DECISION SUMMARY

REYNOLDS METALS COMPANY SITE STUDY AREA

MASSENA, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II

NEW YORK

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Decision Summary for the Decision Document

I. Site Name, Location, and Description

The Reynolds Metals Company (RMC) facility is an active aluminum production plant located on 1600 acres in the town of Massena in St. Lawrence County, New York. The RMC facility is bordered on the north by the Grasse and St. Lawrence Rivers, on the east by the New York Central Railroad, on the west by Haverstock Road (South Grasse River Road), and on the south by the Raquette River. The plant is located off Route 37 near the Massena-Cornwall International Bridge, directly upriver of the General Motors - Powertrain Division Plant (see Figure 1).

The Reynolds Metals Company Study Area Site ("the Site") includes that portion of the St. Lawrence, Grasse, and Raquette Rivers, any tributaries of those rivers and any wetlands which are between the International Bridge and the confluence of the Grasse and St. Lawrence Rivers and that portion of the Raquette River which is south of the confluence of the Grasse and St. Lawrence Rivers and south of the International Bridge. The Reynolds Study Area Site is depicted in Figure 1. In general, the Reynolds Study Area Site encompasses those surface waters, sediments, and wetlands which are adjacent to the Reynolds Metals Company facility in Massena, New York.

Land use in the area surrounding the Site consists of mixed residential and industrial uses. The St. Regis Mohawk Indian Reservation, *Akwesasne*, is located within 0.5 miles of the RMC facility. Approximately 8,500 individuals live on the St. Regis Indian Reservation. The downtown area of Massena is located approximately eight miles west and upriver of the RMC facility. The 1980 population estimate for Massena was 14,856. In addition, the St. Lawrence River forms the border between the U.S. and Canada in this area.

Due to past contamination of the General Motors facility and in the surrounding river system, the General Motors-Powertrain Division plant has been designated as a federal Superfund Site. EPA is overseeing cleanup of the General Motors facility and surrounding river system. EPA is also overseeing the cleanup of the river system surrounding the Aluminum Company of America facility, which is approximately eight miles upriver from the RMC Site.

Major areas of contamination on the RMC facility include an unlined pit used for the disposal of carbon solids known as the Black Mud Pond, a landfill, and the plant's North Yard. The New York State Department of Environmental Conservation (NYSDEC) is overseeing the cleanup of contamination on the RMC and ALCOA facilities.

The St. Lawrence River flows are partially controlled by the Moses-Saunders Power Dam, located approximately four miles upstream of the Site on the St. Lawrence River. In the vicinity of the Site, the St. Lawrence River is greater than 0.5 miles in width with depths exceeding 30 feet in some portions of the River. The section of the St. Lawrence River adjacent to the RMC facility is part of the St. Lawrence Seaway. In general, the Reynolds Study Area is comprised of a shallow shelf containing slow currents, fine-grained sediments, and dense beds of submergent aquatic vegetation. The shallow shelf was created in the late 1950s by dredge spoil from the south Cornwall Navigation Channel that is located 300 to 800 feet offshore from the RMC facility. No dredge spoil has been deposited in this section of the river since the initial dredging.

Local water bodies are used recreationally for swimming, wading, fishing, boating, camping, and picnicking. Two general groups, the Mohawk native population and recreational fisherman, fish in the vicinity of the Reynolds Study Area. However, direct land access to the Reynolds Study Area is limited by the steep nature of the shoreline.

A tract of regulated water wetlands (identified as No. RR-6 by NYSDEC) occur on the Reynolds' property. The wetland is approximately 170 acres in size and is a Class 2 wetland. It is one of the three largest wetlands in the town of Massena. NYSDEC is also overseeing the cleanup of contamination in these wetlands. Remediation of this wetland is being overseen by NYSDEC.

II. Site History and Enforcement Activities

The RMC plant was constructed in 1958 for the production of aluminum from alumina (aluminum oxide). The main components of the plant include the reduction plant and supporting structures and facilities encompassing about 20.5 acres, the solid waste landfill (11.5 acres), and the Black Mud Pond (approximately 6 acres).

Aluminum is produced in individual pots lined with "potliner," which is composed of a mixture of carbon compounds and which acts as the cathode of the electrolytic cell. Potliner is fabricated in the carbon plant section of the plant where coal tar pitch, coke and other materials are blended and shaped to fit the pots. A heat transfer medium (HTM) system is used to maintain the pitch in a flowable and pumpable form. The HTM system used a polychlorinated biphenyl (PCB) oil until 1976.

As a result of production activities and years of continuous operations and expansion, various types of industrial waste, including hazardous waste, were generated, disposed of, and spread throughout the facility. Contaminated areas on the facility property are being investigated and remediated by RMC under the authority of Consent Orders with NYSDEC. Several areas on the facility serve as potential sources of contamination to the Reynolds Study Area. These areas are described briefly below and are depicted in Figure 2.

Wastes from the plant's potliner recovery system were disposed of in the Black Mud Pond. The Black Mud Pond contains waste primarily composed of alumina (30-40%) and carbon (35-35%) with fluoride at 2-5%, cyanide at 61 parts per million (ppm), and PCBs at 3.4-8.1 ppm. These contaminants have been detected in groundwater near the pond. However, groundwater contamination is confined to a limited area within a few tens of feet of the pond. Shallow contaminated groundwater may be discharging to surface water pathways to the south and east of the pond.

The plant's Solid Waste Landfill and former Potliner Storage Area can be characterized as one contaminant source area, based on their proximity and similarity of contaminants and receptor zone of contaminants migrating from the area. The contamination detected in the waste, groundwater, leachate and surface water is characterized by elevated concentrations of cyanides (up to 300 ppm), fluorides (up to 8500 ppm), sulfates (up to 13,000 ppm), aluminum (up to 87,000 ppm) and polyaromatic hydrocarbons (PAHs) (up to 2,200 ppm). PCBs are also detected in both areas at concentrations as high as 690 ppm. Groundwater from these areas may drain to wetlands RR-6, south of the Landfill area. A leachate collection system on the Landfill intercepts some, but not all, contaminated groundwater from the Landfill to the wetlands. Remediation of this wetland is being overseen by NYSDEC.

PCBs, polychlorinated dibenzofurans (PCDFs), and polychlorinated dibenzo-p-dioxins (PCDDs) are distributed in North Yard surficial soils. PCBs have been found in this area at concentrations as high as 89,000 ppm. PCDDs and PCDFs have been detected at levels of 9.92 parts per billion (ppb) and 9.35 ppb, respectively. PCBs, PCDFs, and PCDDs originate from the plant HTM system. North Yard groundwater contamination is characterized by local areas of elevated concentrations of aluminum, arsenic, cyanide, and fluoride. PCBs have not been detected in groundwater.

In addition to contamination throughout the facility, RMC also discharged contaminants to the St. Lawrence River through four outfalls - known as Outfalls 001, 002, 003, and 004. Three of these outfalls - Outfalls 001 and a combined Outfall 002 and 003 - are still in use. These outfalls are depicted in Figure 3 and served as the primary sources of contamination to the Site.

Discharges from Outfall 001 include water from the facility's waste water treatment system. Outfall 002 discharges contact cooling water and stormwater runoff from the facility. It carries the highest volume of water (averaging 2.5 million gallons per day) of all four of the outfalls. Prior to November 1989, the discharge from Outfall 002 traveled down an open ditch on the RMC property to enter the St. Lawrence River. After November 1989, this discharge was combined with that of Outfall 003. Outfall 003 carries treated discharge from the facility sanitary treatment plant. Outfall 003 discharges to the St. Lawrence River through a submerged pipe located approximately 100 feet from the shore. Prior to June 1988, Outfall 004 carried intermittent runoff from northern areas of the plant. The runoff formerly discharged at Outfall 004 is now treated and used in plant operations.

The RMC facility and upland areas are listed on the NYSDEC Registry of Class 2 Inactive Hazardous Waste Sites. In September 1987, RMC and NYSDEC signed a Consent Order, pursuant to which RMC agreed to investigate contamination at the RMC facility. However, this Order did not include an investigation of contamination in the river system surrounding the facility. In January 1992, NYSDEC issued a Record of Decision (ROD) which outlined its selected remedy for the RMC facility, excluding the river system. NYSDEC's selected remedy included a combination of excavation and treatment of areas highly contaminated with PCBs and other contaminants and consolidation and containment of other contaminated areas on the facility. In 1993, RMC and NYSDEC signed a Consent Order which required RMC to implement the remedy in the January 1992 ROD.

In January 1989, RMC completed an initial study of sediment contamination in the St. Lawrence River adjacent to its plant. In September 1989, EPA issued a Unilateral Administrative Order (EPA Index No. II CERCLA-90230), requiring that RMC investigate and clean up contamination in the river system surrounding the RMC facility. The river system has been termed the "Reynolds Study Area." In August 1991, RMC submitted a revised Additional River Sampling (ARS) Report which further characterized the nature and extent of contamination in the Reynolds Study Area. In March 1992, RMC submitted a draft Analysis of Alternatives (AA) Report which evaluated options for remediating contaminated sediments at the Site. In January 1993, RMC submitted a revised draft AA Report for the Reynolds Study Area.

III. Highlights of Community Participation

The ARS and AA Reports and the Proposed Plan for the Reynolds Study Area Site were released to the public for comment on February 19, 1993. These documents were made available to the public in both the administrative record and in information repositories maintained at the EPA Docket Room in Region II, at the St. Regis Mohawk Tribal Offices, and at the Massena Public Library. The notice of availability for these two documents was published in the Massena Courier-Observer on February 19, 1993, in the People's Voice on February 22, 1993, and in the Indian Times on February 19, 1993. A public comment period on the documents was held from February 19, 1993 through April 21, 1993. The public comment period was extended once upon the request of officials from Environment Canada.

EPA held a public meeting regarding the Reynolds Study Area Site on March 9, 1993 at the Massena Town Hall. At this meeting, representatives from EPA answered questions about problems at the Site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this Decision Document. The Responsiveness Summary and Decision Document, along with the administrative record for the Reynolds Study Area Site, are available at the information repositories referenced above.

IV. Scope and Role of Operable Unit or Response Action Within Site Strategy

This Decision Document addresses the first and only planned remedial action for the Reynolds Study Area Site. This action is intended to address the principal threats to human health and the environment posed by the contaminated sediments in the Reynolds Study Area. Remediation of the contaminated upland areas on the RMC facility is being overseen by NYSDEC.

V. Summary of Site Characteristics

Hydrodynamic Conditions

Prior to completion of the ARS, RMC conducted a study of flow conditions in the St. Lawrence River adjacent to its facility. The flow study, conducted in November 1989, supplemented previous flow studies done by RMC and its consultants. The flow study yielded the following general conclusions about the Reynolds Study Area Site which are depicted graphically in Figure 3. The main river current which enters the area adjacent to the RMC facility from Polly's Gut has velocities of 8 feet per second or greater. This flow is deflected to the east by training dikes which protect the Seaway channel. There are a series of clockwise and counterclockwise eddies as the main current exits the training dikes. These eddies are characterized by low velocity flow and migrate toward the shore in both upstream and downstream directions. There is an area in the vicinity of Outfalls 001 and 004 which exhibits some flow separation with predominantly upstream flow to the west of the outfalls and predominantly downstream flow to the east of the outfalls.

The overall result of these flow patterns is that water generally stagnates along the shoreline in the vicinity of Outfall 001. Because of this stagnation, sediments and particulate materials discharged into the River through the four outfalls generally remain close to shore. This pattern would be enhanced in summer months by extensive vegetation growth that would act to further slow currents in the shallow water near the shore.

Contaminant Characteristics

As part of the ARS, sediment samples were collected from 47 locations in the St. Lawrence River and 17 locations in the Raquette River adjacent to the RMC facility. A total of 127 sediment samples were collected, 20 in the Raquette River and 107 in the St. Lawrence River. The results of the ARS sampling were generally consistent with the results from 67 sediment samples taken in 1988 by RMC.

Based on sampling and analyses conducted during the ARS, there are several contaminants in Reynolds Study Area sediments including PCBs, PAHs, total dibenzofurans (TDBFs), fluoride, and cyanide.

PCBs are the primary contaminant found in sediment samples in the Reynolds Study Area. Contaminants other than PCBs are generally found in a pattern similar to that of PCBs and will be remediated along with PCBs.

PCBs were found in 72 of the sediment samples taken from the St. Lawrence River. However no PCBs were found in background samples or in sediment samples from the Raquette River. Figures 4 - 6 show an approximation of the general distribution of PCBs at various depths in the Reynolds Study Area. Figures 7 - 10 show the distribution of PAHs, cyanides, fluorides, and TDBFs in the Reynolds Study Area. EPA estimates that there are approximately 51,500 cubic yards of sediment with PCB concentrations above 1 ppm, PAH concentrations above 10 ppm, and TDBF concentrations above 1 ppb.

The highest concentration of PCBs detected in sediments in the Reynolds Study Area was 1300 parts per million (ppm). All samples with PCB concentrations above 100 ppm are located within 500 feet of the RMC outfalls. Concentrations decrease away from the shoreline. PCBs were detected in some samples at a depth of 24 inches into the sediments and may extend below that depth at some locations. Sediment depths range from one foot to over 5 feet. PCBs were not detected in water samples taken by RMC from the St. Lawrence River. However, NYSDEC, using a more sensitive analytical technique than the one used by RMC, detected PCBs in surface water at levels up to 54 parts per trillion (ppt).

PCBs and other contaminants which are present in Reynolds Study Area sediments may migrate downstream or dissolve slowly into the River. In addition, PCBs in contaminated sediments can serve as a source of contamination for aquatic organisms and begin to bioaccumulate within the food chain. Therefore, one potential pathway of human exposure is human consumption of PCBs in the fatty tissue of fish and wildlife, as explained below.

VI. Summary of Site Risks

Human Health Risks

Contaminant Identification and Exposure Assessment

EPA conducted a baseline risk assessment to evaluate the potential risks to human health and the environment associated with the Site in its current state. The baseline risk assessment focused on the chemicals in Reynolds Study Area sediments which are likely to pose the most significant risks to human health and the environment. These "contaminants of concern" for the Reynolds Metals Company Study Area Site are listed in Table 1.

EPA's Baseline Risk Assessment identified several potential exposure pathways by which the public may be exposed to contaminant releases. The potential exposure routes which were identified in the baseline risk assessment for St. Lawrence River and Raquette River sediments include:

- dermal contact with contaminated sediments;
- ingestion of contaminated sediments;
- ingestion of fish caught from the St. Lawrence River;
- ingestion of surface water from the St. Lawrence River;
- inhalation of contaminants volatilized from surface water; and
- dermal contact with surface water during swimming.

Of these potential pathways of exposure, ingestion of surface water, inhalation of volatilized contaminants, and dermal contact with surface water were not evaluated quantitatively in the baseline risk assessment because available data indicated that the risks associated with these exposure pathways would be relatively minor compared to the other routes of exposure considered.

The baseline risk assessment evaluated both present and possible future exposures for recreational users and for subsistence fishermen. Potentially exposed populations include area residents and residents of the St. Regis Mohawk Reservation and Canadians who are downriver of the Site. Risks were calculated for small children and for adults. Exposure assumptions were based on reasonable maximum exposure scenarios. Tables 2 - 4 present the exposure assumptions used by EPA in its Baseline Risk Assessment.

Toxicity Assessment

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and noncarcinogenic effects due to exposure to Site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and noncarcinogenic risks associated with exposures to individual contaminants were summed separately to indicate the potential risks associated with mixtures of potential carcinogens and noncarcinogens, respectively.

Potential carcinogenic risks were evaluated using the cancer slope factors developed by EPA for the contaminants of concern. Cancer slope factors (SFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor (CRAVE) for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. SF values for Reynolds Study Area contaminants of concern are given in Table 5.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of milligrams/kilogram-day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. RfDs for Reynolds Study Area contaminants of concern are given in Table 5.

Human Health Risk Characterization

Excess lifetime cancer risks for the Reynolds Study Area were determined by multiplying the intake levels with the SF (see Table 5) for each contaminant of concern. These risks are probabilities that are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that as a plausible upper bound, an individual has an additional one in one million chance of developing cancer as a result of site-related exposure to contaminants over a 70-year lifetime under the specific exposure conditions presented in the Reynolds Study Area. Table 6 presents a summary of the carcinogenic risks posed by each exposure pathway developed for the Reynolds Study Area. The greatest carcinogenic risks values calculated for the Site are associated with the ingestion of fish caught in the St. Lawrence River. The only contaminants contributing to this value were PCBs.

For known or suspected carcinogens, the USEPA considers excess upper bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the Site. As illustrated in Table 6, the risks associated with all exposure pathways associated with the St. Lawrence River are outside the range considered acceptable by EPA. The risks associated with ingestion of fish from the Raquette River were calculated and were found to be unacceptable. However, these risks are assumed to be attributable to sources other than the Reynolds Study Area Site due to the low levels of contaminants detected in Raquette River sediments (< 1 ppm PCBs) and surface water (< 65 ppt PCBs) in the vicinity of the Reynolds facility.

