STATE OF MICHIGAN
IN THE 30th JUDICIAL CIRCUIT COURT
INGHAM COUNTY

MICHIGAN DEPARTMENT
OF NATURAL RESOURCES
AND ENVIRONMENT,

Plaintiff,

v

STRAITS STEEL & WIRE COMPANY,

Defendant.

File No. 10-1186-CE

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CONSENT DECREE

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ATTACHMENT A – LEGAL DESCRIPTION OF LPC PROPERTY
ATTACHMENT B – LEGAL DESCRIPTION OF STRAITS PROPERTY
ATTACHMENT C – SAMPLING AND ANALYSIS PLAN
ATTACHMENT D – CITY OF LUDINGTON WATER WELL RESTRICTION ORDINANCE

CONSENT DECREE

The Plaintiff is the Michigan Department of Environmental Quality (MDEQ)[1].

The Defendant is Straits Steel & Wire Company (Straits).

This Consent Decree (Decree) is a settlement of the above-captioned action which requires the placement and maintenance of appropriate land use and resource use restrictions on the Straits Steel & Wire Facility (Straits Facility) and the former Ludington Plating Company Facility (LPC Facility) that are located in Ludington, Michigan. In addition, this Decree requires the performance of response activities and the preparation and submission of a No Further Action (NFA) Report for the Straits Facility. The terms "LPC Facility" and "Straits Facility" are defined below in Paragraphs 5.10 and 5.15, respectively. Straits and MDEQ (the Parties) agree not to contest (a) the authority or jurisdiction of the Court to enter this Decree or (b) any terms or conditions set forth herein.

The Parties agree, and the Court by entering this Decree finds, that the response activities set forth herein are necessary to abate the release or threatened release of hazardous substances into the environment and to protect public health, safety, and welfare, and the environment, and that this settlement is in good faith, fair, and in the public interest.

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[1] During the pendency of this matter, the Department of Natural Resources and Environment (DNRE) was reorganized under Executive Order 2011-1 and the functions and responsibilities of the DNRE under the Natural Resources and Environmental Protection Act, 1994 PA 451, MCL 324.101 to MCL 324.90106, were transferred to the Department of Environmental Quality (DEQ). MDEQ will be used throughout this Consent Decree.

NOW, THEREFORE, before the taking of any testimony, and without this Decree constituting an admission of any fact or any liability, or any of the allegations in the Complaint or as evidence of the same, and upon the consent of the Parties, by their attorneys, it is hereby ORDERED, ADJUDGED, AND DECREED:

I. JURISDICTION

1.1 This Court has jurisdiction over the subject matter of this action pursuant to MCL 324.3115, MCL 324.20137, and MCL 324.21323. This Court also has personal jurisdiction over Straits. Straits waives all objections and defenses that they may have with respect to jurisdiction of the Court or to venue in this Court.

1.2 The Court determines that the terms and conditions of this Decree are reasonable, adequately resolve the environmental issues raised, and properly protect the interests of the people of the State of Michigan.

1.3 The Court shall retain jurisdiction over the Parties and subject matter of this action to enforce this Decree and to resolve disputes arising under this Decree, including those that may be necessary for its construction, execution, or implementation, subject to Section XVII (Dispute Resolution).

II. DENIAL OF LIABILITY

2.1 The entry of this Decree by Straits is neither an admission or denial of liability with respect to any issue dealt with in this Decree nor an admission or denial of any factual allegations or legal determinations stated or implied herein.

III. PARTIES BOUND

3.1 This Decree shall apply to and be binding upon the Parties and their successors and assigns. Any change in the ownership or corporate or legal status of Straits, including, but not limited to, any transfer of assets or of real or personal property, shall not in any way alter Straits' responsibilities under this Decree. To the extent that Straits is the owner of a part or all of the Straits Facility and the LPC Facility, Straits shall provide the MDEQ with written notice prior to the transfer of ownership of part or all of the Straits Property or LPC Property and shall provide a copy of this Decree to any subsequent owners or successors prior to the transfer of any ownership rights. Straits shall comply with the requirements of Section 20116 of the Natural Resources Environmental Protection Act (NREPA), MCL 324.20116.

3.2 Notwithstanding the terms of any contract that Straits may enter with respect to the performance of response activities pursuant to this Decree, Straits is responsible for compliance with the terms of this Decree and shall ensure that its contractors, subcontractors, laboratories, and consultants perform all response activities in conformance with the terms and conditions of this Decree.

3.3 The signatories to this Decree certify that they are authorized to execute this Decree and to legally bind the Parties they represent.

IV. STATEMENT OF PURPOSE

4.1 In entering into this Decree, it is the mutual intent of the Parties to:

(a) Require Straits to reimburse the State for Past and Future Response Activity Costs as described in Section XV (Reimbursement of Costs);

(b) Require Straits to conduct further response activities to address the chromium contamination emanating from the Straits Facility;

(c) Require Straits to place and maintain the appropriate land use and resource use restrictions on the Straits Facility and LPC Facility;

(d) Require Straits to continue operating the groundwater extraction and capture system (PW-1) or alternate MDEQ-approved treatment system for the Straits Facility as described in Paragraph 7.2;

(e) Require Straits to develop and submit to the MDEQ an approvable NFA for the Straits Facility that complies with Part 201 and includes, if necessary, a financial assurance mechanism (FAM);

(f) Require Straits to continue to conduct all work specified in the MDEQ-approved *Groundwater Sampling and Analysis Plan* dated February, 2011, prepared by Fishbeck, Thompson, Carr & Huber on behalf of Straits (Sampling & Analysis Plan);

(g) Require Straits to achieve and maintain compliance with Section 20107a of the NREPA at the Straits and LPC Properties to the extent owned by Straits; and

(h) Resolve this litigation and release Straits for any further liability for these covered matters.

