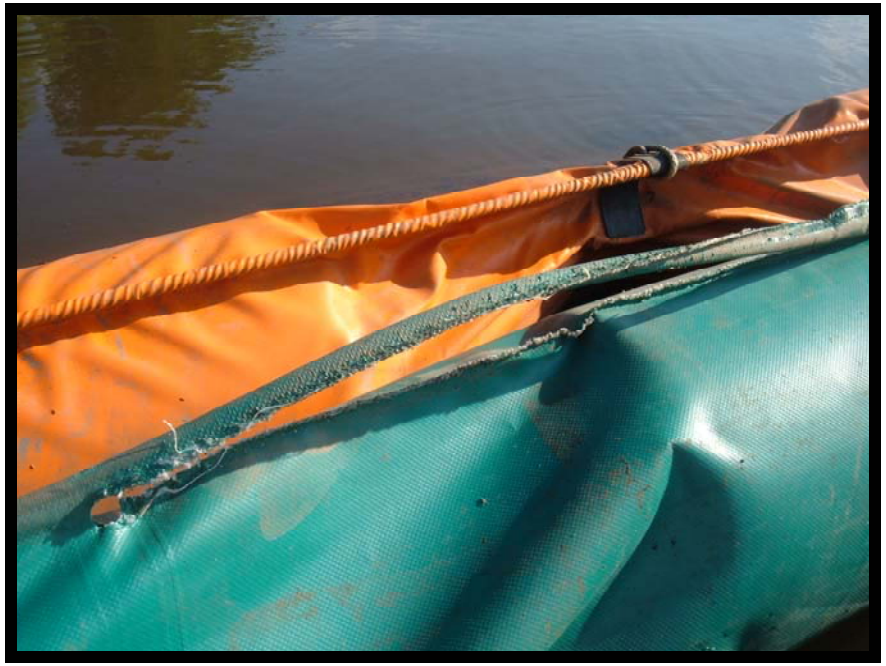
RA20 8/25/05

Work Zone 2 debris removal

RA21 8/30/05

Dredge line repair

RA22 9/1/05



Hi-strength curtain damage

RA23 9/1/05

Northern near shore debris

RA24 9/1/05

Northern near shore capping

RA25 9/12/05

Main channel capping

RA26 9/12/05

Pressure wave influence

RA27 9/12/05

Excavator mounted clamshell

RA28 9/14/05

Curtain damage from high river flows and high winds

RA29 9/27/05

Damage caused by high river flows

RA30 9/27/05

Armored cap material placement

RA31 9/30/05

Air curtain compressors

RA32 10/10/05

Hydraulic swinging ladder cutterhead dredge

RA33 10/12/05

Typical post-dredging core

RA34 10/22/05

Air curtain

RA35 10/26/05

Hydraulic swinging ladder cutterhead dredge

RA36 10/26/05

Southern near shore capping

RA37 11/2/05

Silt curtain removal

RA38 11/15/05

Breaking ice during demobilization

RA39 11/28/05

Demobilization activities

RA40 12/10/05

Site restoration

RA41 12/13/05

Secure Landfill Cell 3
Photo Album

Cell prepared for receiving waste material

SLF1 8/4/05

1st load of waste

SLF2 8/8/05

Waste placement

SLF3 10/3/05

Sand cap placement

SLF4 10/19/05

Under drain piping
SLF5 10/19/05

Cap anchor trench
SLF6 10/19/05

Liner cap placement
SLF7 10/21/05

Waste final grading
SLF8 10/24/05

Stormwater swale

SLF9 10/28/05

Western edge liner tie-in

SLF10 11/8/05

Liner cap

SLF11 11/12/05

Frost protection placement

SLF12 11/28/05

Appendix E

ROPS Video Documentation
Included on Separate DVD