The potential risks of noncarcinogenic effects of contaminants in a single medium are expressed as the hazard index (or the ratio of the intake level for a given medium to the RfD), given in Table 5, for each contaminant of concern. Table 7 presents a summary of the HIs posed by each exposure pathway. Again, the noncarcinogenic effects associated with ingestion of fish are generally greater than those associated with other exposure pathways.

A hazard index greater than 1 indicates that potential exists for noncarcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. As illustrated in Table 7, the noncarcinogenic effects associated with all exposure pathways associated with the St. Lawrence River are above 1. The noncarcinogenic effects associated with Raquette River pathways were below 1 due to the low levels of contaminants detected in Raquette River sediments and surface water.

It can be seen from Table 7 that the HI for noncarcinogenic effects from ingestion of fish from the St. Lawrence and Raquette Rivers is 70. Therefore, noncarcinogenic effects may occur from the exposure routes evaluated in the Risk Assessment. The noncarcinogenic risk was attributable to PCBs.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis;
- environmental parameter measurement;
- fate and transport modeling;
- exposure parameter estimation; and
- toxicological data.

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled. Uncertainty in the exposure assessment is related to the presence of potentially sensitive populations (fishermen and residents) in very close proximity to the Site. Additional uncertainties arise from estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the baseline risk assessment provides upper bound estimates of the risks to populations near the Site.

Potential site-specific sources of uncertainty for the Reynolds Study Area Site include the inherent variability associated with environmental sampling of biota, especially fish. For example, fish contaminant concentrations may vary depending on species, mobility, fat content, age, and feeding habits. The significant total number of samples in the Reynolds Study Area serves to reduce this source of uncertainty.

Environmental Risks

An ecological risk assessment was performed to determine the actual and/or potential effects of contaminants of concern on fish and other primarily aquatic wildlife in the Reynolds Study Area. A four-step process was utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: **Problem Formulation and Hazard Identification** - development of information characterizing habitats and potentially exposed species found in the Reynolds Study Area and identification of contaminants of concern and exposure pathways and receptors; **Exposure Assessment** - involves the estimation of actual and potential exposure point concentrations for selected indicator species; **Ecological Effects Assessment** - literature reviews, field studies, and toxicity tests linking contaminant concentrations to effects on indicator species; and **Risk Characterization** - measurement or estimation of both current and future adverse effects from exposure to contaminants in the Reynolds Study Area.

EPA identified several contaminants which were of concern from an ecological risk perspective and their respective animal receptors including PCBs, PAHs, aluminum, fluoride, and cyanide in aquatic macroinvertebrates, yellow perch, white sucker, least bittern, belted kingfisher, little brown bat, and mink. PCBs have been shown to have adverse effects on these receptors including reproductive impairment in certain birds and reproductive failure in mink.

Aquatic macroinvertebrates may take up contaminants from water which has contacted contaminated sediments. Aquatic macroinvertebrates are then consumed by fish, birds, and small mammals. Because PCBs remain in the fat cells of these animals, the concentrations of PCBs in these small animals increase over time. These small animals with increasingly higher PCB concentrations may then be eaten by larger animals.

The results of the ecological risk assessment indicate that the contaminated sediment and water in the St. Lawrence River in the Reynolds Study Area pose unacceptable risks to several species. These risks include reproductive effects to animals which bioaccumulate PCBs in their tissues. In addition, the concentrations of several contaminants, including aluminum and PAHs, are several times higher than federal and State ambient water quality criteria and federal sediment quality criteria and National

Oceanic and Atmospheric Administration sediment guidelines which are based on protection of wildlife.

Risk Summary

Actual or threatened releases of hazardous substances from the Site, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare or the environment.

VII. Description of Alternatives

Sediment Cleanup Levels

Based on the results of its risk assessment, EPA established cleanup levels for contaminated sediment in the Reynolds Study Area which are protective of human health and the environment. The cleanup levels are: PCBs - 1 ppm; PAHs - 10 ppm; TDBF - 1 ppb. Cleanup levels are the concentration of contaminants in sediment above which some remedial action will be taken (i.e., treatment or containment). These cleanup levels were based on ingestion of sediment by local fishermen and represent contaminant concentrations which would be associated with carcinogenic risks of 10^{-5}.

Cleanup to these levels will also remove the threat from other contaminants such as fluoride and cyanide. The 1 ppm PCB cleanup level is identical to that selected by EPA for contaminated sediment associated with the General Motors Site which is immediately downstream of the RMC facility. EPA estimates that a 1 ppm PCB cleanup level is associated with a 1×10^{-5} (1 in 100,000) excess cancer risk to humans. A rough approximation of the area which must be addressed to meet these cleanup levels is given in Figure 11. There are approximately 51,500 cubic yards of sediment over a 27-acre area with PCB concentrations above 1 ppm, PAHs above 10 ppm, and TDBFs above 1 ppb. EPA considers such sediments to pose a principal threat to human health and the environment.

It should be noted that federal and New York State sediment quality criteria guidance indicate that PCB cleanup levels well below 1 ppm are required to achieve protection of the environment. While EPA would prefer a lower cleanup level which would be associated with a 10^{-6} cancer risk, EPA has selected the 1 ppm PCB cleanup level because it believes it is technically practicable to achieve in the St. Lawrence River. In selecting the 1 ppm cleanup goal, EPA has also balanced its desire for a very low cleanup level which will minimize residual risk with the constraints posed by the limitations of dredging as a means of removing sediment with the further intent of selecting treatment as a principal element over containment. EPA believes that a 1 ppm cleanup goal in the St. Lawrence River provides an acceptable measure of protection of human health.

EPA's 1990 "Guidance for Remedial Actions for Superfund Sites with PCB Contamination" (also referred to as the "PCB Guidance") recommends a 10-25 ppm PCB action level for soils in an industrial area. In general, according to this guidance, soils with PCB concentrations in the 10 - 25 ppm range may be disposed on an industrial facility with minimal long-term management controls. Accordingly, EPA has evaluated alternatives which include disposal of treated sediments with PCB concentrations between 10 and 25 ppm.

Description of Alternatives

The AA Report evaluated in detail several alternatives for addressing the contamination in the St. Lawrence River in the Reynolds Study Area. These alternatives are described below. Construction times given include the time necessary to construct and implement the remedy but do not include the time required for design or contract award.

Alternative A: No Action

Capital Cost: $ 0
O&M Cost: $ 0/year
Present Worth Cost: $ 0
Construction Time: None

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) requires that the "no action" alternative be considered as a baseline for comparison with other alternatives. This action consists of allowing the 51,500 cubic yards of contaminated sediments with concentrations above the cleanup levels to remain in their present state. No actions would be taken to remove or contain contaminated sediments which currently pose a threat to human health and the environment.

Because this alternative would result in contaminants remaining on-site above health-based levels, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative B: In-Situ Capping of Sediments

Capital Cost: $ 13.3 million
O&M Cost: $ 190,000/year
Present Worth Cost: $ 16.6 million
Construction Time: 3 years

This alternative involves leaving the 51,500 cubic yards of contaminated sediments in place and placing a multilayer cap consisting of fine-grained clean sand and a woven geotextile fabric over the sediments. The portion of the Site adjacent to the shoreline would then be armored to minimize erosion (see Figure 12). This alternative is designed to isolate and limit the transport of river sediments and is based on methods commonly used to reduce shoreline erosion.

Prior to construction, the Reynolds Study Area bathymetry would be refined and remapped. In addition, areas of dense vegetation and any areas containing boulders or debris would be identified and mapped. The geotextile fabric would be pieced together from sections delivered to the shoreline and each geofabric piece transported on a barge out to each area defined for sediment capping. Once lowered from the barge, the geotextile would be anchored with sand bags. The placement of the geotextile would be carefully controlled to minimize mudwaves and turbidity. Clean sand would then be spread in an approximate 1.5 foot layer over the geotextile using a diffuser.

Armoring material would then be placed in the shallow area adjacent to the shoreline which is exposed to wave action and boat wakes. The armoring system would be concrete revetment which consists of a water permeable fabric casing, which has been woven from high-strength synthetic fibers and which would be laid by laborers and then filled with concrete. The total area of the cap would extend 10 to 20 percent beyond the contaminated area to maximize isolation of the contaminated sediment from the aquatic environment. Inspections and monitoring would be conducted during construction including depth sounding and water quality monitoring. After construction, a long-term physical, chemical, and biological performance monitoring program would be instituted to determine the cover's effectiveness in containing contaminated sediments. This alternative also provides for periodic maintenance of the cover and posting warning signs and restricting access from both on and offshore.

Because this alternative would result in contaminants remaining on-site above health-based levels, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative D: Sediment Removal/Landfilling

Capital Cost: $ 33.4 million
O&M Cost: $ 28,000/year
Present Worth Cost: $ 33.9 million
Construction Time: 4 years

This alternative involves dredging sediment which is above Reynolds Study Area cleanup levels (approximately 51,500 cubic yards) from the St. Lawrence River adjacent to the RMC facility. The dredged sediment would then be pretreated and placed in an engineered landfill on the RMC facility.

Prior to dredging, silt curtains would be installed to minimize transport of contaminated sediment which may be suspended during the dredging process. Hydraulic dredges would be used to remove sediments. Oversized materials would be screened from the dredged sediments as the sediments are offloaded into scows and transported to the shoreline. Sediments would then be decanted and dewatered and placed, along with the previously screened oversized debris, into an on-site landfill. Water removed from the sediments would be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water would then be discharged to the St. Lawrence River through RMC's 001 outfall.

Following completion of sediment placement in the landfill, the on-site landfill would be closed. Leachate from the landfill would be collected, treated, and discharged to the St. Lawrence River. Groundwater downgradient of the landfill would be monitored.

The major ARARs associated with this alternative include the applicable federal Toxic Substances Control Act (TSCA) and the relevant and appropriate federal and State Resource Conservation and Recovery Act (RCRA) regulations which govern the construction, closure, and monitoring of the on-site landfill. In addition, all discharges to the St. Lawrence River would be subject to applicable substantive provisions of the New York State Pollutant Discharge Elimination System (SPDES) which regulates surface water discharges in New York State.

Because this alternative would result in contaminants remaining on-site above health-based levels, CERCLA requires that the Site be reviewed at least once every five years. If justified by the five year review, remedial actions may be implemented to remove or treat the wastes.

Alternative E: Sediment Removal/Incineration/On-site Disposal or Landfilling

Capital Cost: $ 52.8 million (without landfill construction)
$ 55.3 million (with landfill construction)
O&M Cost: $ 28,000/year
Present Worth Cost: $ 53.3 million (without landfill construction)
$ 55.8 million (with landfill construction)
Construction Time: 4 years

This alternative involves dredging sediments which are above Reynolds Study Area cleanup levels (approximately 51,500 cubic yards) from the St. Lawrence River adjacent to the RMC facility. The dredged sediment would then be pretreated to remove water, incinerated to destroy organic contaminants, and disposed of on-site.

Prior to dredging, silt curtains would be installed to minimize transport of contaminated sediment which may be resuspended during the dredging process. Hydraulic dredges would be used to remove sediments. Oversized materials would be screened from the dredged sediments as the sediments are offloaded into scows and transported to the shoreline. Sediments would then be decanted, dewatered, and incinerated on-site. The incinerator ash would have PCB levels at or below 2 ppm. EPA does not expect that the ash from the incinerator will be a RCRA hazardous waste. However, the ash would be tested using the RCRA Toxicity Characteristic Leaching Procedure (TCLP) test and, if found to be hazardous, placed, along with the previously screened oversized debris, into an on-site landfill. Therefore, the costs of this alternative may vary, depending on whether construction of an engineered landfill is necessary. Such construction would not be necessary if the treated sediments are not a RCRA hazardous waste. If the treated sediments were not found to be RCRA hazardous, they would be disposed of on-site.

Water removed from the sediments would be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water would then be discharged to the St. Lawrence River through RMC's 001 outfall.

The major ARARs associated with this alternative include the applicable federal TSCA and the relevant and appropriate federal and State RCRA regulations which govern the operation and monitoring of the on-site incinerator and the construction, closure, and monitoring of the on-site landfill. In addition, air emissions from the incinerator would be monitored to ensure compliance with federal Clean Air Act regulations. Discharges to the St. Lawrence River would be subject to applicable substantive SPDES provisions which regulate surface water discharges in New York State.

Alternative F: Sediment Removal/Thermal Desorption/On-site Disposal or Landfilling

Capital Cost: $ 43.7 million (without landfill construction)
$ 46.2 million (with landfill construction)
O&M Cost: $ 28,000/year (with landfill construction)
Present Worth Cost: $ 44.2 million (without landfill construction)
$ 46.7 million (with landfill construction)
Construction Time: 4 years

This alternative involves dredging sediments which are above Reynolds Study Area cleanup levels (approximately 51,500 cubic yards) from the St. Lawrence River adjacent to the RMC facility. The dredged sediment would then be pretreated to remove water, treated by thermal desorption to remove organic contaminants, and disposed of on-site.

Prior to dredging, silt curtains would be installed to minimize transport of contaminated sediment which may be suspended during the dredging process. Hydraulic dredges would be used to remove sediments. Oversized materials would be screened from the dredged sediments as the sediments are offloaded into scows and transported to the shoreline. Sediments would then be decanted, dewatered, and treated on-site. The sediment treatment process would consist of thermal desorption, an innovative technology which thermally extracts organic contaminants and subsequently condenses and recovers the distilled contaminants. The recovered contaminants would then be sent to an off-site location for incineration at a permitted commercial incinerator.

Based on the results of treatability testing, treated sediments would have PCB concentrations below 10 ppm. EPA does not expect that the treated sediments will be a RCRA hazardous waste. However, the treated sediments would be tested using the RCRA TCLP test and, if found to be hazardous, placed, along with the previously screened oversized debris, into an on-site landfill. Therefore, the costs of this alternative may vary, depending on whether construction of an engineered landfill is necessary. Such construction would not be necessary if the treated sediments are not a RCRA hazardous waste. If the treated sediments were not found to be RCRA hazardous, they would be disposed of on-site.

Water removed from the sediments would be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water would then be discharged to the St. Lawrence River through RMC's 001 outfall.

The major ARARs associated with this alternative include the applicable federal TSCA and the relevant and appropriate federal and State RCRA regulations which govern the construction, closure, and monitoring of the on-site landfill. In addition, air emissions from the thermal desorption process would be monitored to ensure compliance with federal Clean Air Act regulations. Discharges to the St. Lawrence River would be subject to applicable substantive SPDES provisions which regulate surface water discharges in New York State.

Alternative G: Sediment Removal/Partial Thermal Desorption/Disposal with Soil Cover

Alternative G(A) - 25 ppm treatment level
Capital Cost: $ 34.8 million
O&M Cost: $ 28,000/year
Present Worth Cost: $ 35.1 million
Construction Time: 4 years

Alternative G(B) - 10 ppm treatment level
Capital Cost: $ 36.4 million
O&M Cost: $ 28,000/year
Present Worth Cost: $ 36.7 million
Construction Time: 4 years

This alternative is very similar to Alternative F above. However, under this alternative, only those more highly contaminated sediments would be treated by thermal desorption. As in Alternatives D - F, this alternative involves dredging sediments which are above Reynolds Study Area cleanup levels (approximately 51,500 cubic yards) from the St. Lawrence River adjacent to the RMC facility. The dredged sediment would then be pretreated to remove water. Sediment with PCB concentrations above the treatment level would be treated by thermal desorption to remove organic contaminants. Treated sediment and untreated sediment would then be disposed of on-site.

Under this alternative, EPA has evaluated two different treatment levels. Under Alternative G(A), only those sediments with PCB concentrations above 25 ppm (approximately 14,500 cubic yards) would be treated by thermal desorption. The remaining 37,000 cubic yards of sediment with PCB concentrations below 25 ppm would be disposed of on-site without prior treatment. Under Alternative G(B), only those sediments with PCB concentrations above 10 ppm (approximately 19,700 cubic yards) would be treated by thermal desorption. The remaining 31,800 cubic yards of sediment would be disposed of on-site without prior treatment. The 10 ppm and 25 ppm PCB treatment levels evaluated represent levels which EPA generally considers acceptable for on-site disposal in an industrial area. Per the August 1990 PCB Guidance, material with PCB concentrations in the 10 - 25 ppm range may generally be disposed of on an industrial facility with minimal long-term management.