4.2 The foregoing constitutes the matters covered by this settlement, and for which Straits' liability is hereby resolved.

V. DEFINITIONS

5.1 "Decree" means this Consent Decree and any attachment hereto, including any future modifications, and any reports, plans, specifications, and schedules required by the Consent Decree which, upon approval of the MDEQ, shall be incorporated into and become an enforceable part of this Consent Decree.

5.2 "Effective Date" means the date that the Court enters this Decree.

5.3 "Financial Assurance" or "Financial Assurance Mechanism" or "FAM" means a performance bond, escrow, cash, certificate of deposit, irrevocable letter of credit, or other equivalent security, or any combination thereof acceptable to the MDEQ, other than a corporate guarantee or financial test,.

5.4 "Future Response Activity Costs" means costs incurred by the State after the Effective Date to oversee, enforce, monitor, and document compliance with this Decree, and to perform response activities required by this Decree, including, but not limited to, costs incurred to: monitor response activities at the Straits Facility and LPC Facility (including collect and analyze samples, evaluate data, purchase equipment and supplies to perform monitoring activities), observe and comment on field activities, review and comment on Submissions, attend and participate in meetings, prepare and review cost reimbursement documentation, and perform response activities pursuant to Paragraph 7.10 (MDEQ's Performance of Response Activities) and Section X (Emergency Response). Future Response

Activity Costs relating to the LPC Facility exclude those costs associated with volatile organic compound contamination existing on the Effective Date of this Decree and are otherwise limited to those response activity costs associated with Straits' obligations as set forth in Paragraphs 7.4 and 7.5. State contractor costs are also considered Future Response Activity Costs.

5.5 "MDEQ" means the Michigan Department of Environmental Quality, its successor entities, and those authorized persons or entities acting on its behalf.

5.6 "O&M Costs" means monitoring, operation and maintenance, oversight, and other costs that are determined by the MDEQ to be necessary to assure the effectiveness and integrity of the remedial action as set forth in an MDEQ-approved NFA for the Straits Facility.

5.7 "Part 201" means Part 201, Environmental Remediation, of the NREPA, 1994 PA 451, as amended, MCL 324.20101 *et seq.*, cleanup criteria developed pursuant to MCL324.20120(a)(1), and the Part 201 Administrative Rules.

5.8 "Party" means either Straits or the State. "Parties" means Straits and the State.

5.9 "Past Response Activity Costs" means response activity costs that the State incurred and paid prior to the Effective Date.

5.10 "LPC Facility" means any area where a hazardous substance has been released from the LPC Property (identified in Attachment A), in excess of the concentrations that satisfy the cleanup criteria for unrestricted residential use has been released, deposited, or disposed of, or otherwise comes to be located.

5.11 "LPC Property" means the property located at 902 North Harrison Street, Ludington, Michigan and described in the legal description provided in Attachment A.

5.12 "No Further Action Report" or "NFA" means a report under section 20114d of the NREPA that satisfies the requirements of Part 201, details the completion of the remedial action at the facility, and includes, if necessary, a postclosure plan and postclosure agreement.

5.13 "RD" means the Remediation Division of the MDEQ and its successor entities.

5.14 "State" or "State of Michigan" means the Michigan Department of Attorney General (MDAG) and the MDEQ, and any authorized representatives acting on their behalf.

5.15 "Straits Facility" means any area where a hazardous substance released from the Straits Property (identified in Attachment B), in excess of the concentrations that satisfy the cleanup criteria for unrestricted residential use has been released, deposited, or disposed of, or otherwise comes to be located. For purposes of this Decree, the Straits Facility does not include the LPC Property or the LPC Facility.

5.16 "Straits Property" means the property located at 902 North Rowe Street, Ludington, Michigan and described in the legal description provided in Attachment B.

5.17 "Submissions" means all plans, reports, schedules, and other submittals that Straits is required to provide to the State or the MDEQ pursuant to this Decree. "Submissions" does not include the notifications set forth in Section XI (*Force Majeure*).

5.18 Unless otherwise stated herein, all other terms used in this Decree, which are defined in Part 3, Definitions, of the NREPA, MCL 324.301 or Part 201 shall have the same meaning in this Decree as in Parts 3 and 201. Unless otherwise specified in this Decree, "day" means a calendar day and "month" means calendar month.

VI. COMPLIANCE WITH STATE AND FEDERAL LAWS

6.1 All actions required to be taken pursuant to this Decree shall be undertaken in accordance with the requirements of all applicable or relevant and appropriate state and federal laws, rules, and regulations, including, but not limited to, Part 201, and laws relating to occupational safety and health. Other agencies may also be called upon to review the performance of response activities under this Decree.