Prior to dredging, silt curtains would be installed to minimize transport of contaminated sediment which may be suspended during the dredging process. Hydraulic dredges would be used to remove sediments. Oversized materials would be screened from the dredged sediments as the sediments are offloaded into scows and transported to the shoreline. Sediments would then be decanted, dewatered, and, for those sediments with PCB concentrations above the treatment level, treated on-site by thermal desorption. Contaminants recovered during treatment would then be sent to an off-site location for incineration at a permitted commercial incinerator.

Based on the results of treatability testing, treated sediments would have PCB concentrations below 10 ppm. Treated sediments would be tested to ensure that they cannot be classified as a RCRA hazardous waste using the RCRA TCLP test . Treated sediments, along with untreated dewatered sediments, would be disposed of on-site, preferably in the Black Mud Pond, and covered. If the sediments are not disposed in the Black Mud Pond, they will be disposed of elsewhere on-site and covered with a soil cover and monitored to ensure that the soil cover remains intact.

Water removed from the sediments would be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water would then be discharged to the St. Lawrence River through RMC's 001 outfall.

The major ARARs associated with this alternative include the applicable federal TSCA and the relevant and appropriate federal and State RCRA regulations which govern the disposal and monitoring of the sediments. In addition, air emissions from the thermal desorption process would be monitored to ensure compliance with federal Clean Air Act regulations. Discharges to the St. Lawrence River would be subject to applicable substantive SPDES provisions which regulate surface water discharges in New York State.

Because this alternative would result in contaminants remaining on-site above health-based levels, CERCLA requires that the Site be reviewed at least once every five years. If justified by the five year review, remedial actions may be implemented to remove or treat the wastes.

Alternative I: Sediment Removal/Partial Thermal Desorption/Landfilling

Alternative I(A) - 500 ppm treatment level
Capital Cost: $ 35.3 million
O&M Cost: $ 28,000/year
Present Worth Cost: $ 35.8 million
Construction Time: 4 years

Alternative I(B) - 50 ppm treatment level
Capital Cost: $ 37.4 million
O&M Cost: $ 28,000/year
Present Worth Cost: $ 37.9 million
Construction Time: 4 years

This alternative is very similar to Alternative G above. However, under this alternative, only the most highly contaminated sediments would be treated by thermal desorption. As in Alternatives F and G, this alternative involves dredging sediments which are above Reynolds Study Area cleanup levels (approximately 51,500 cubic yards) from the St. Lawrence River adjacent to the RMC facility. The dredged sediment would then be pretreated to remove water and sediment with PCB concentrations above the treatment level would be treated by thermal desorption to remove organic contaminants. Treated sediment and untreated sediment would then be disposed of on-site.

Under this alternative, EPA has evaluated two different treatment levels. Under Alternative I(A), only those sediments with PCB concentrations above 500 ppm (approximately 2,300 cubic yards) would be treated by thermal desorption. The remaining 49,200 cubic yards of sediment with PCB concentrations below 500 ppm would be disposed of in an on-site landfill without prior treatment. Under Alternative I(B), only those sediments with PCB concentrations above 50 ppm (approximately 11,300 cubic yards) would be treated by thermal desorption. The remaining 39,700 cubic yards of sediment would be disposed of on-site without prior treatment.

Prior to dredging, silt curtains would be installed to minimize transport of contaminated sediment which may be suspended during the dredging process. Hydraulic dredges would be used to remove sediments. Oversized materials would be screened from the dredged sediments as the sediments are offloaded into scows and transported to the shoreline. Sediments would then be decanted, dewatered, and, for those sediments with PCB concentrations above the treatment level, treated on-site by thermal desorption. Contaminants recovered during treatment would then be sent to an off-site location for incineration at a permitted commercial incinerator.

Based on the results of treatability testing, treated sediments would have PCB concentrations below 10 ppm. Treated sediments would be tested to ensure that they cannot be classified as a RCRA hazardous waste. Treated and untreated sediments would be placed, along with the previously screened oversized debris and untreated sediments, into an on-site landfill.

Water removed from the sediments would be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water would then be discharged to the St. Lawrence River through RMC's 001 outfall.

The major ARARs associated with this alternative include the applicable federal TSCA and the relevant and appropriate federal and State RCRA regulations which govern the construction, closure, and monitoring of the on-site landfill. In addition, air emissions from the thermal desorption process would be monitored to ensure compliance with federal Clean Air Act regulations. Discharges to the St. Lawrence River would be subject to applicable substantive SPDES provisions which regulate surface water discharges in New York State.

Because this alternative would result in contaminants remaining on-site above health-based levels, CERCLA requires that the Site be reviewed at least once every five years. If justified by the five year review, remedial actions may be implemented to remove or treat the wastes.

Alternative J: Partial Sediment Removal/Thermal Desorption/On-site Disposal or Landfilling/In-Situ Capping

Capital Cost: $ 17.1 million (without landfill construction)
$ 19.6 million (with landfill construction)

O&M Cost: $ 28,000/year
Present Worth Cost: $ 17.6 million (without landfill construction)
$ 23.2 million (with landfill construction)

Construction Time: 3 years

This alternative includes dredging approximately 2,300 cubic yards of contaminated sediment with PCB concentrations above 500 ppm from the St. Lawrence River adjacent to the RMC facility. The dredged sediment would then be pretreated to remove water and treated by thermal desorption to remove organic contaminants. Treated sediment would then be disposed of on-site. The remaining 49,200 cubic yards of contaminated sediment would be left in place and covered in the river with a multilayer cap.

Prior to dredging, silt curtains would be installed to minimize transport of contaminated sediment which may be resuspended during the dredging process. Hydraulic dredges would be used to remove sediments. Oversized materials would be screened from the dredged sediments as the sediments are offloaded into scows and transported to the shoreline. Sediments would then be decanted, dewatered, and treated on-site by thermal desorption. Contaminants recovered during treatment would then be sent to an off-site location for incineration at a permitted commercial incinerator. Water removed from the sediments would be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water would then be discharged to the St. Lawrence River through RMC's 001 outfall.

Based on the results of treatability testing, treated sediments would have PCB concentrations below 10 ppm. EPA does not expect that the treated sediments will be a RCRA hazardous waste. However, the treated sediments would be tested using the RCRA TCLP test and, if found to be hazardous, placed, along with the previously screened oversized debris, into an on-site landfill. Therefore, the costs of this alternative may vary, depending on whether construction of an engineered landfill is necessary. Such construction would not be necessary if the treated sediments are not a RCRA hazardous waste. If the treated sediments were not found to be RCRA hazardous, they would be disposed of on-site.

As in Alternative B, the remaining 49,200 cubic yards of sediment would be left in place and a multilayer cap consisting of fine-grained clean sand and a woven geotextile fabric would be placed over the sediments. The capping system design, construction, and monitoring would be identical to that described in Alternative B. This alternative also provides for periodic maintenance of the cover and posting warning signs and restricting access from both on and offshore.

The major ARARs associated with this alternative include the applicable federal TSCA and the relevant and appropriate federal and State RCRA regulations which govern the construction, closure, and monitoring of the on-site landfill. In addition, air emissions from the thermal desorption process would be monitored to ensure compliance with federal Clean Air Act regulations. Discharges to the St. Lawrence River would be subject to applicable substantive SPDES provisions which regulate surface water discharges in New York State.

Because this alternative would result in contaminants remaining on-site above health-based levels, CERCLA requires that the Site be reviewed at least once every five years. If justified by the five year review, remedial actions may be implemented to remove or treat the wastes.

VIII. Summary of Comparative Analysis of Alternatives

In accordance with the National Contingency Plan (NCP), a detailed analysis of each alternative was performed. The purpose of the detailed analysis was to objectively assess the alternatives with respect to nine evaluation criteria that encompass statutory requirements and include other gauges of the overall feasibility and acceptability of remedial alternatives. The analysis was comprised of an individual assessment of the alternatives against each criterion and a comparative analysis designed to determine the relative performance of the alternatives and identify major trade-offs, that is, relative advantages and disadvantages, among them.

The nine evaluation criteria against which the alternatives were evaluated are as follows:

Threshold Criteria - The first two criteria must be satisfied in order for an alternative to be eligible for selection.

1. **Overall Protection of Human Health and the Environment** addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with Applicable, or Relevant and Appropriate Requirements (ARARs)** is used to determine whether each alternative will meet all of its federal and state ARARs. When an ARAR is not met, the detailed analysis should discuss whether one of the six statutory waivers is appropriate.

Primary Balancing Criteria - The next five "primary balancing criteria" are to be used to weigh major trade-offs among the different hazardous waste management strategies.

3. **Long-term Effectiveness and Permanence** focuses on any residual risk remaining at the Site after the completion of the remedial action. This analysis includes consideration of the degree of threat posed by the hazardous substances remaining at the Site and the adequacy of any controls (for example, engineering and institutional) used to manage the hazardous substances remaining at the Site.

4. **Reduction of Toxicity, Mobility, or Volume Through Treatment** is the anticipated performance of the treatment technologies a particular remedy may employ.

5. **Short-term Effectiveness** addresses the effects of the alternative during the construction and implementation phase until the remedial response objectives are met.

6. **Implementability** addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation.

7. **Cost** includes estimated capital, and operation and maintenance costs, both translated to a present worth basis. The detailed analysis evaluates and compares the cost of the respective alternatives, but draws no

conclusions as to the cost effectiveness of the alternatives. Cost effectiveness is determined in the remedy selection phase, when cost is considered along with the other balancing criteria.

Modifying Criteria - The final two criteria are regarded as "modifying criteria," and are to be taken into account after the above criteria have been evaluated. They are generally to be focused upon after public comment is received.

8. **State Acceptance** reflects the statutory requirement to provide for substantial and meaningful State and Tribal involvement.

9. **Community Acceptance** refers to the St. Regis Mohawk Tribe's and the community's comments on the remedial alternatives under consideration, along with the Proposed Plan. Comments received during the public comment period, and the EPA's responses to those comments, are summarized in the Responsiveness Summary which is attached to this ROD.

The following is a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria.

Overall Protection of Human Health and the Environment

With the exception of Alternative A, no action, each of the alternatives, if properly implemented, operated, and maintained, protects human health and the environment. Although the alternatives differ in the degree of protection they afford, all reduce excess carcinogenic health risks to humans to levels within the acceptable EPA range of 10^{-4} to 10^{-6}. Each of the alternatives also differs in how they provide protection, either through treatment of contaminated sediments, containment of sediments, or a combination of both.

Since Alternative A, the no action alternative, is not protective, it will not be considered in the remainder of this analysis.

Compliance with ARARs

All action alternatives comply with ARARs. As noted in the section above, the major federal and State ARARs include applicable portions of TSCA and RCRA and State solid and hazardous waste disposal regulations. In addition, State SPDES provisions and federal Clean Air Act regulations are applicable to several of the alternatives. There are no chemical-specific action levels or ARARs for sediments.

Long-Term Effectiveness and Permanence

In general, the containment and capping alternatives (Alternatives B and D) provide a lesser degree of permanence in remediating contamination than treatment alternatives (Alternatives E, F, G, I, and J) which destroy contamination. Alternative B which allows contamination to remain in the river system is less permanent than Alternative D. Alternatives E and F, which include treatment of all contaminated sediment, best meet this criterion. The mixed treatment/containment alternatives (Alternatives G, I, and J) provide a higher degree of permanence than the containment alternatives (Alternatives B and D) through permanent destruction of contaminants in highly contaminated sediments.

Of the alternatives which include treatment of contaminated sediments (Alternatives E, F, G, I, and J), long-term effectiveness varies depending on the extent to which contaminants are permanently destroyed. Accordingly, Alternatives E and F which include treatment and destruction of contaminants in all dredged sediments are more effective than Alternatives G, I, and J which include partial treatment of contaminants in dredged sediments. Similarly, Alternative G which includes treatment of sediments with PCB concentrations above 25 ppm (Alternative G(A)) or 10 ppm (Alternative G(B)) is more effective than Alternatives I and J which includes treatment of sediments with PCB concentrations above 500 ppm (Alternative I(A) and Alternative J) or 50 ppm (Alternative I(B)).

The proper implementation of all alternatives would result in acceptable residual cancer risks and noncarcinogenic effects, i.e., cancer risks between 10^{-4} and 10^{-6}, and hazard indices below 1. However, the effectiveness of certain alternatives is dependent on specific technical constraints. For example, the long-term effectiveness of Alternative B (in-situ capping) depends on the success of efforts to accurately place the sediment cap and to repair or replace the cap if monitoring indicates that it is failing to adequately isolate the sediments. Similarly, the effectiveness of Alternatives D, E, F, G, and I will depend on whether it is technically possible to dredge contaminated sediments completely such that all sediment cleanup levels are met.

Alternatives B and J, which include in-situ capping, would require the greatest degree of long-term monitoring and operations and maintenance. This is because, contrary to the other alternatives where contaminated sediments are removed from the river system, the contaminated sediments would be left in-place in the river system under Alternatives B and J. Monitoring and maintenance of contained underwater sediments is technically more difficult than monitoring treated or untreated sediments which are placed in an upland landfill. Because the sediments are submerged, the contained underwater sediments would require periodic inspections by divers. In addition, several rounds of sampling might be required to detect underwater containment cell leakage, since any leaking contamination would be diluted. Further, if underwater monitoring revealed that cap repairs were necessary, such repairs could likely only be undertaken in late spring or in summer.

In addition, the operation and maintenance requirements for Alternatives B and J pose the greatest uncertainties and technical difficulties. For example, the risk to human health and the environment is greatest if Alternatives B and J fail since contaminated sediments would reenter the river system and be available to contaminate fish and wildlife. Sediments contained in a landfill are more secure since a leak in the landfill cap or liner does not automatically result in sediments reentering the river system and contaminating fish and wildlife.

Reduction of Toxicity, Mobility, or Volume through Treatment

In general, all of the alternatives which include dredging and treatment best meet this criterion. Alternatives E and F, which include treatment of all 51,500 cubic yards of contaminated sediments with PCB concentrations above 1 ppm, would result in the greatest reduction of toxicity, mobility, and volume of all the alternatives. Alternative G which includes treatment of sediments with PCB concentrations above 25 ppm (Alternative G(A)) or 10 ppm (Alternative G(B)) is more effective in reducing contaminant toxicity, mobility, and volume than Alternatives I and J which includes treatment of sediments with PCB concentrations above 500 ppm (Alternative I(A) and Alternative J) or 50 ppm (Alternative I(B)).

Although capping and containment alternatives (Alternatives B and D) would reduce the mobility of contaminated material in sediment, no treatment would be performed. Incineration or thermal desorption of sediments (as in Alternatives E, F, G, I, and J) would reduce the mobility, toxicity, and volume of the contaminated material. Incineration produces an ash which must be disposed. Thermal desorption would produce a toxic extract which would be shipped off-site for incineration. Both thermal desorption and incineration would result in the production of treated sediment residuals or ash which EPA does not anticipate will be hazardous.

Short-Term Effectiveness

In general, effective alternatives which can be implemented quickly with little risk to human health and the environment are favored under this criterion. Of the action alternatives evaluated, Alternative B (in-situ capping) would have the fewest short-term effects because sediment suspension would be minimized. Sediment suspension is a concern because any suspended contaminated sediment could redeposit in downstream areas. Alternatives which involve sediment dredging (Alternatives D, E, F, G, I, and J) include the use of extensive controls such as silt curtains to minimize sediment suspension and deposition in the River.

Sediment treatment alternatives (Alternatives E, F, G, I, and J) would reduce the potential for direct contact with contaminated sediment by permanently removing the source of contamination. Community and worker exposure would be minimized by the use of construction methods that minimize air emissions from treatment processes; also, protective equipment that minimizes workers' contact with the contaminated materials would be utilized. Air quality would be monitored during remediation.

Completion of remedial design for any selected remedy would take up to two years. The time required to implement each alternative is: 3 years for Alternative B; 4 years for Alternatives D, E, F, G, and I; and 3 years for Alternative J.

Implementability

All of the alternatives are implementable from an engineering standpoint. However, there are some inherent difficulties which make some alternatives more difficult to implement than others.

While the technology associated with Alternatives B and J (in-situ capping) has been generally used in lakes and harbors, the technical feasibility of ensuring the integrity of the cap, given the currents in the area adjacent to the RMC facility, remains questionable. If the integrity of the cap cannot be maintained in the future, additional cleanup activities, such as sediment dredging, would be required. In addition, because sediments would remain underwater, it may be technically difficult to monitor the effectiveness of the cap. If a cap failure went undetected, fish and wildlife would again be exposed to PCBs and other contaminants.

The greatest potential technical difficulty associated with the sediment removal alternatives (Alternatives D, E, F, G, I, and J) is the technical feasibility of dredging sediments sufficiently to achieve the cleanup goals for the Site. To date, no environmental dredging program has had as its goal the removal of sediments to levels of 1 ppm PCBs. If dredging cannot achieve the 1 ppm PCB level, additional cleanup activities, which could include sediment containment, would be required. For example, Alternative J includes a combination of dredging to remove some highly contaminated sediment and containment of the remaining sediment which is not dredged. In addition, the possible presence of large boulders or debris within the Reynolds Study Area may hamper remediation in areas adjacent to such obstructions.