6.2 This Decree does not obviate Straits' obligation to obtain and maintain compliance with any applicable permits.

VII. PERFORMANCE OF RESPONSE ACTIVITIES

7.1 Response Activities at the Straits Facility

(a) Within one hundred and eighty (180) days of the Effective Date, Straits shall submit to the MDEQ for review and approval a Response

Activity Plan that describes the response activities that are being and will be implemented to address the chromium contamination at and emanating from the Straits Facility. The Response Activity Plan shall also include any necessary revisions to the February 2011 Sampling & Analysis Plan to effectively monitor the change in groundwater conditions as a result of any new response activity including in-situ treatment and a schedule for implementation of the response activities.

(b) Within ninety (90) days after MDEQ approval, Straits shall commence performance of the response activities in accordance with the Response Activity Plan and implementation schedule contained therein.

7.2 Continued Operation of Extraction System

Straits shall continue to monitor, operate and maintain, and oversee the groundwater extraction and capture system (PW-1) located at the Straits Facility. Operation and maintenance will continue until Straits demonstrates, and MDEQ approves, that Straits can shutdown PW-1 because: (a) it is no longer necessary to contain the groundwater contamination at and emanating from the Straits Facility consistent with applicable Part 201 requirements; or (b) an alternate remedy is proposed by Straits and approved by the MDEQ pursuant to the Response Activity Plan under Paragraph 7.1 above, and Straits demonstrates that the alternate remedy, without using PW-1, prevents the unacceptable exposure to hazardous substances consistent with applicable Part 201 requirements. Until such time, Straits shall assure the ongoing effectiveness and integrity of PW-1 to prevent

unacceptable exposure to hazardous substances consistent with applicable Part 201 requirements.

7.3 No Further Action (NFA) Report

(a) Within thirty-six (36) months of the Effective Date, Straits shall prepare and submit to MDEQ a NFA documenting the basis for concluding the remedial action that satisfy applicable criteria has been completed at the Straits Facility.

(b) The NFA shall be subject to MDEQ review and approval consistent with Paragraphs 14.4 through 14.7 of this Decree, and shall include the following:

(i) All technical and administrative components required by Sections 20114d of the NREPA.

(ii) A detailed description and supporting documentation of the remedial action conducted at the Straits Facility.

(iii) A detailed explanation of how the results of the remedial action satisfy the cleanup criteria under Part 201 of the NREPA.

(iv) A postclosure plan (which may include monitoring, land use or resource use restrictions) if the remedial action for the Straits Facility in the NFA does not then satisfy the cleanup criteria for unrestricted residential use.

(v) A postclosure agreement if the remedial action for the Straits Facility includes O&M Costs exceeding $2,500.00 per year in

2001 dollars or the remedial action for the Straits Facility is not limited to land use or resource use restrictions.

(vi) A list of performance objectives for the remedial action.

(c) If the NFA includes a postclosure plan, the postclosure plan shall include the following:

(i) A draft amended restrictive covenant that complies with the applicable requirements of Part 201 and covers all of the property owned by Straits at the Straits Facility and LPC Facility.

(ii) A description of any permanent markers to be placed at the Straits Facility if required by Section 20114c(2)(b) of the NREPA to describe the restricted areas of the Straits Facility and the nature of any restrictions.

(d) If the NFA includes a postclosure agreement, the postclosure agreement shall include a FAM acceptable to the MDEQ to pay for O&M Costs that are determined by the MDEQ to be necessary to assure the effectiveness and integrity of the remedial action as set forth in an MDEQ-approved NFA consistent with this Decree. Straits shall be responsible for providing and maintaining the FAM if the O&M costs are more than an average of $2,500.00 per year in 2001 dollars. In addition, the following conditions apply:

(i) The cost of activities covered by the FAM shall be documented on the basis of an annual estimate of maximum costs for

the activity as if they were to be conducted by a person under contract to the state, not employees of Straits. The proposed FAM shall be submitted to the MDEQ as part of the NFA pursuant to Paragraph 7.3(a) and shall be in an amount sufficient to cover O&M Costs at the Straits Facility for a thirty (30)-year period, or such shorter time period as may be established by the NFA or qualified professional and approved by MDEQ.

(ii) The FAM must be a performance bond, escrow, cash, certificate of deposit, irrevocable letter of credit, or other equivalent security, or any combination thereof acceptable to the MDEQ other than a corporate guarantee or financial test.

7.4 Response Activities at the LPC Facility

Straits' responsibilities for response activities at the LPC Facility are limited to its obligations set forth in Paragraph 7.5 and its due care obligations in accordance with Section 20107(a) of the NREPA.

7.5 Placement and Monitoring of Land Use or Resource Use Restrictions

(a) The amended Restrictive Covenant pursuant to Paragraph 7.3(c) shall be filed with the Mason County Register of Deeds within thirty (30) days of MDEQ approval of the NFA. Proof that the amended Restrictive Covenant was delivered to the Mason County Register of Deeds shall be provided to MDEQ within seven (7) days of delivery to the Register of Deeds. Straits shall also provide a true copy of the recorded amended Restrictive

Covenant and the liber/page numbers to the MDEQ within ten (10) days of Straits' receipt of a copy from the Register of Deeds.

(b) Straits shall maintain the effectiveness and integrity of the amended Restrictive Covenant provided for in Paragraph 7.5(a) and any other exposure control mechanisms in place as of the Effective Date of this Decree at the Straits Facility and LPC Facility necessary to prevent unacceptable exposure to hazardous substances and exacerbation of contamination in accordance with Part 201 of the NREPA.

7.6 Implementation of Sampling and Analysis Plan and Quality Assurance

Upon the Effective Date, Straits shall continue to implement the Sampling & Analysis Plan (Attachment C) that is incorporated into and made an enforceable part of this Decree. With respect to any response activities, work plans, or the NFA, Straits agrees to utilize "MDEQ RRD Operational Memorandum No.2, Sampling and Analysis" and other relevant guidance documents as applicable and appropriate.

7.7 Health and Safety Plan (HASP)

Within sixty (60) days of the Effective Date of this Decree, Straits shall submit to the MDEQ a HASP that is developed in accordance with the standards promulgated pursuant to the National Contingency Plan, 40 CFR 300.150; the Occupational Safety and Health Act of 1970, 29 CFR 1910.120; and the Michigan Occupational Safety and Health Act, 1974 PA 154, as amended, MCL 408.1001 *et seq.* Response activities performed by Straits pursuant to this Decree shall be in

accordance with the HASP. The HASP is not subject to the MDEQ's approval under Section XIV (Submissions and Approvals) of this Decree.

7.8 Failure to Meet Performance Objectives Identified in NFA

In the event the remedial action taken by Straits fails to meet the performance objectives identified in the MDEQ-approved NFA, Straits shall be liable for response activities necessary to satisfy the performance objectives.

7.9 Progress Reports

(a) Straits shall provide to the MDEQ Project Coordinator written progress reports regarding response activities and other matters at the Straits Facility and LPC Facility related to the implementation of this Decree. These progress reports shall include the following:

(i) A description of the activities that have been taken toward achieving compliance with this Decree during the specified reporting period.

(ii) All results of sampling and tests and other data that relate to the response activities performed pursuant to this Decree received by Straits, its employees, or authorized representatives during the specified reporting period.

(iii) The status of any access issues that have arisen, which affect or may affect the performance of response activities, and a description of how Straits proposes to resolve those issues and the schedule for resolving the issues.

(iv) The results of an annual assessment of the integrity of all exposure control mechanisms on which the remedial action is dependent (e.g., barriers).

(v) An annual update on the status of compliance with land use or resource use restrictions, including institutional controls.

(vi) A description of the nature and amount of waste materials that were generated and the name and location of the facilities that were used for the off-site transfer, storage, and treatment, or disposal of those waste materials, including copies of all waste manifests.

(vii) A description of data collection and other activities scheduled for the next reporting period.

(viii) Any other relevant information regarding other activities or matters at the Straits Facility or LPC Facility that affect or may affect the implementation of the requirements of this Decree.

(b) The first progress report shall be submitted to the MDEQ within ninety (90) days following the Effective Date of this Decree. Thereafter, progress reports shall be submitted quarterly. The MDEQ may modify the schedule or Straits may request modification of the schedule for the submittal of progress reports. Any modifications to the schedule shall be in writing.

7.10 MDEQ's Performance of Response Activities

If Straits ceases to perform the response activities required by this Decree, is not performing response activities in accordance with this Decree, or is performing response activities in a manner that causes or may cause an endangerment to human health or the environment, the MDEQ may, at its option and upon providing thirty (30) days prior written notice to Straits, take over the performance of those response activities. The MDEQ, however, is not required to provide thirty (30) days written notice prior to performing response activities that the MDEQ determines are necessary pursuant to Section X (Emergency Response). If the MDEQ finds it necessary to take over the performance of response activities that Straits is obligated to perform under this Decree, Straits shall reimburse the State for its costs to perform these response activities consistent with this Decree, including any accrued interest. Interest, at the rate specified in Section 20126a(3) of the NREPA, shall begin to accrue on the State's costs on the day the State begins to incur costs for those response activities after Notice to Straits. However, interest shall begin to accrue without Notice to Straits if MDEQ determines the response activities are necessary pursuant to Section X (Emergency Response). Costs incurred by the State to perform response activities pursuant to this paragraph shall be considered to be "Future Response Activity Costs" and Straits shall provide reimbursement of these costs and any accrued interest to the State in accordance with Paragraphs 15.2, 15.4, and 15.5 of Section XV (Reimbursement of Costs).