Incineration, a component of Alternative E, is the most proven and widely available technology for treating many contaminants. However, test burns would be required prior to implementation of incineration. Thermal desorption processes, included in Alternatives F, G, I, and J, while not as widely applied as incineration, have been used in full-scale sediment remediation. Landfilling is also a widely used, easily implementable, relatively easily monitored technology. Coordination with several agencies, including the St. Lawrence Seaway Development Corporation and the

U.S. Corps of Engineers would be required prior to implementation of any alternative.

Cost

The costs associated with each alternative are presented in the descriptions of the alternatives given above. These costs are estimates and may change as a result of modifications made during design and/or construction.

The least expensive action alternative is Alternative B with a present worth cost of $ 16.6 million. Alternative J is the next least expensive with present worth costs ranging from $ 17.6 million to $ 23.2 million. Alternatives D, G and I have present worth costs which range from $ 33.9 million to $ 37.9 million. Alternative F has present worth costs which range from $ 44.2 million to $ 46.7 million. Alternative E is the most expensive alternative with present worth costs ranging from $ 53.3 million to $ 55.8 million.

State Acceptance

New York State has indicated its support for a remedy which includes removal of contaminated sediments from the Reynolds Study Area. In addition, the State also believes that untreated sediments and treated residuals should be disposed in an engineered disposal cell. Alternatively, the State supports disposal of such material in the Black Mud Pond. The State believes that utilizing the Black Mud Pond for disposal would consolidate contaminants in one management unit while realizing cost savings due to eliminating construction, maintenance, and monitoring of a new disposal cell and substantially reducing the volume of fill needed for the Black Mud Pond before capping.

Community Acceptance

Comments from the community submitted during the public comment period indicate that the community has varying opinions regarding remediation of the Reynolds Study Area. The St. Regis Mohawk Tribe expressed a desire for a cleanup plan which takes the contaminants out of the river system and permanently disposes of them. They prefer a 0.1 ppm PCB cleanup level for contaminated sediments and called for additional sampling in the Raquette River.

Comments received from the general public indicated that a majority supported Alternative G(B) with one modification: that sediments and treated residuals be disposed in an engineered landfill, rather than disposed of on-site with a soil cover. Comments from the Canadian government indicated that they believed a pilot-scale dredging study was essential prior to full-scale remedy implementation and requested that EPA consider additional containment measures other than a soil cover for sediments. However, comments received from area industries, including Reynolds, General Motors, and ALCOA, and from the Massena Industrial Development Corporation supported the increased use of in-place containment of sediments as part of EPA's selected remedy and questioned whether a 1 ppm PCB cleanup level is technically achievable. Comments are responded to in detail in the Responsiveness Summary which is an appendix to this document.

IX. Selected Remedy

Based upon an evaluation of the various alternatives and comments received from the public, EPA has selected Alternative G(A), Sediment Removal/Partial Thermal Desorption/Disposal with Soil Cover for remediation of the Reynolds Study Area Site. The major components of the selected remedy include:

- Dredging/Excavation of Contaminated Sediments

Sediments in the St. Lawrence River with PCB levels above 1 ppm, PAH levels above 10 ppm, and TDBF levels above 0.1 ppm will be dredged and/or excavated. The approximate area to be dredged is shown in Figure 11. Approximately 51,500 cubic yards of sediment will be removed from the Reynolds Study Area. All contaminated sediments in the area to be dredged will be removed given the technological limitations associated with dredging. In selecting the 1 ppm cleanup goal, EPA has balanced its desire for a very low cleanup level which will minimize residual risk with the constraints posed by dredging as a means of removing sediment from a riverine environment.

Prior to dredging, additional sediment and surface water sampling will be conducted to better delineate the extent of the area to be dredged and to serve as baseline monitoring data. Bathymetry in the Reynolds Study Area will be refined and remapped. In addition, areas of dense vegetation and any areas containing boulders or debris will be identified and mapped. A phase I dredging program will be conducted to develop site-specific information and operating parameters including information regarding sediment removal efficiencies, sediment resuspension and settling characteristics, dredging rates and costs, silt curtain/sheet pile effectiveness, and sediment dewatering locations and methods.

Silt curtains and, if deemed necessary during design, sheet piling will be installed on the river side of the areas to be dredged to provide a stilling basin for dredging operations and to minimize transport of contaminated sediment which may be resuspended during the dredging process. Sediments will generally be removed using hydraulic dredges but mechanical dredges may also be used when appropriate. Sediments near the shoreline may also be excavated using conventional excavation equipment. During dredging, sediments and surface water will be monitored to ensure that downstream transport of contaminated sediment is minimized. A contingency plan will be developed which describes measures to control and/or minimize the impacts of dredging. Measures to control the impacts of dredging could include, if approved by EPA, modification and/or suspension of dredging activities. Oversized materials will be screened from the dredged sediments as the sediments are transported to the shoreline. Dredged/excavated areas will be restored to their original grade either through the use of fill or, if determined to be appropriate by EPA during design, through natural sediment deposition.

- Partial Thermal Desorption of Sediments

Removed sediments will then be decanted and dewatered. Those sediments with PCB concentrations above 25 ppm (approximately 14,500 cubic yards) will then be treated on-site by thermal desorption. Based on the results of treatability testing, treated sediments will have PCB concentrations below 10 ppm. Condensed contaminants recovered during thermal desorption will be sent to an off-site location for incineration at a permitted commercial incinerator. Water removed from the sediments will be treated using methods including flocculation and chemical precipitation to remove solids, and sand bed filtration and activated carbon adsorption. Treated water will then be discharged to the St. Lawrence River through RMC's 001 outfall in compliance with State discharge regulations.

Emissions from the thermal desorption system will be controlled using venturi scrubbers and scrubber towers. Emissions will be monitored to ensure compliance with federal and State air quality requirements.

- Sediment On-site Disposal with Soil Cover

Sediments will be tested using the RCRA TCLP to ensure that they cannot be classified as RCRA hazardous waste. If they are RCRA hazardous waste, additional treatment, such as solidification, may be required to render them non-hazardous. Treated sediments, along with approximately 37,000 cubic yards of untreated dewatered sediments with PCB concentrations between 1 and 25 ppm, (and rinsed oversized material) will be disposed of on-site, preferably in the Black Mud Pond, and covered. If the sediments are not disposed in the Black Mud Pond, they will be disposed of elsewhere on-site and covered with a soil cover and monitored to ensure that the soil cover remains intact. If the sediments are disposed of in the Black Mud Pond, the Black Mud Pond will be capped, in compliance with the requirements of the New York State-Reynolds Consent Order, with a multilayer cap and monitored and maintained to ensure the integrity of the cap.

Prior to remediation, a floodplains assessment will be performed and a statement of consistency with the New York State Coastal Zone Management Program will be required. Some changes may be made to the remedy as a result of the remedial design and construction processes. Post-remediation monitoring of the St. Lawrence River will be performed.

The capital cost of the selected remedy is $ 34.8 million. Annual operation and maintenance costs are $ 28,000/year. The total present worth cost of the selected remedy is $ 35.1 million. A more detailed breakdown of estimated costs associated with the selected remedy is presented in Table 8.

X. Statutory Determinations

Protection of Human Health and the Environment

The selected remedy protects human health and the environment through the removal of contaminated sediments from the river system and the subsequent permanent treatment of highly contaminated sediments. Treated sediments and untreated sediments with low level contamination will be disposed of on-site. Cleaned oversized items which cannot be treated will also be disposed of on-site. Following implementation of the selected remedy, the excess cancer risk to adults will be on the order of 10^{-5}, within the range considered acceptable by EPA. In addition, following implementation, hazard indices for non-carcinogens will be less than one.

Compliance with Applicable or Relevant and Appropriate Requirements

A list of ARARs for the selected remedy is presented in Table 9. The selected remedy complies with these ARARs.

Cost-Effectiveness

The selected remedy is cost-effective because it has been demonstrated to provide overall effectiveness proportional to its costs. The present worth cost of the selected alternative is $ 35.1 million. EPA has selected the least expensive alternative which provides for permanent removal and treatment of the majority of the principal threat posed by contaminated sediments. In addition, an analysis of the costs of Alternatives G and I demonstrates that it is more expensive to construct a landfill for disposal of sediments with PCB concentrations between 25 and 500 ppm than it is to treat such sediments. Therefore, Alternative G is more cost-effective than Alternative I.

The use of thermal desorption, rather than incineration, minimizes the cost of treatment. The 25 ppm treatment threshold results in permanent treatment of the majority of the contaminated sediments and is consistent with EPA guidance and the State's cleanup plans for the upland portion of the Reynolds facility. EPA's preference for use of the Black Mud Pond for disposal is also cost-effective since it will minimize the amount of fill needed in this area and it will consolidate material in one management area.

Utilization of Permanent Solutions and Alternative Treatment (or resource recovery) Technologies to the Maximum Extent Practicable (MEP)

The selected remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable. The selected remedy represents the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost while also considering the statutory preference for treatment as a principal element and considering State, Tribe, and community acceptance.

The selected remedy offers a higher degree of permanence than in-situ containment alternatives. Because PCBs, PAHs, and TDBFs are highly persistent in the environment, removal and treatment provide the most effective way of assuring long-term protection. In addition, the treatment of the most highly contaminated sediments combined with on-site containment of untreated sediments and treatment residuals significantly reduces the total concentration of PCBs in the material which must be managed over the long-term. The use of thermal desorption combined with incineration of the condensed extract from the thermal desorption process will reduce the toxicity and mobility of contaminants. Although there are short-term impacts associated with the selected remedy, these will be mitigated through the use of controls such as silt curtains and, if necessary, sheet piles.

EPA realizes that the implementability of the selected remedy has not been fully established. Therefore, a phase I dredging program will be conducted to develop site-specific information and operating parameters including information regarding sediment removal efficiencies, sediment suspension and settling characteristics, dredging rates and costs, silt curtain/sheet pile effectiveness, and sediment dewatering locations and methods. Among the alternatives considered for the Site, the major tradeoffs that provided the basis for EPA's remedy selection were the fact that the selected remedy provides long-term effectiveness and permanence and reduces the toxicity of the principal threat material at the lowest cost while being consistent with the State's selected remedy for the upland portion of the Reynolds facility.

Preference for Treatment as a Principal Element

By removing and treating the contaminated sediments with PCB concentrations above 25 ppm, the selected remedy satisfies the statutory preference for remedies that employ treatment as a principal element. The selected remedy is consistent with Superfund program expectations that indicate that highly toxic, persistent wastes are a priority for treatment.

XI. Documentation of Significant Changes

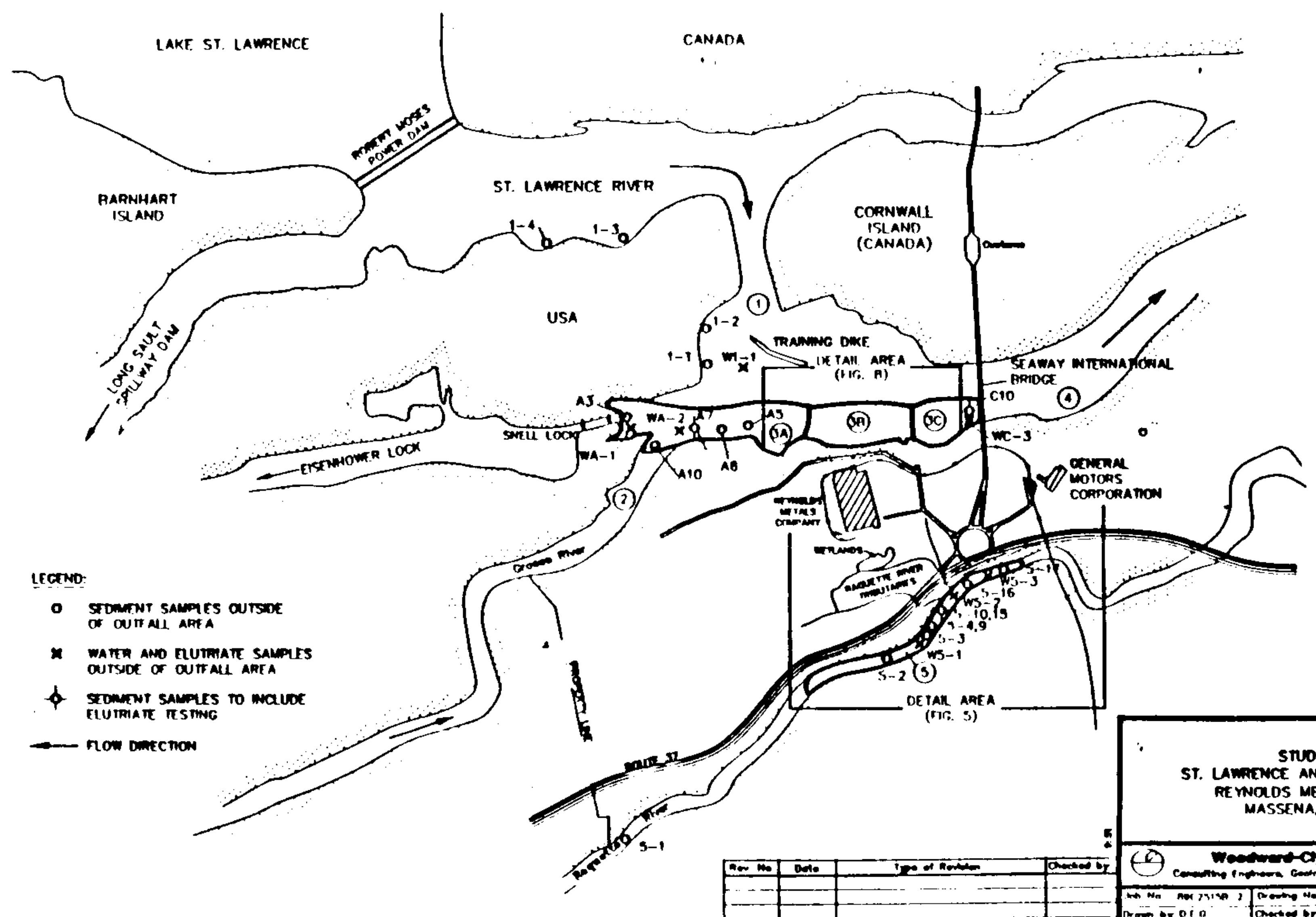
After reviewing comments received from the New York State Department of Environmental Conservation, EPA has determined that the Black Mud Pond would be a suitable location for disposal of treatment residuals and untreated sediment. Utilization of the Black Mud Pond as a disposal area would consolidate contaminants in one management unit while realizing cost savings due to eliminating construction, maintenance, and monitoring of a new disposal cell and substantially reducing the volume of fill needed for the Black Mud Pond before capping.

Originally, EPA, in its Proposed Plan, preferred Alternative G(B), sediment removal/partial thermal desorption/disposal with soil cover which incorporated a 10 ppm PCB treatment level. However, EPA has determined that a 25 ppm PCB treatment level is consistent with New York State's plans for remediating on-site contamination and that this change will lower remedial costs. This is consistent with EPA guidance which recommends a 10 - 25 ppm soil cleanup level for industrial sites as generally protective of human health and the environment.

In addition, material with PCB concentrations below 25 ppm could be placed in the Black Mud Pond since it would not contain concentrations significantly above material currently found in the Black Mud Pond. Accordingly, EPA has selected Alternative G(A), which incorporates a 25 ppm PCB treatment level and a preference for disposal in the Black Mud Pond, for remediation of the Reynolds Study Area sediments.