VIII. ACCESS

8.1 Upon the Effective Date of this Decree, Straits shall allow the MDEQ and its authorized employees, agents, representatives, contractors, and consultants to enter the Straits Facility, LPC Facility, or associated properties at all reasonable times to the extent the Straits Facility, LPC Facility, and any associated properties are owned, controlled by, or available to Straits. Upon presentation of proper credentials and upon making a reasonable effort to contact the person in charge of the Straits Facility, LPC Facility, or associated properties, MDEQ staff and its authorized employees, agents, representatives, contractors, and consultants shall be allowed to enter the Straits Facility, LPC Facility, or associated properties for the purpose of conducting any activity to which access is required for the implementation of this Decree or to otherwise fulfill any responsibility under state or federal laws with respect to the Straits Facility, LPC Facility, or associated properties, including, but not limited to the following:

(a) Monitoring response activities or any other activities taking place pursuant to this Decree;

(b) Verifying any data or information submitted to the MDEQ;

(c) Assessing the need for, or planning, or conducting, investigations relating to the Straits Facility or LPC Facility;

(d) Obtaining samples;

(e) Assessing the need for, or planning, or conducting, response activities at or near the Straits Facility or LPC Facility;

(f) Assessing compliance with requirements for the performance of monitoring, operation and maintenance, or other measures necessary to assure the effectiveness and integrity of the response activities;

(g) Inspecting and copying non-privileged records, operating logs, contracts, or other documents;

(h) Determining whether the Straits Facility, LPC Facility, or other property is being used in a manner that is or may need to be prohibited or restricted pursuant to this Decree; and

(i) Assuring the protection of public health, safety, and welfare, and the environment.

8.2 To the extent the MDEQ requires access to either the Straits Property or the LPC Property, the MDEQ agrees that it will use reasonable efforts to avoid disruption of ongoing business activities and use reasonable efforts to restore any real or personal property damaged by MDEQ to its original condition.

8.3 To the extent that the Straits Facility, LPC Facility, or any other property where the response activities are to be performed by Straits under this Decree, are owned or controlled by persons other than Straits, Straits shall use its best efforts to secure from such persons written access agreements or judicial orders providing access for the Parties and their authorized employees, agents, representatives, contractors, and consultants. Straits shall provide the MDEQ with a copy of any document granting such access rights secured pursuant to this section. For purposes of this paragraph, "best efforts" includes, but is not limited to,

providing reasonable consideration to the owner or taking judicial action to secure such access. If judicial action is required to obtain access for Straits to conduct response activities approved by MDEQ, Straits shall provide proof to the MDEQ that such judicial action has been filed in a court of competent jurisdiction no later than sixty (60) days after Straits is denied access if such access is required to comply with this Decree. If Straits has not been able to obtain access within sixty (60) days after filing judicial action, Straits shall promptly notify the MDEQ of the status of its efforts to obtain access and shall describe how any delay in obtaining access may affect the performance of response activities for which the access is needed. Any delay in obtaining access shall not be an excuse for delaying the performance of response activities, unless the State determines that the delay was caused by a *Force Majeure* event pursuant to Section XI (*Force Majeure*). Straits' failure to secure access may subject Straits to stipulated penalties pursuant to Section XVI (Stipulated Penalties). Straits shall not be subject to stipulated penalties if Straits uses its "best efforts," including meeting the timeframes set forth above, and a court denies Straits access.

8.4 Any lease, purchase, contract, or other real property agreement entered into by Straits that transfers to another person a right of control over the Straits Facility or LPC Facility, or a portion of the Straits Facility or LPC Facility, shall contain a provision preserving for the MDEQ or any other person undertaking the response activities, and their authorized representatives, the access provided under this section and Section XII (Record Retention/Access to Information).

8.5 Any person granted access to the Straits Facility, LPC Facility, or any other property pursuant to this Decree shall comply with all applicable health and safety laws and regulations.

IX. SAMPLING AND ANALYSIS

9.1 All sampling and analysis conducted pursuant to this Decree shall be in accordance with the quality assurances procedures specified in Paragraph 7.6 (Implementation of Sampling and Analysis Plan and Quality Assurance) and the MDEQ-approved response activity plans.

9.2 Straits, or its consultants or subcontractors, shall provide the MDEQ a ten (10)-day notice prior to any sampling activity to be conducted pursuant to this Decree to allow the MDEQ Project Coordinator, or his or her authorized representative, the opportunity to take split or duplicate samples or to observe the sampling procedures. In circumstances where a ten (10)-day notice is not possible, Straits, or its consultants or subcontractors, shall provide notice of the planned sampling activity as soon as possible to the MDEQ Project Coordinator and explain why earlier notification was not possible. If the MDEQ Project Coordinator concurs with the explanation provided, Straits may forego the ten (10)-day notification period for that particular sampling event.

9.3 Straits shall provide the MDEQ with the results of all environmental sampling, and other analytical data generated in the performance or monitoring of any requirement under this Decree. These results shall be included in the progress reports set forth in Paragraph 7.9.

9.4 For the purpose of quality assurance monitoring, Straits shall assure that the MDEQ and its authorized representatives are allowed access to any laboratory used by Straits in implementing this Decree.

X. EMERGENCY RESPONSE

10.1 If during the course of Straits performing response activities conducted pursuant to this Decree, an act or the occurrence of an event caused by Straits or Straits' employees, agents, representatives, or contractors causes a release or threat of release of a hazardous substance at or from the Straits Facility or the LPC Facility, or causes exacerbation of existing contamination at the Straits Facility or the LPC Facility, and the release, threat of release, or exacerbation poses or threatens to pose an imminent and substantial endangerment to public health, safety, or welfare, or the environment, Straits shall immediately undertake all appropriate actions to prevent, abate, or minimize such release, threat of release, or exacerbation consistent with Part 201 requirements; and shall immediately notify the MDEQ Project Coordinator. In the event of the MDEQ Project Coordinator's unavailability, Straits shall notify the Pollution Emergency Alerting System (PEAS) at 1-800-292-4706. In such an event, any actions taken by Straits shall be in accordance with all applicable health and safety laws and regulations and with the provisions of the HASP referenced in Paragraph 7.7.

10.2 Within ten (10) days of notifying the MDEQ of such an act or event, Straits shall submit a written report setting forth a description of the act or event that occurred and the measures taken or to be taken to mitigate any release, threat

of release, or exacerbation caused or threatened by the act or event and to prevent recurrence of such an act or event. Regardless of whether Straits notifies the MDEQ under this section, if an act or event causes a release, threat of release, or exacerbation, the MDEQ may: (a) require Straits to stop response activities at the Straits Facility or LPC Facility for such period of time as may be needed to prevent or abate any such release, threat of release, or exacerbation; (b) require Straits to undertake any actions that the MDEQ determines consistent with Part 201 requirements are necessary to prevent or abate any such release, threat of release, or exacerbation; or (c) undertake any actions that the MDEQ determines are necessary to prevent or abate such release, threat of release, or exacerbation. This Section is not subject to the dispute resolution procedures set forth in Section XVII (Dispute Resolution), except that Straits may invoke dispute resolution to dispute the MDEQ determination that there was an act or occurrence of event that required an emergency response as described in this Section. Straits shall not invoke dispute resolution until after the MDEQ determines that all response activities necessary to comply with subparagraphs (a) through (c) above are completed.

XI. *FORCE MAJEURE*

11.1 Straits shall perform the requirements of this Decree within the time limits established herein, unless performance is prevented or delayed by events that constitute a "*Force Majeure.*" Any delay in the performance attributable to a *Force Majeure* shall not be deemed a violation of this Decree in accordance with this Section.

11.2 For the purposes of this Decree, a *Force Majeure* event is defined as any event arising from causes beyond the control of and without the fault of Straits, of any person controlled by Straits, or of Straits' contractors that delays or prevents the performance of any obligation under this Decree despite Straits' "best efforts to fulfill the obligation." The requirement that Straits exercise "best efforts to fulfill the obligation" includes Straits using best efforts to anticipate any potential *Force Majeure* event and to address the effects of any potential *Force Majeure* event during and after the occurrence of the event, such that Straits minimizes any delays in the performance of any obligation under this Decree to the greatest extent possible. *Force Majeure* includes an occurrence or nonoccurrence arising from causes beyond the control of and without the fault of Straits, such as an act of God, untimely review of permit applications or submissions by the MDEQ or other applicable authority, and acts or omissions of third parties that could not have been avoided or overcome by the diligence of Straits and that delay the performance of an obligation under this Decree. *Force Majeure* does not include, among other things, unanticipated or increased costs, changed financial circumstances, or failure to obtain a permit or license as a result of actions or omissions of Straits.

11.3 Straits shall notify the MDEQ by telephone within seventy-two (72) hours of discovering any event that causes a delay in its compliance with any provision of this Decree. Verbal notice shall be followed by written notice within ten (10) calendar days and shall describe, in detail, the anticipated length of delay for each specific obligation that will be impacted by the delay, the cause or causes of

delay, the measures taken by Straits to prevent or minimize the delay, and the timetable by which those measures shall be implemented. Straits shall use its best efforts to avoid or minimize any such delay.

11.4 Failure of Straits to comply with the notice requirements of Paragraph 11.3, above, shall render this Section XI void and of no force and effect as to the particular incident involved. The MDEQ may, at its sole discretion and in appropriate circumstances, waive the notice requirements of Paragraph 11.3.

11.5 If the parties agree that the delay or anticipated delay was beyond the control of Straits, this may be so stipulated and the parties to this Decree may agree upon an appropriate modification of this Decree. If the parties to this Decree are unable to reach such agreement, the dispute shall be resolved in accordance with Section XVII (Dispute Resolution) of this Decree. The burden of proving that any delay was beyond the control of Straits, and that all the requirements of this Section have been met by Straits, is on Straits.

11.6 An extension of one compliance date based upon a particular incident does not necessarily mean that Straits qualifies for an extension of a subsequent compliance date without providing proof regarding each incremental step or other requirement for which an extension is sought.

XII. RECORD RETENTION/ACCESS TO INFORMATION

12.1 Straits shall preserve and retain, for a period of ten (10) years after completion of operation and maintenance and long-term monitoring at the Straits Facility, all records, sampling and test results, charts, and other documents relating

to the release or threatened release of hazardous substances, and the storage, generation, disposal, treatment, and handling of hazardous substances at the Straits Facility; and any other records that are maintained or generated pursuant to any requirement of this Decree, including records that are maintained or generated by representatives, consultants, or contractors of Straits. However, Straits shall retain any records pertaining to any land use or resource use restrictions that are placed at the Straits Facility and LPC Facility until the MDEQ determines that land use and resource use restrictions are no longer needed. After the ten (10)-year period of document retention following completion of operation and maintenance and long-term monitoring at the Straits Facility, Straits shall notify MDEQ at least ninety (90) days prior to the destruction of any documents that are not required to be held in perpetuity and upon request by the MDEQ, Straits shall deliver any such documents to MDEQ. In the alternative, Straits may make a written commitment, with the MDEQ's approval, to continue to preserve and retain the documents for a specified period of time. Straits' notification shall be accompanied by a copy of this Decree and sent to the address listed in Section XIII (Project Coordinators and Communications/Notices) or to such other address as may subsequently be designated in writing by the MDEQ.