APPENDIX 1

FIGURES



Rev No	Date	Type of Revision	Checked by

STUDY AREA
ST. LAWRENCE AND RAQUETTE RIVERS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

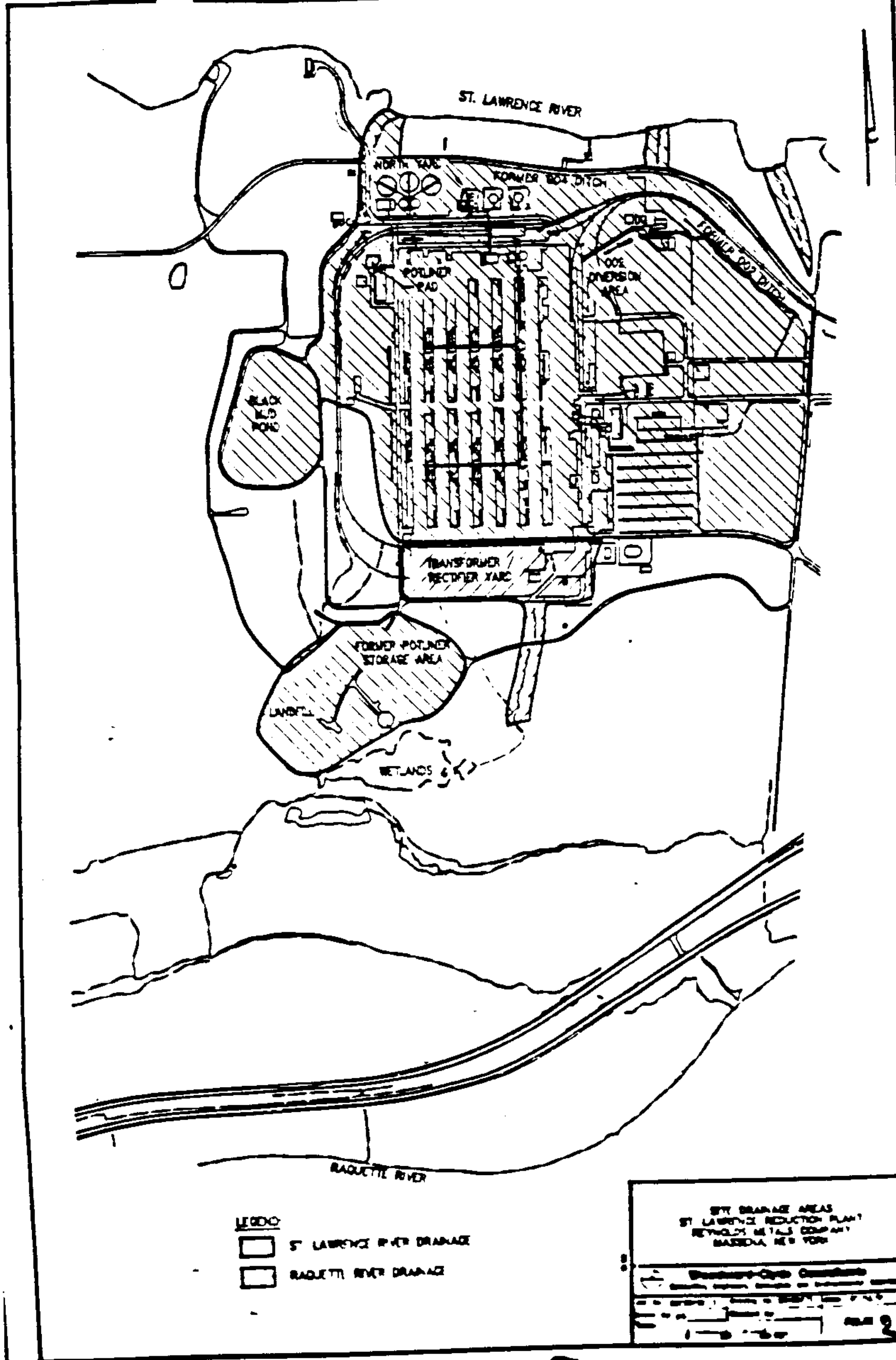
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Drawn by D.E.O. | Checked by | Date 08/12/91

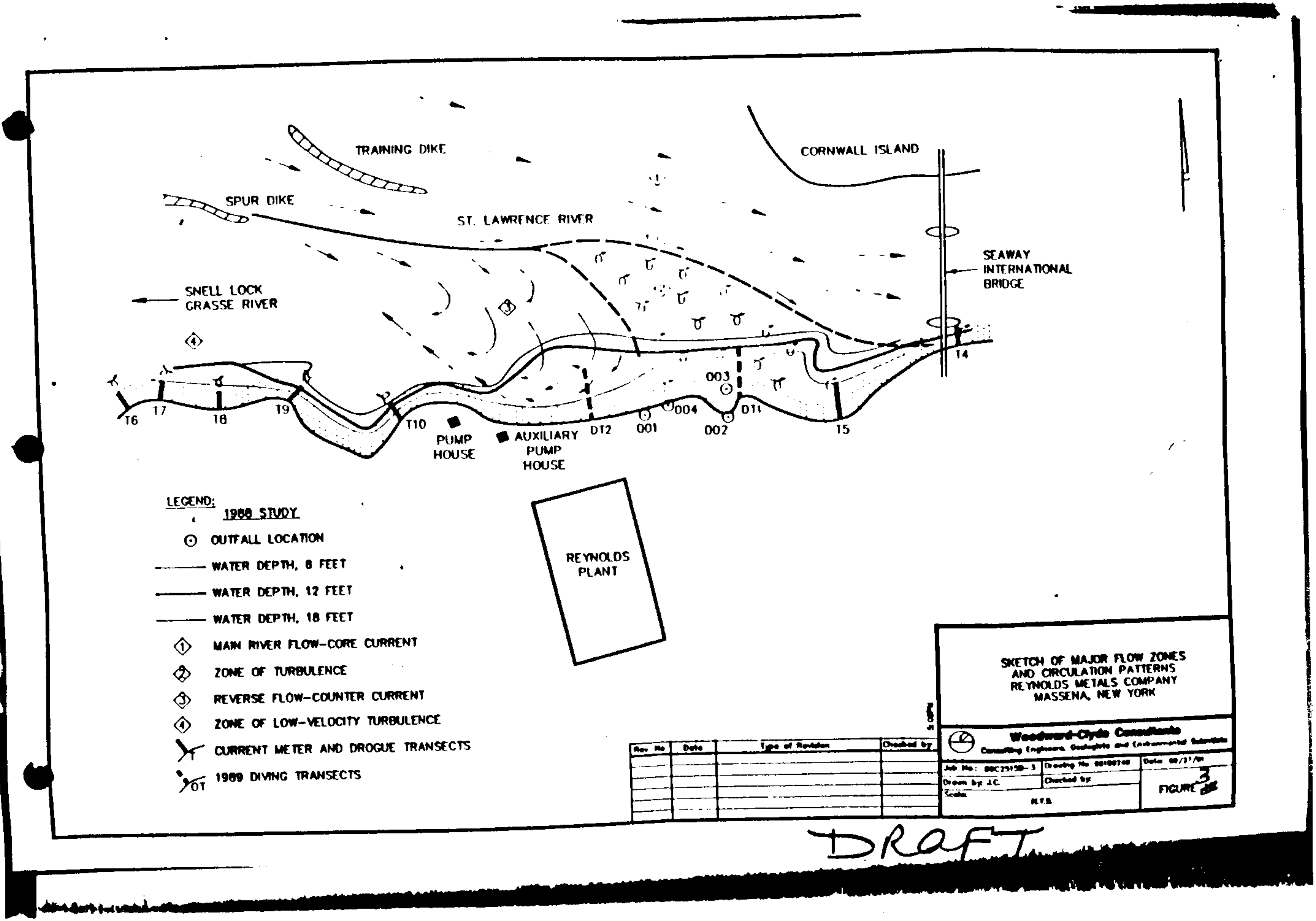
Scale 0 — 3000 FEET

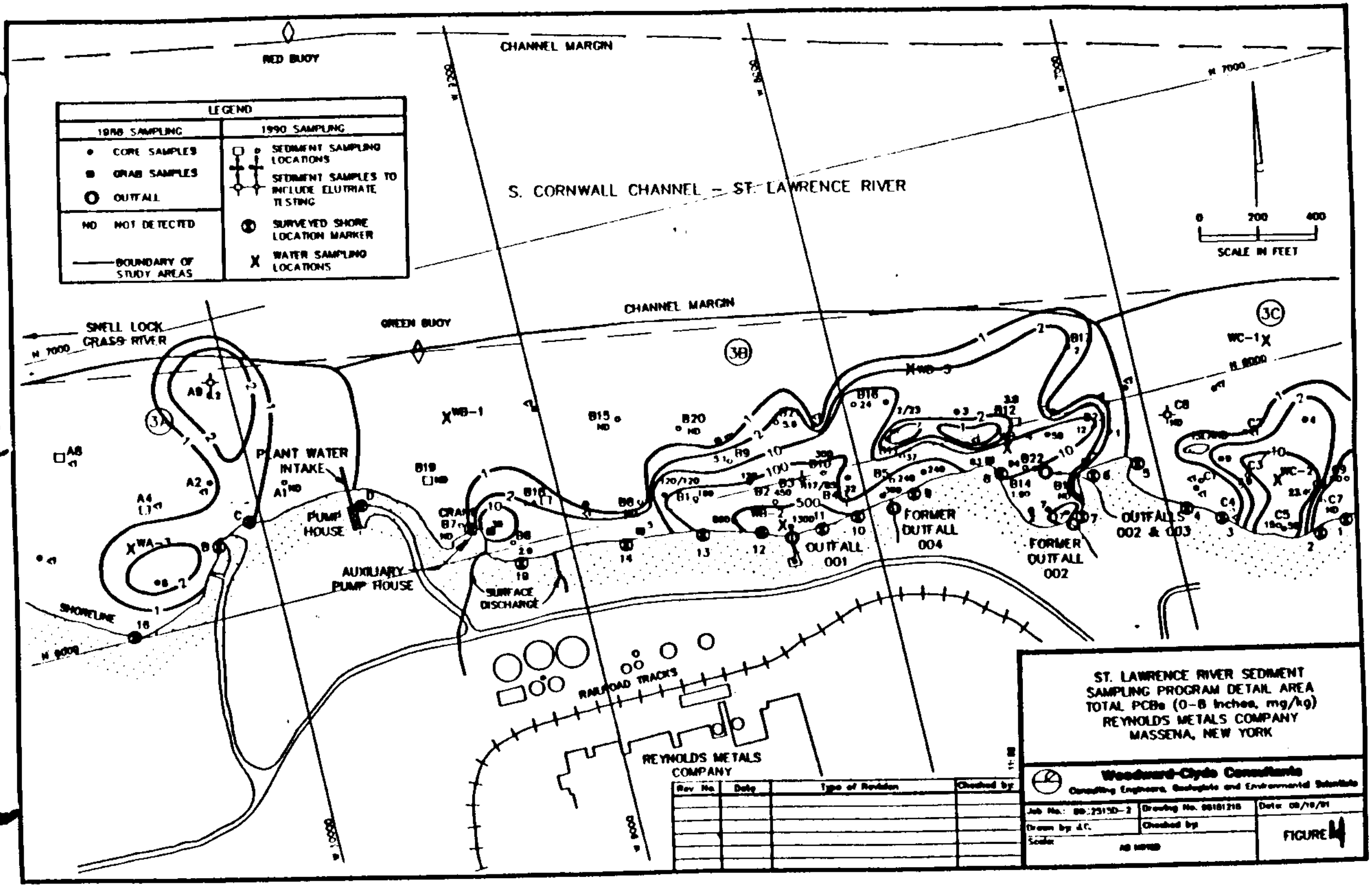
FIGURE 1

DRAFT

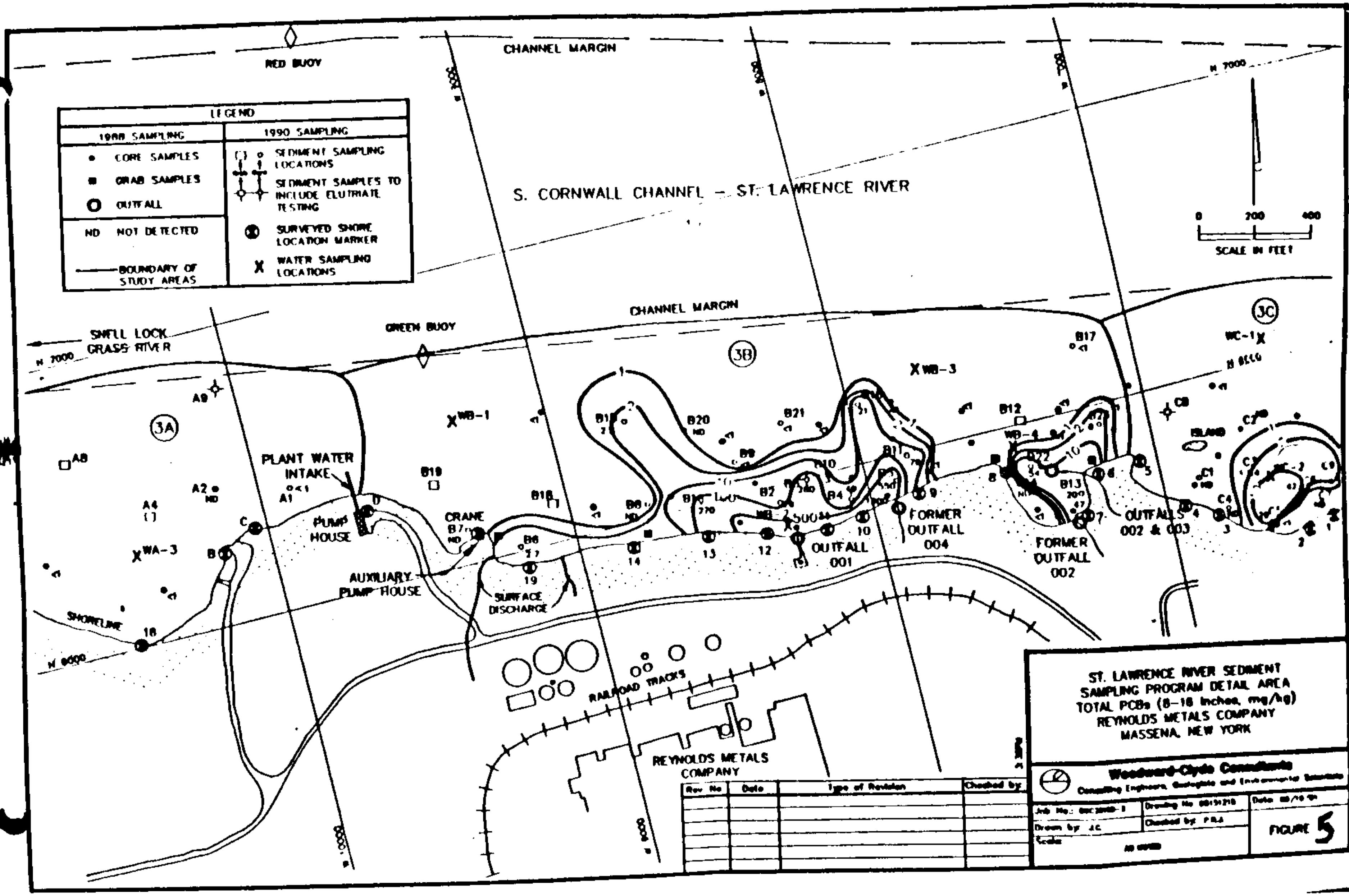

ST. LAWRENCE RIVER
NORTH YARD
FORMER 004 DITCH
FORMER 002 DITCH
POTLINER PAD
100% DIVERSION AREA
BLACK MUD POND
TRANSFORMER RECTIFIER YARD
FORMER POTLINER STORAGE AREA
LANDFILL
WETLANDS
RAQUETTE RIVER
LEGEND
ST. LAWRENCE RIVER DRAINAGE
RAQUETTE RIVER DRAINAGE
SITE DRAINAGE AREAS
ST. LAWRENCE REDUCTION PLANT
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

DRAFT


TRAINING DIKE
CORNWALL ISLAND
SPUR DIKE
ST. LAWRENCE RIVER
SEAWAY INTERNATIONAL BRIDGE
SNELL LOCK GRASSE RIVER
T6
T7
T8
T9
T10
PUMP HOUSE
AUXILIARY PUMP HOUSE
DT2
001
004
003
002
DT1
T5
T4
REYNOLDS PLANT
LEGEND:
1988 STUDY
OUTFALL LOCATION
WATER DEPTH, 6 FEET
WATER DEPTH, 12 FEET
WATER DEPTH, 18 FEET
MAIN RIVER FLOW-CORE CURRENT
ZONE OF TURBULENCE
REVERSE FLOW-COUNTER CURRENT
ZONE OF LOW-VELOCITY TURBULENCE
CURRENT METER AND DROGUE TRANSECTS
1989 DIVING TRANSECTS
SKETCH OF MAJOR FLOW ZONES AND CIRCULATION PATTERNS REYNOLDS METALS COMPANY MASSENA, NEW YORK
Woodward-Clyde Consultants
Rev No
Date
Type of Revision
Checked by
Drawn by: J.C.
Checked by
Scale
N.T.S.
FIGURE 3
DRAFT