12.2 Upon request, Straits shall provide to the MDEQ copies of all documents and information within its possession, or within the possession or control of its employees, contractors, agents, or representatives, relating to the performance of response activities or other requirements of this Decree, including,

but not limited to, records regarding the collection and analysis of samples, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing forms, or other correspondence, documents, or information related to response activities. Upon request, Straits shall also make available to the MDEQ, upon reasonable notice, Straits' employees, contractors, agents, or representatives with knowledge of relevant facts concerning the performance of response activities. Straits may withhold documents and information it claims to be privileged or confidential, except as provided in Section 20117(11)(a)-(h), so long as such documents and information are set forth in a privilege log provided to the MDEQ. Nothing in this paragraph precludes MDEQ from asserting that the withheld documents or information are not covered by the specified privilege or claim of confidentiality and arguing for their production.

12.3 If Straits submits documents or information to the MDEQ that Straits believes are entitled to protection as provided for in Section 20117(10) of the NREPA, Straits may designate in that submittal the documents or information which it believes are entitled to such protection. If no such designation accompanies the information when it is submitted to the MDEQ, the information may be made available to the public by the MDEQ without further notice to Straits. Information described in Section 20117(11)(a)-(h) of the NREPA shall not be claimed as confidential or privileged by Straits. Information or data generated under this Decree shall not be subject to Part 148, Environmental Audit Privilege and Immunity, of the NREPA, MCL 324.14801 *et seq.*

XIII. PROJECT COORDINATORS AND COMMUNICATIONS/NOTICES

13.1 Each Party shall designate one or more Project Coordinators. Whenever notices, progress reports, information on the collection and analysis of samples, sampling data, response activity plan submittals, approvals, or disapprovals, or other technical submissions are required to be forwarded by one Party to the other Party under this Decree, or whenever other communications between the Parties is needed, such communications shall be directed to the designated Project Coordinator at the address listed below. If any Party changes its designated Project Coordinator, the name, address, and telephone number of the successor shall be provided to the other Party, in writing, as soon as practicable.

(a) As to the MDEQ:

(i) For all matters pertaining to this Decree, except those specified in Paragraphs 13.1(a)(ii), (iii), and (iv) below:

John Vanderhoof, Project Coordinator
Cadillac District Office
Remediation Division
Michigan Department of Environmental Quality
120 West Chapin St.
Cadillac, Michigan 49601-2158
Phone: 231-876-4459
Fax: 231-775-1511
E-mail address: vanderhoofj@michigan.gov

This Project Coordinator will have primary responsibility for the MDEQ for overseeing the performance of response activities at the Straits Facility and LPC Facility and other requirements specified in this Decree.

(ii) For all matters specified in this Decree that are to be directed to the RD Chief:

Chief, Remediation Division
Michigan Department of Environmental Quality
P.O. Box 30426
Lansing, MI 48909-7926
Phone: 517-335-1104
Fax: 517-373-2637

Via courier:
Chief, Remediation Division
Michigan Department of Environmental Quality
Constitution Hall, 4th Floor, South Tower
525 West Allegan Street
Lansing, MI 48933-2125

A copy of all correspondence that is sent to the RD Chief shall also be provided to the MDEQ Project Coordinator designated in Paragraph 13.1(a)(i).

(iii) For providing a true copy of a recorded restrictive covenant pursuant to Section VII (Performance of Response Activities); for Record Retention pursuant to Section XII (Record Retention/Access to Information); and for questions concerning financial matters pursuant to Section VII (Performance of Response Activities), including financial assurance mechanisms associated with a NFA:

Chief, Compliance and Enforcement Section
Remediation Division
Michigan Department of Environmental Quality
P.O. Box 30426
Lansing, MI 48909-7926
Phone: 517-373-7818
Fax: 517-373-2637

Via courier:
Chief, Compliance and Enforcement Section
Remediation Division
Michigan Department of Environmental Quality
Constitution Hall, 4th Floor, South Tower
525 West Allegan Street
Lansing, MI 48933-2125

A copy of all correspondence that is sent to the Compliance and Enforcement Section Chief, RD, shall also be provided to the MDEQ Project Coordinator designated in Paragraph 13.1(a)(i).

(iv) For all payments pursuant to Section XV (Reimbursement of Costs) and Section XVI (Stipulated Penalties):

Revenue Control Unit
Finance Section
Administration Division
Michigan Department of Environmental Quality
P.O. Box 30657
Lansing, MI 48909-8157

Via courier:
Revenue Control Unit
Finance Section
Administration Division
Michigan Department of Environmental Quality
Constitution Hall, 5th Floor, South Tower
525 West Allegan Street
Lansing, MI 48933-2125

To ensure proper credit, all payments made pursuant to this Decree must reference the Straits Facility, Court Case No. 10-1186-CE and the RD Account Number RRD 3012.

A copy of all correspondence that is sent to the Revenue Control Unit shall also be provided to the MDEQ Project Coordinator designated in Paragraph

13.1(a)(i), the Compliance and Enforcement Section Chief designated in Paragraph 13.1(a)(iii), and the Division Chief designated in Paragraph 13.1(b).