ST. LAWRENCE RIVER SEDIMENT
SAMPLING PROGRAM DETAIL AREA
TOTAL PCBs (0-6 Inches, mg/kg)
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
Woodward-Clyde Consultants
FIGURE 4
LEGEND
1988 SAMPLING
CORE SAMPLES
GRAB SAMPLES
OUTFALL
ND NOT DETECTED
BOUNDARY OF STUDY AREAS
1990 SAMPLING
SEDIMENT SAMPLING LOCATIONS
SEDIMENT SAMPLES TO INCLUDE ELUTRIATE TESTING
SURVEYED SHORE LOCATION MARKER
WATER SAMPLING LOCATIONS
S. CORNWALL CHANNEL – ST. LAWRENCE RIVER
CHANNEL MARGIN
RED BUOY
GREEN BUOY
SNELL LOCK
GRASS RIVER
SCALE IN FEET
PLANT WATER INTAKE
PUMP HOUSE
AUXILIARY PUMP HOUSE
SURFACE DISCHARGE
OUTFALL 001
FORMER OUTFALL 004
FORMER OUTFALL 002
OUTFALLS 002 & 003
SHORELINE
RAILROAD TRACKS
REYNOLDS METALS COMPANY

DROFT



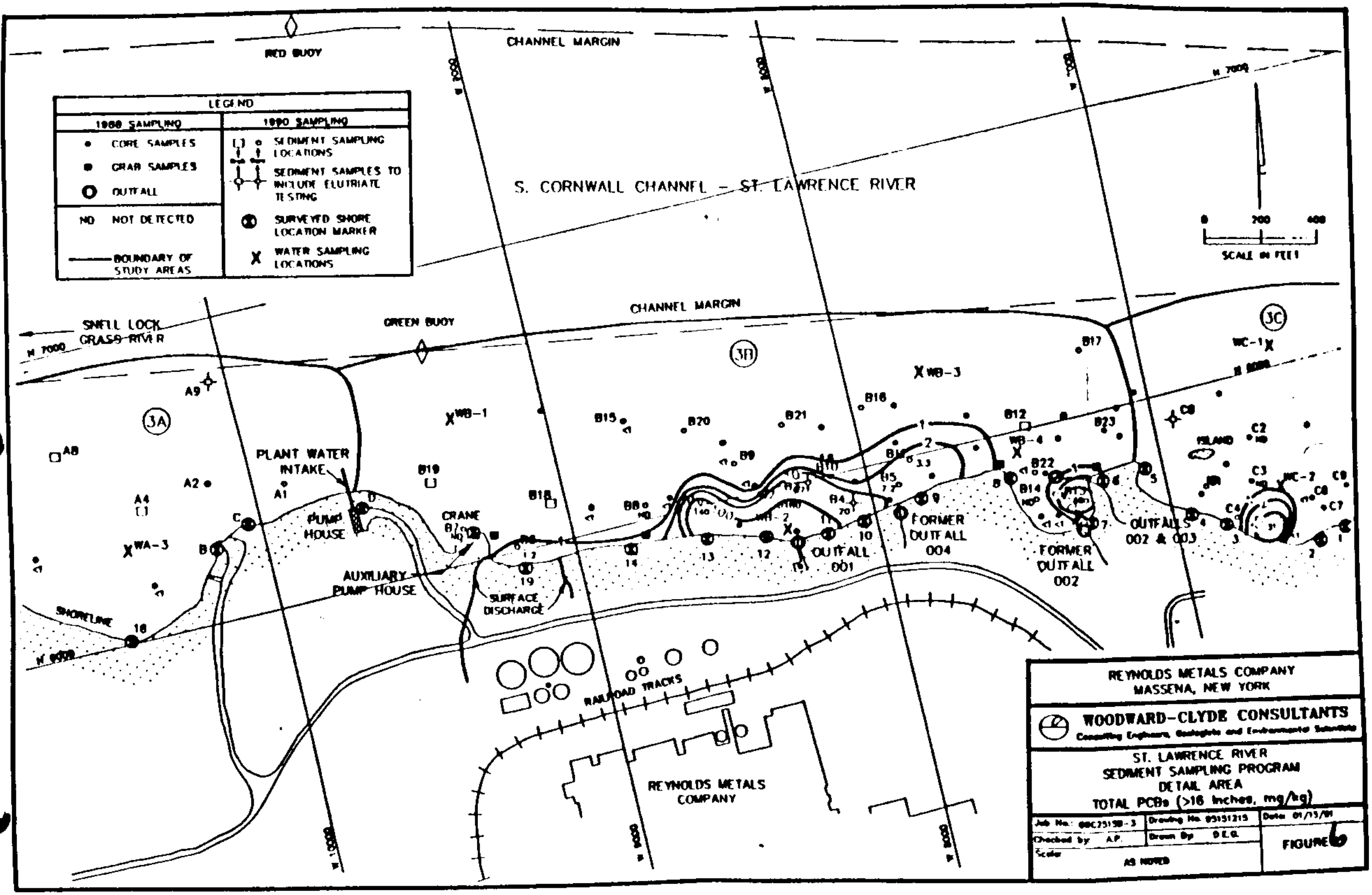
ST. LAWRENCE RIVER SEDIMENT SAMPLING PROGRAM DETAIL AREA
TOTAL PCBs (8-16 Inches, mg/kg)
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

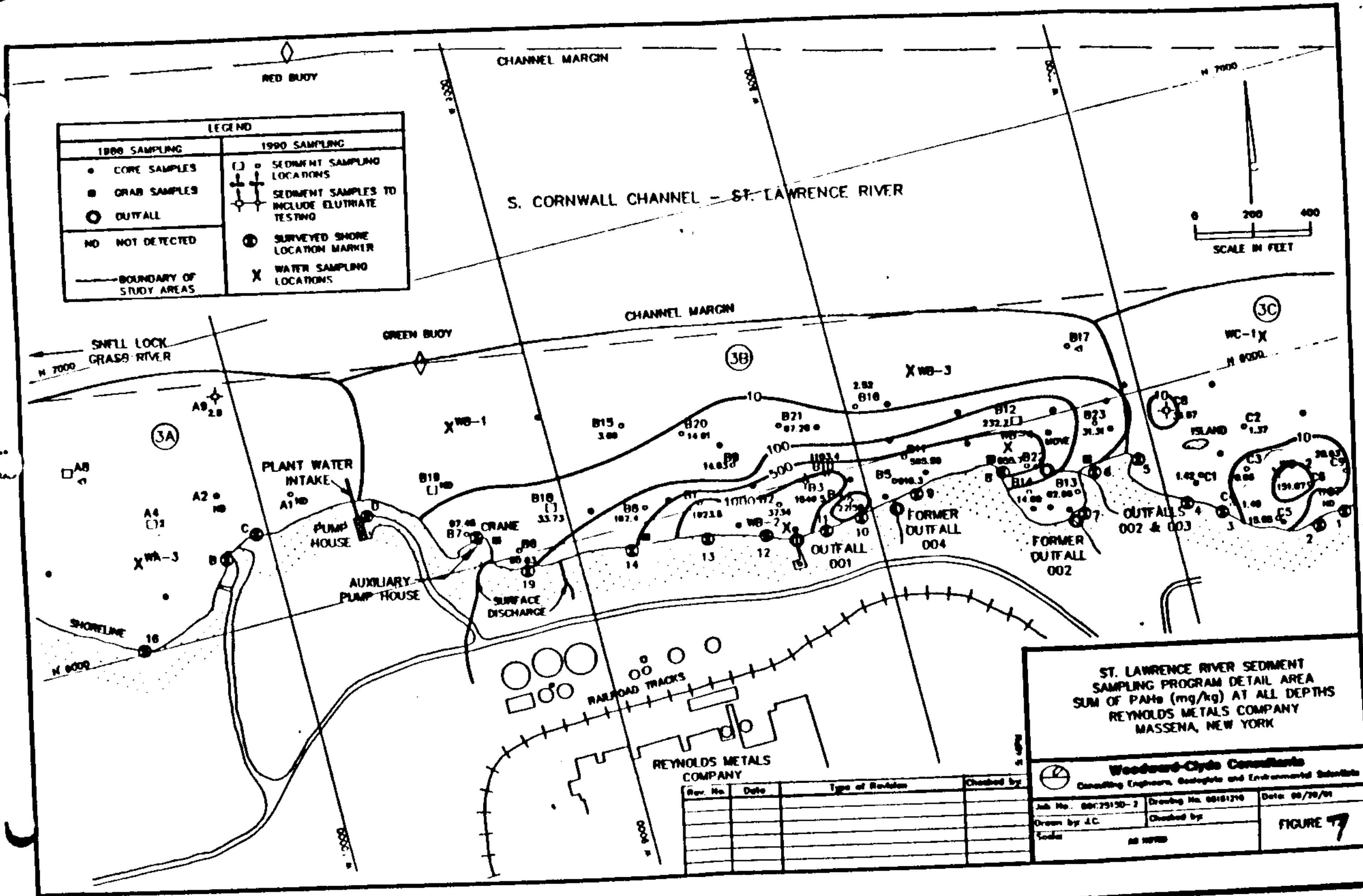
Rev No	Date	Type of Revision	Checked by

FIGURE 5

DRAFT


RED BUOY
CHANNEL MARGIN
LEGEND
1988 SAMPLING
CORE SAMPLES
GRAB SAMPLES
OUTFALL
ND NOT DETECTED
BOUNDARY OF STUDY AREAS
1990 SAMPLING
SEDIMENT SAMPLING LOCATIONS
SEDIMENT SAMPLES TO INCLUDE ELUTRIATE TESTING
SURVEYED SHORE LOCATION MARKER
WATER SAMPLING LOCATIONS
S. CORNWALL CHANNEL - ST. LAWRENCE RIVER
SCALE IN FEET
CHANNEL MARGIN
SNELL LOCK
GRASS RIVER
GREEN BUOY
PLANT WATER INTAKE
PUMP HOUSE
CRANE
AUXILIARY PUMP HOUSE
SURFACE DISCHARGE
SHORELINE
OUTFALL 001
FORMER OUTFALL 004
FORMER OUTFALL 002
OUTFALLS 002 & 003
ISLAND
RAILROAD TRACKS
REYNOLDS METALS COMPANY
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists
ST. LAWRENCE RIVER
SEDIMENT SAMPLING PROGRAM
DETAIL AREA
TOTAL PCBs (>16 Inches, mg/kg)
Job No. 88C7515B-3
Drawing No. 85151215
Date 01/15/91
Checked by A.P.
Drawn By D.E.G.
Scale AS NOTED
FIGURE 6

DRAFT



ST. LAWRENCE RIVER SEDIMENT
SAMPLING PROGRAM DETAIL AREA
SUM OF PAHs (mg/kg) AT ALL DEPTHS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No. 89C2515D-2	Drawing No.	Date 08/20/91
Drawn by J.C.	Checked by	FIGURE 7
Scale AS NOTED		

Rev. No.	Date	Type of Revision	Checked by

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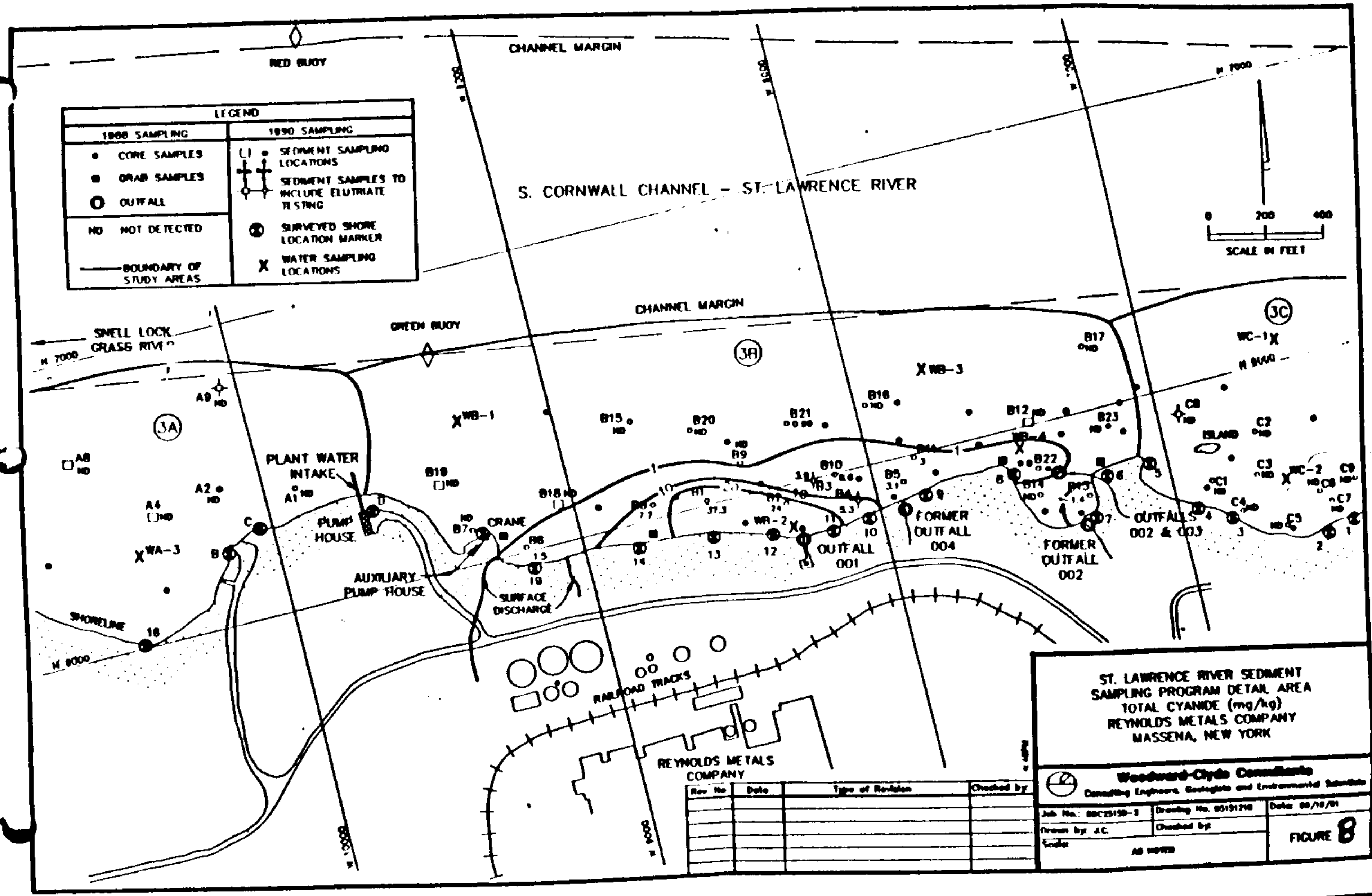
LEGEND
1988 SAMPLING
CORE SAMPLES
GRAB SAMPLES
OUTFALL
ND NOT DETECTED
BOUNDARY OF STUDY AREAS
1990 SAMPLING
SEDIMENT SAMPLING LOCATIONS
SEDIMENT SAMPLES TO INCLUDE ELUTRIATE TESTING
SURVEYED SHORE LOCATION MARKER
WATER SAMPLING LOCATIONS
RED BUOY
CHANNEL MARGIN
S. CORNWALL CHANNEL - ST. LAWRENCE RIVER
GREEN BUOY
SNELL LOCK
GRASS RIVER
SCALE IN FEET
PLANT WATER INTAKE
PUMP HOUSE
AUXILIARY PUMP HOUSE
CRANE
SURFACE DISCHARGE
SHORELINE
OUTFALL 001
FORMER OUTFALL 004
FORMER OUTFALL 002
OUTFALLS 002 & 003
ISLAND
RAILROAD TRACKS
REYNOLDS METALS COMPANY
3A
3B
3C
WB-1
WB-3
WB-4
WA-3
WC-1
WC-2
WB-2
ST. LAWRENCE RIVER SEDIMENT SAMPLING PROGRAM DETAIL AREA TOTAL CYANIDE (mg/kg) REYNOLDS METALS COMPANY MASSENA, NEW YORK
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Drawn by: J.C.
Scale: AS NOTED
FIGURE 8
Rev. No
Date
Type of Revision
Checked by

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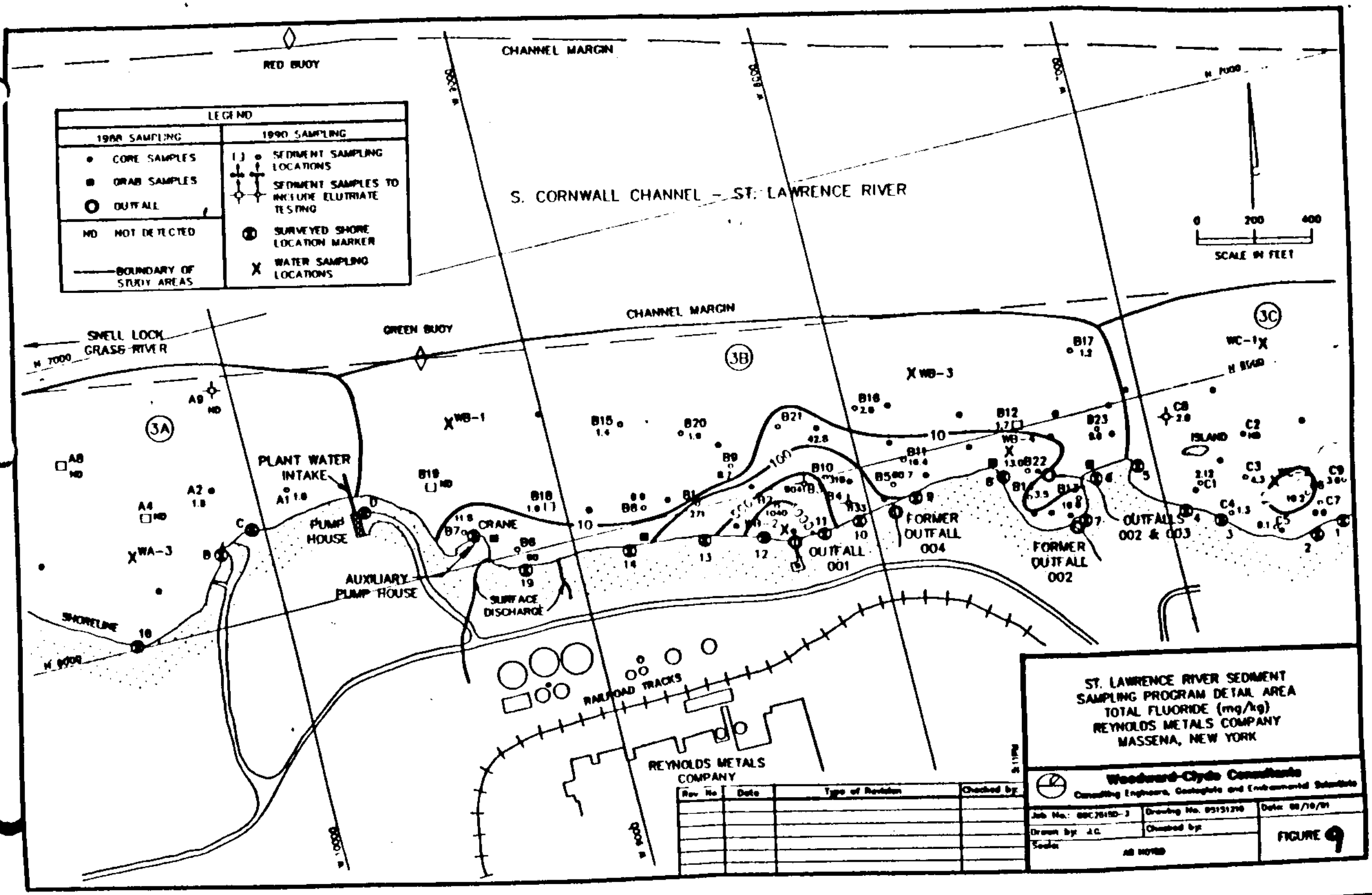
RED BUOY
CHANNEL MARGIN
LEGEND
1988 SAMPLING
CORE SAMPLES
GRAB SAMPLES
OUTFALL
ND NOT DETECTED
BOUNDARY OF STUDY AREAS
1990 SAMPLING
SEDIMENT SAMPLING LOCATIONS
SEDIMENT SAMPLES TO INCLUDE ELUTRIATE TESTING
SURVEYED SHORE LOCATION MARKER
WATER SAMPLING LOCATIONS
S. CORNWALL CHANNEL - ST. LAWRENCE RIVER
0 200 400
SCALE IN FEET
SNELL LOCK
GRASS RIVER
GREEN BUOY
CHANNEL MARGIN
3A
3B
3C
PLANT WATER INTAKE
PUMP HOUSE
AUXILIARY PUMP HOUSE
CRANE
SURFACE DISCHARGE
SHORELINE
OUTFALL 001
FORMER OUTFALL 004
FORMER OUTFALL 002
OUTFALLS 002 & 003
ISLAND
RAILROAD TRACKS
REYNOLDS METALS COMPANY
ST. LAWRENCE RIVER SEDIMENT SAMPLING PROGRAM DETAIL AREA TOTAL FLUORIDE (mg/kg) REYNOLDS METALS COMPANY MASSENA, NEW YORK
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Rev No
Date
Type of Revision
Checked by
Drawn by: J.C.
Checked by:
Scale: AS NOTED
Date: 08/10/91
FIGURE 9

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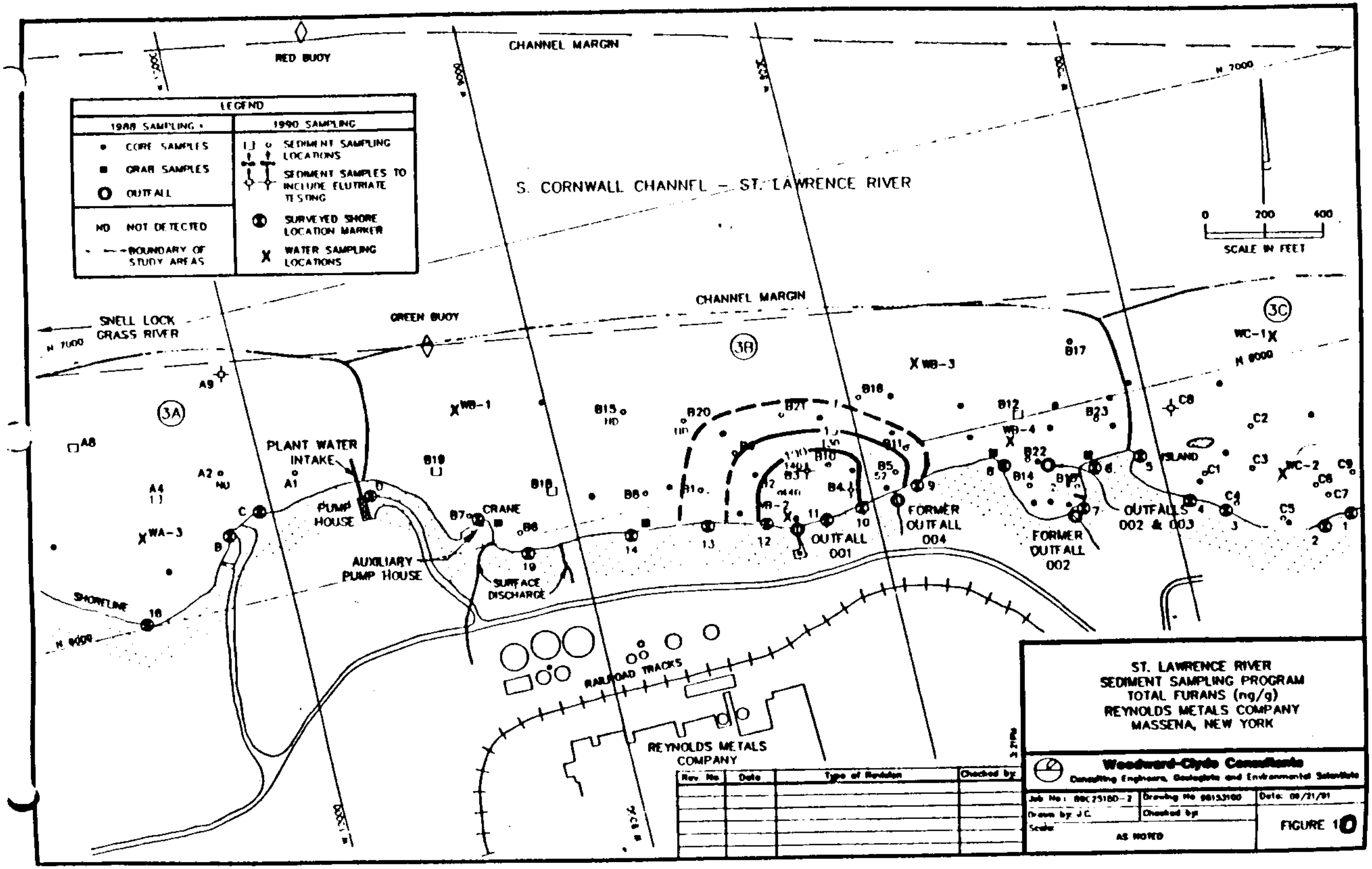
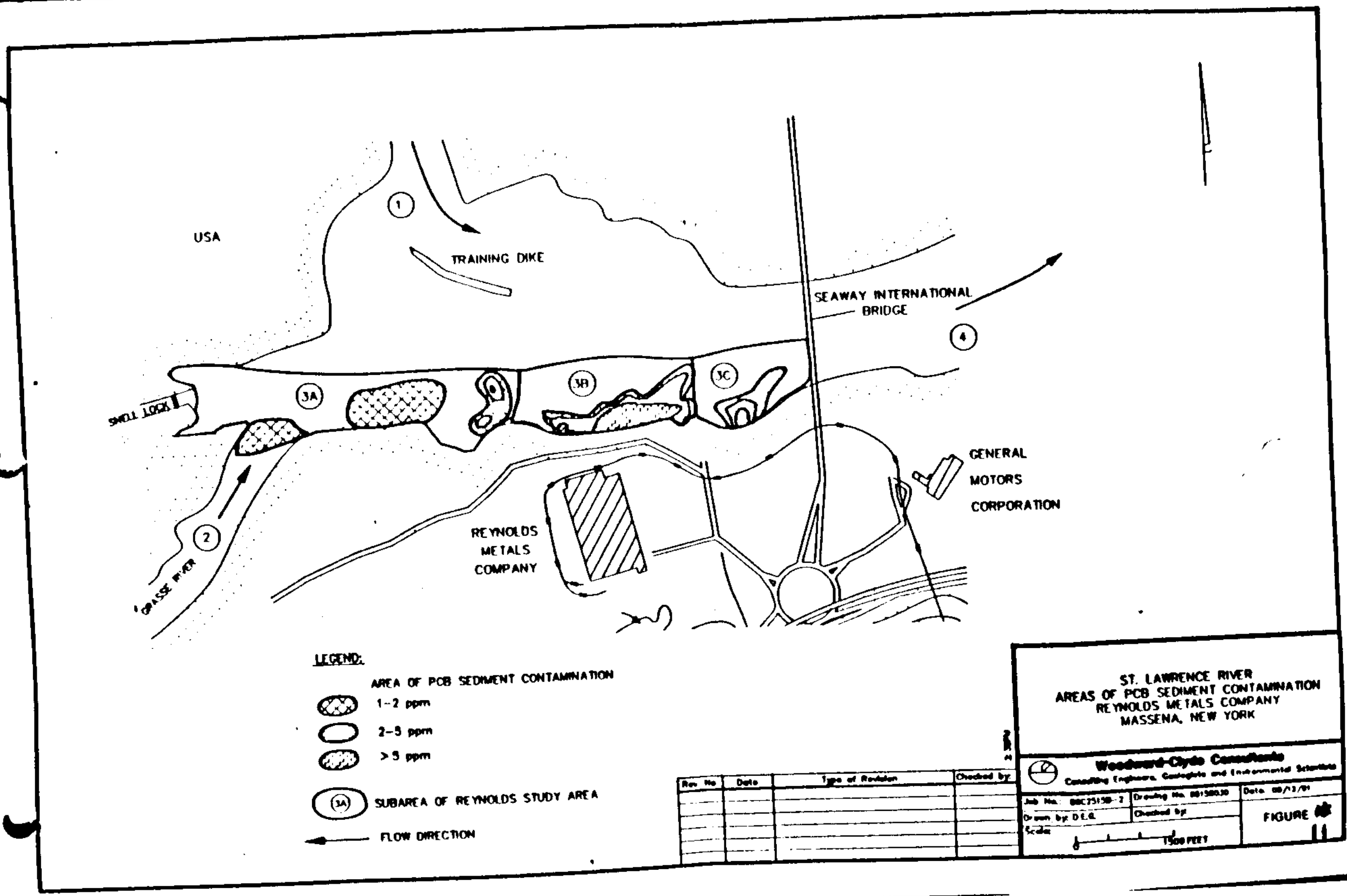
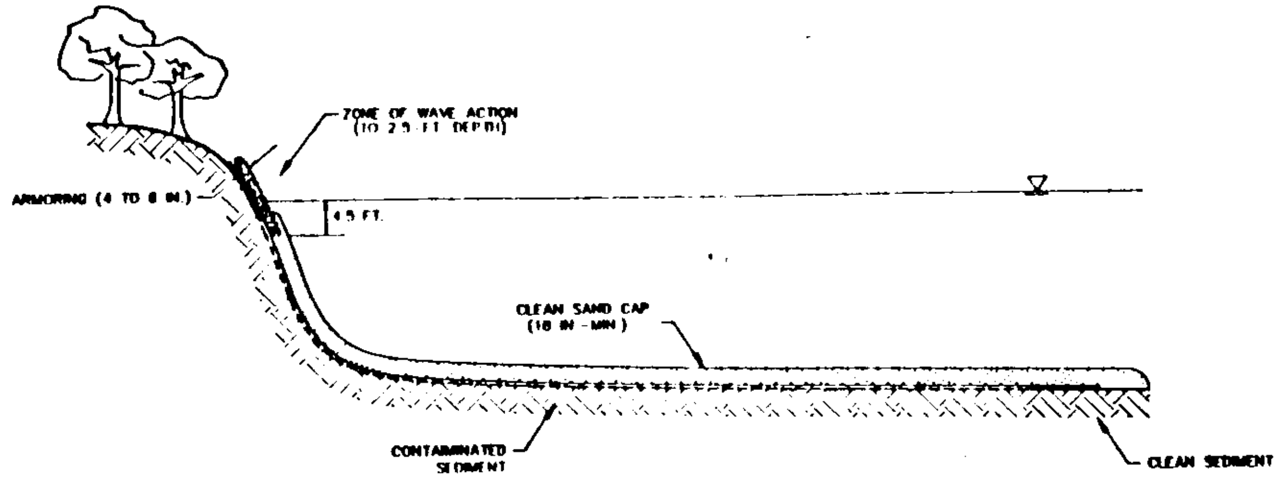

CHANNEL MARGIN
RED BUOY
LEGEND
1988 SAMPLING
CORE SAMPLES
GRAB SAMPLES
OUTFALL
1990 SAMPLING
SEDIMENT SAMPLING LOCATIONS
SEDIMENT SAMPLES TO INCLUDE ELUTRIATE TESTING
SURVEYED SHORE LOCATION MARKER
WATER SAMPLING LOCATIONS
ND NOT DETECTED
BOUNDARY OF STUDY AREAS
S. CORNWALL CHANNEL — ST. LAWRENCE RIVER
0 200 400
SCALE IN FEET
CHANNEL MARGIN
SNELL LOCK
GRASS RIVER
GREEN BUOY
3A
3B
3C
PLANT WATER INTAKE
PUMP HOUSE
AUXILIARY PUMP HOUSE
CRANE
SURFACE DISCHARGE
SHORELINE
OUTFALL 001
FORMER OUTFALL 004
FORMER OUTFALL 002
OUTFALLS 002 & 003
ISLAND
RAILROAD TRACKS
REYNOLDS METALS COMPANY
WB-1
WB-3
WB-4
WC-1
WC-2
WA-3
ST. LAWRENCE RIVER
SEDIMENT SAMPLING PROGRAM
TOTAL FURANS (ng/g)
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Rev. No
Date
Type of Revision
Checked by
Drawn by J.C.
Checked by
Scale
AS NOTED
FIGURE 10

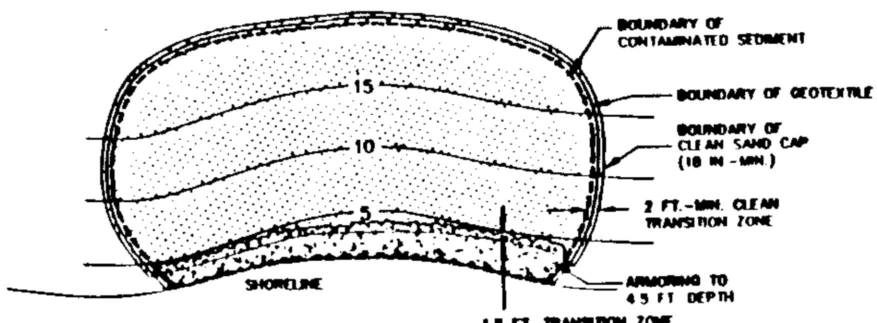
DRAFT


USA
1
TRAINING DIKE
SEAWAY INTERNATIONAL BRIDGE
4
3A
3B
3C
SMALL LOCK
2
GRASSE RIVER
GENERAL MOTORS CORPORATION
REYNOLDS METALS COMPANY
LEGEND:
AREA OF PCB SEDIMENT CONTAMINATION
1-2 ppm
2-5 ppm
> 5 ppm
3A SUBAREA OF REYNOLDS STUDY AREA
FLOW DIRECTION
Rev No | Date | Type of Revision | Checked by
ST. LAWRENCE RIVER
AREAS OF PCB SEDIMENT CONTAMINATION
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
Woodward-Clyde Consultants
Drawn by: D.E.G.
Checked by
Scale
0 1500 FEET
FIGURE 11

DRAFT



CROSS-SECTION



PLAN VIEW

LEGEND:

- BOUNDARY OF CONTAMINATED SEDIMENT
- TYPICAL EXISTING BATHYMETRY CONTOURS
- GEOTEXTILE
- CLEAN SAND CAP
- ARMORING (REVETMENT MAT)

IN-SITU CAP SCHEMATIC
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Rev No.	Date	Type of Revision	Checked by

Job No. 88C2315F-1 | Drawing No. 88158380 | Date: 01/08/1993
Drawn by DEB | Checked by
Scale: NOT TO SCALE
FIGURE 12

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APPENDIX 2

TABLES

TABLE 4 REYNOLDS METAL STUDY AREA: CONTAMINANTS OF CONCERN

Contaminants	Sediments		Fish	
	St. Lawrence	Raquette	St. Lawrence	Raquette
SEMIVOLATILES				
Acenaphthene	X			
Acenaphthylene	X			
Anthracene	X			
Benzo(a)anthracene	X			
Benzo(a)pyrene	X			
Benzo(b)fluoranthene	X			
Benzo(b)fluoranthene	X			
Benzo(g,h,i)perylene	X			
Chrysene	X			
Dibenzo(a,b)anthracene	X			
Dibenzofurans	X			
Fluoranthene	X			
Fluorene	X		X	
Phenanthrene	X			
Pyrene	X			
CDDs/CDFs	X		X	X
METALS				
Aluminum	X	X		
Fluoride	X	X	X	
Lead	X	X		
Cyanide	X	X	X	
Mercury	X	X	X	X
PESTICIDES/PCBs*				
Aroclor 1016	X		X	X
Aroclor 1221	X		X	
Aroclor 1248	X		X	
Aroclor 1254	X		X	X
Aroclor 1260	X		X	
Dieldrin			X	X
DDE			X	X

*Risk Assessment evaluates total PCBs.

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TABLE 2 EXPOSURE PATHWAY: INGESTION OF FISH BY MOHAWK NATION RESIDENTS FOR PRESENT AND FUTURE SCENARIOS

Variable	Range	Midpoint	Value Used	Rationale	Reference
Receptor Population				Mohawk Nation Residents	
Body Weight (kg) Resident	-	-	70	Per EPA guidance	EPA, 1989d EPA, 1989a
Duration of Exposure (Years) Resident	1 - 70	35	70	Based on known residence time of Mohawk Nation members	Jock, 1991
Exposure Frequency (Days/Year)	1-365	183	350	Value used is specified in supplemental EPA guidance	EPA, 1991a
Ingestion Rate (g/Day) Resident	-	-	132	Per EPA guidance	EPA, 1989a
Averaging Time (Days) noncarcinogenic carcinogenic	365 - 25550	12775	25550	Range, midpoint and value used are based on exposure duration for noncarcinogens and lifetime for carcinogens	EPA, 1989a

EPA, 1989a. Risk Assessment Guidance for Superfund, Volume I, EPA 540/1-89/002. Office of Emergency and Remedial Response. December 1989.
EPA, 1989d. Exposure Factors Handbook, EPA 600/8/-89/043. Exposure Assessment Group, Office of Health and Environmental Assessment. 1989.
EPA, 1991a. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". OSWER Directive 9285.6-03. March 25, 1991.
Jock, 1991. St. Regis Mohawk Tribe Environmental Program, Personal communication with Naida Gavrelis, TRC Environmental Corporation.

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TABLE 3 EXPOSURE PATHWAY: DERMAL CONTACT WITH RIVER SEDIMENTS BY LOCAL RESIDENTS AND FISHERMEN FOR PRESENT AND FUTURE SCENARIOS

Variable	Range	Midpoint	Value Used	Rationale	Reference
Receptor Population				Local Residents	
Body Weight (Kg)					
Small Child (Age 1-6)	-	-	15	As specified in supplemental guidance	EPA, 1991a
Adult	-	-	70		
Duration of Exposure (Years)					
Small Child	1 - 6	3	6	Based on known residence time of Mohawk Nation members	Jock, 1991
Adult/Fisherman	1 - 70	35	64		
Exposure Frequency (Days/Year)					
Small Child	1 - 365	183	143	Assume child spends 5 d/wk outdoors during summer and 3 d/wk during spring and fall (39 weeks total)	
Adult	1 - 365	183	78	Assume adult spends 2 d/wk outdoors during spring, summer, and fall (39 weeks total)	
Fisherman	1 - 365	183	350	Assumes fishing occurs daily year round.	Jock, 1992 EPA, 1991a
Skin Surface Area Contacted (sq.cm)					
<u>Small Child</u>					
Arms	-	-	960	50th percentile values; assume ave. is represented by values for ages 3-4	EPA, 1989a EPA, 1989d
Hands	-	-	400		
Legs	-	-	1800		
Feet	-	-	520		
Total Area of These Limbs	-	-	3680		
<u>Adult/Fisherman</u>					
Arms	-	-	2300	Values used are presented in RAGS, except for feet (EFH)	EPA, 1989a EPA, 1989d
Hands	-	-	820		
Total Area of These Limbs	-	-	3120		
Soil Skin Adherence Factor (mg/sq. cm)	0.2 - 1.0	0.6	0.6	Value used is midpoint of range	EPA, 1992b

TABLE 3 (cont) EXPOSURE PATHWAY: DERMAL CONTACT WITH RIVER SEDIMENTS BY LOCAL RESIDENTS AND FISHERMEN FOR PRESENT AND FUTURE SCENARIOS (continued)

Variable	Range	Midpoint	Value Used	Rationale	Reference
Absorption Factor (Percent)					
PCBs (Aroclor 1254)	0.006 - 0.06	0.03	0.03	Value used is midpoint of range given by EPA	EPA, 1992b
CDD/CDFs	0.001 - 0.03	0.02	0.02		
Averaging Time (Days)					
Small Child				Range, midpoint, and value used are based on exposure duration for noncarcinogens and lifetime for carcinogens	EPA, 1989a
noncarcinogenic	365 - 2190	1095	2190		
carcinogenic			25550		
Adult/Fisherman					
noncarcinogens	365 - 25550	12775	23360		
carcinogens			25550		

EPA, 1989a. Risk Assessment Guidance for Superfund, Volume I, EPA 540/1-89/002. Office of Emergency and Remedial Response. December 1989.
EPA, 1989d. Exposure Factors Handbook, EPA 600/8-89/043. Exposure Assessment Group, Office of Health and Environmental Assessment. 1989.
EPA, 1991a. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". OSWER Directive 9285.6-03. March 25, 1991.
EPA, 1992b. Dermal Exposure Assessment: Principles and Applications. Interim Report, EPA/600/8-91/011B. Office of Research and Development. January 1992.
St. Regis Mohawk Tribe Environmental Programs. Personal communication with Naida Gavrelis and Jock, 1991 and 1992. Scott Heim, TRC Environmental Corporation.

TABLE 4-[illegible] EXPO RE PATHWAY: INGESTION OF SEDIMI S FROM THE RIVER BANKS BY LOCAL RESIDENTS AND FISHERMEN FOR PRESENT AND FUTURE SCENARIOS

Variable	Range	Midpoint	Value Used	Rationale	Reference
Receptor Population				Local Residents	
Body Weight (kg)					
Small Child (Age 1-6)	-	-	15	As specified in supplemental guidance	EPA, 1991a
Adult	-	-	70		
Duration of Exposure (Years)					
Small Child	1 - 6	3	6	Total duration equals 70 year residence time	EPA, 1991a
Adult/Fisberman	1 - 70	35	64		
Exposure Frequency (Days/Year)					
Small Child	1 - 365	183	143	Assumes 5 d/wk outdoors during summer and 3 d/wk during spring and fall (39 weeks total)	
Adult	1 - 365	183	78	Assume 2 d/wk outdoors during spring, summer, and fall (39 weeks total)	
Fisberman	1 - 365	183	350	Assumes fishing occurs daily year round	Jock, 1992 EPA, 1991a
Ingestion Rate (mg/Day)					
Child	-	-	200	Value used is specified in RAGS	EPA, 1989a
Adult	-	-	100		
Fraction Ingested from Contaminated Source (Unitless)	-	-	1	Assume that all soil contacted is contaminated	EPA, 1989a
Averaging Time (Days)					
Child	365 - 2190	1095		Range, midpoint, and value used are based on exposure duration for noncarcinogens and lifetime for carcinogens	EPA, 1989a
noncarcinogens			2190		
carcinogens			25550		
Adult/Fisberman	365 - 25550	12775			
noncarcinogens			23360		
carcinogens			25550		

EPA, 1989a. Risk Assessment Guidance for Superfund, Volume I, EPA 540/1-89/002. Office of Emergency and Remedial Response. December 1989.

EPA, 1991a. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". OSWER Directive 9285.6-03. March 25, 1991.

Jock, 1992. St Regis Mohawk Tribe Environmental Programs. Personal Communication with Scott Heim, TRC Environmental Corporation.

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TABLE 5 TOXICITY VALUES FOR THE REYNOLDS SITE CONTAMINANTS						
	CARCINOGENIC				CHRONIC	
Chemical	Weight of Evidence Classification		Oral Slope Factor (mg/kg/day)-1		Chronic Oral RfD (mg/kg/day)	
Acenaphthene	–	a			6.00E-02	a
Acenaphthylene	D	a				
Anthracene	D	a			3.00E-01	a
Benzo(a)anthracene	B2	a	7.30E-01	d		
Benzo(a)pyrene	B2	a	7.30E+00	a		
Benzo(b)fluoranthene	B2	a	7.30E-01	d		
Benzo(g,h,i)perylene	D	a				
Benzo(k)fluoranthene	B2	a	7.30E-01	d		
Chrysene	B2	a	7.30E-02	d		
Dibenzofuran	D	a			4.00E-03	c
Dibenz(a,h)anthracene	B2	a	7.30E+00	d		
Fluoranthene	D	a			4.00E-02	a
Fluorene	D	a			4.00E-02	a
2,3,7,8-Heptachlorodibenzodioxin	B2	b	1.60E+03	e		
2,3,7,8-Heptachlorodibenzofuran	B2	b	1.60E+03	e		
2,3,7,8-Hexachlorodibenzodioxin	B2	b	1.60E+04	e		
2,3,7,8-Hexachlorodibenzofuran	B2	b	1.60E+04	e		
Octochlorodibenzodioxin	B2	b	1.60E+02	e		
Octochlorodibenzofuran	B2	b	1.60E+02	e		
2,3,7,8-Pentachlorodibenzodioxin	B2	b	8.00E+04	e		
1,2,3,7,8-Pentachlorodibenzofuran	B2	b	8.00E+03	e		
2,3,4,7,8-Pentachlorodibenzofuran	B2	b	8.00E+04	e		
Phenanthrene	D	a				
Pyrene	D	a			3.00E-02	a
2,3,7,8-Tetrachlorodibenzodioxin	B2	b	1.60E+05	b		
2,3,7,8-Tetrachlorodibenzofuran	B2	b	1.60E+04	e		

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TABLE 5 (CONTINUED)						
	CARCINOGENIC				CHRONIC	
Chemical	Weight of Evidence Classification		Oral Slope Factor (mg/kg/day)-1		Chronic Oral RfD (mg/kg/day)	
Aroclor - 1260	B2	a	7.70E+00	a		
Aroclor - 1016					7.00E - 05	c
Aluminum	D	d			1.00E+00	c
Cyanide	D	a			2.00E-02	a
Fluoride	–	a			6.00E-02	a
Lead	B2	a				
Mercury	D	a			3.00E-04	b

a. U.S EPA, Integrated Risk Information System (IRIS), September 1, 1992.
b. U.S. EPA, Health Effects Assessment Summary Tables (HEAST), FY 1992.
c. Interim value from ECAO (see text for specific references).
d. Oral slope factor for B(a)P used for PAHs classified as B2 carcinogens with the following TEFs applied:

Benzo(a)anthracene	0.1
Benzo(a)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.0

e. Oral slope factor for 2,3,7,8-TCDD was used for other chlorinated dioxins/dibenzofurans with the following TEFs (EPA, 1989e) applied:

2,3,7,8-PeCDDs	0.5
2,3,7,8-HxCDDs	0.1
2,3,7,8-HpCDDs	0.01
OCDDs	0.001
2,3,7,8-TCDFs	0.1
2,3,7,8-PeCDFs	0.5
1,2,3,7,8-PeCDFs	0.05
2,3,7,8-HxCDFs	0.1
2,3,7,8-HpCDFs	0.01
OCDFs	0.001

TABLE 6. SUMMARY OF CARCINOGENIC RISK ESTIMATED FOR THE REYNOLDS SITE

Scenario	Receptor	Present/Future	Total Risk
FISH INGESTION			
St. Lawrence River at RMC	Resident	P/F	4×10^{-2}*
St. Lawrence River - RMC Vicinity	Resident	P/F	6×10^{-2}*
Raquette River	Resident	P/F	4×10^{-2}*
SEDIMENT			
Ingestion - St. Lawrence River	Fisherman	P/F	6×10^{-3}*
Dermal Contact - St. Lawrence River	Fisherman	P/F	3×10^{-3}*
Ingestion - Raquette River	Fisherman	P/F	N/A
Ingestion - St. Lawrence River	Resident	P/F	3×10^{-3}*
Dermal Contact - St. Lawrence River	Resident	P/F	1×10^{-3}*
Ingestion - Raquette River	Resident	P/F	N/A

*Exceeds 10^{-4} risk
N/A - Not applicable, no carcinogens detected

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TABLE 7 SUMMARY OF NONCARCINOGENIC HAZARD INDICES (HI) ESTIMATED FOR THE REYNOLDS SITE

Scenario	Receptor	Present/Future	Total Risk
FISH INGESTION			
St. Lawrence River at RMC	Resident	P/F	$7x10^{+1}$*
St. Lawrence River - RMC Vicinity	Resident	P/F	$1x10^{+2}$*
Raquette River	Resident	P/F	$7x10^{+1}$*
SEDIMENT			
Ingestion - St. Lawrence River	Fisherman	P/F	$5x10^{0}$*
Dermal Contact - St. Lawrence River	Fisherman	P/F	$3x10^{0}$*
Ingestion - Raquette River	Fisherman	P/F	$2x10^{-2}$
Ingestion - St. Lawrence River	Resident	P/F	$2x10^{+1}$*
Dermal Contact - St. Lawrence River	Resident	P/F	$9x10^{0}$*
Ingestion - Raquette River	Resident	P/F	$9x10^{-2}$

*HI exceeds one (1)

TABLE 8

SUMMARY OF COSTS OF SELECTED REMEDY

Component of Selected Remedy	Cost
Sampling	$ 200,000
Mobilization/Demobilization	$ 1,200,000
Site Preparation	$ 2,100,000
Dredging/Dewatering/On-shore Loading	$ 15,900,000
ATP Treatment	$ 2,900,000
DIRECT COSTS	$ 22,300,000
INDIRECT COSTS (30% of direct costs)	$ 6,700,000
SUBTOTAL	$ 29,000,000
CONTINGENCY (20% of subtotal)	$ 5,800,000
TOTAL CAPITAL COSTS OF REMEDY	$ 34.8 million
O&M COSTS*	$ 14,500/year
O&M 30 YEAR PRESENT WORTH**	$ 250,000
TOTAL PRESENT WORTH COSTS OF REMEDY	$ 35.1 million

* O&M begins after completion of construction.

** Based on an assumed discount rate of 5%.

TABLE 9

MAJOR APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, AMONG OTHERS, ASSOCIATED WITH THE SELECTED REMEDY

Chemical-Specific ARARs

- Clean Air Act
  - National Primary and Secondary Ambient Air Quality Standards at 40 CFR Part 50
- New York State Requirements
  - Surface water regulations at 6 NYCRR Parts 701 and 702, including Appendix 31
  - Air quality standards at 6 NYCRR Part 257
  - Air emission regulations at 6 NYCRR Part 211

Action-Specific ARARs

- Toxic Substances Control Act
  - 40 CFR 761.60-79 PCB disposal requirements
- Resource Conservation and Recovery Act
  - Closure requirements at 40 CFR 264 Subparts G, K, L and N
  - Groundwater monitoring requirements at 40 CFR 264 Subpart F
  - Generator requirements at 40 CFR 262
  - Transporter requirements at 40 CFR 263
- Clean Water Act
  - Best available technology and monitoring requirements at 40 CFR 122.44
  - Best management practices program at 40 CFR 125.100, 40 CFR 125.104, 40 CFR 136.1-136.4
- River and Harbors Act
  - Dredging requirements at 33 CFR 320-330
- New York State Requirements
  - Solid waste management facility regulations at 6 NYCRR Part 360
  - Final status standards for hazardous waste facilities at 6 NYCRR Part 373