(b) As to the MDAG:

Division Chief
Environment, Natural Resources, and Agriculture Division
Michigan Department of Attorney General
G. Mennen Williams Building, 6th Floor
525 West Ottawa Street
Lansing, MI 48933
Phone: 517-373-7540
Fax: 517-373-1610

(c) As to Straits:

Brian K. Calhoun
Corporate Safety & Environmental Director
SSW Holding Company
176 W. Colon Road
Coldwater, MI 49036
Phone: 517-227-6118
E-mail address: bcalhoun@sswholding.net

With copies to:

Kenneth G. Wiley
Fishbeck Thompson Carr & Huber – Grand Rapids
1515 Arboretum Drive, S.E.
Grand Rapids, MI 49546
Phone: 616-464-3735
Fax: 616-575-8155
E-mail address: kgwiley@ftch.com

Charles M. Denton
Barnes & Thornburg LLP
171 Monroe Avenue, N.W., Suite 1000
Grand Rapids, MI 49503
Phone: 616-742-3974
Fax: 616-742-3999
E-mail address: cdenton@btlaw.com

13.2 Straits' Project Coordinator shall have primary responsibility for overseeing the performance of the response activities at the Straits Facility, LPC Facility, and other requirements specified in this Decree for Straits.

13.3 The MDEQ may designate other authorized representatives, employees, contractors, and consultants to observe and monitor the progress of any activity undertaken pursuant to this Decree.

XIV. SUBMISSIONS AND APPROVALS

14.1 All Submissions required by this Decree shall comply with all applicable laws and regulations and the requirements of this Decree and shall be delivered to the MDEQ in accordance with the schedule set forth in this Decree. All Submissions delivered to the MDEQ pursuant to this Decree shall include a reference to the Straits Facility and Court Case No. 10-1186-CE. All Submissions delivered to the MDEQ for approval shall also be marked "Draft" and shall include, in a prominent location in the document, the following disclaimer: *"Disclaimer: This document is a DRAFT document that has not received approval from the Michigan Department of Environmental Quality (MDEQ). This document was prepared pursuant to a court consent decree. The opinions, findings, and conclusions expressed are those of the authors and not those of the MDEQ."*

14.2 With the exception of the submittal of a NFA, after receipt of any Submission relating to response activities that is required to be submitted for approval pursuant to this Decree, the MDEQ will in writing: (a) approve the

Submission; (b) approve the Submission with conditions; or (c) disapprove the Submission and notify Straits of the deficiencies in the Submission. Straits may challenge a conditional approval or disapproval pursuant to Section XVII (Dispute Resolution). Upon receipt of a notice of approval or approval with conditions from the MDEQ, Straits shall proceed to take the actions and perform the response activities required by the Submission, as approved or approved with conditions, and shall submit a new cover page and any modified pages of the Submission marked "Approved."

14.3 Upon receipt of a notice of disapproval from the MDEQ pursuant to Paragraph 14.2(c), Straits shall correct the deficiencies and provide the revised Submission to the MDEQ for review and approval within sixty (60) days, unless the notice of disapproval specifies a longer time period for resubmission. Unless otherwise stated in the MDEQ's notice of disapproval, Straits shall proceed to take the actions and perform the response activities not directly related to the deficient portion of the Submission. Any stipulated penalties applicable to the delivery of the Submission shall accrue during the sixty (60)-day period or other time period specified for Straits to provide the revised Submission, but shall not be payable unless the resubmission is also disapproved. The MDEQ will review the revised Submission in accordance with the procedure set forth in Paragraph 14.2. If the MDEQ disapproves a revised Submission, the MDEQ will so advise Straits and, as set forth above, stipulated penalties shall accrue from the date of the MDEQ's

disapproval of the original Submission and continue to accrue until Straits delivers an approvable Submission.

14.4 After receipt of a NFA, the MDEQ will: (a) approve the NFA; (b) deny the NFA; or (c) notify Straits that the NFA does not contain sufficient information necessary or required by the MDEQ to make a decision regarding NFA approval.

14.5 Within ninety (90) days of receipt of a denial of approval of a NFA or a notice of insufficient information from the MDEQ pursuant to Paragraph 14.4(b) or (c), Straits shall submit the revised NFA to the MDEQ for review and approval. The time period for resubmission may be extended by the MDEQ. If the MDEQ does not approve the NFA upon resubmission, the MDEQ will so advise Straits. Any stipulated penalties applicable to the delivery of the NFA shall accrue during the ninety (90)-day period or other time period specified for Straits to submit another NFA, but shall not be payable unless the revised NFA is also denied or Straits is again notified that the NFA does not contain sufficient information. The MDEQ will review the revised NFA in accordance with the procedure stated in Paragraph 14.4. If the MDEQ denies a revised NFA or notifies Straits that the revised NFA does not contain sufficient information, the MDEQ will so advise Straits and, as set forth above, stipulated penalties shall accrue from the date of the MDEQ's denial of the original NFA Submission and continue to accrue until Straits delivers an approvable NFA.

(a) If the NFA is denied because the MDEQ has determined that additional response activities are necessary to satisfy the applicable cleanup

criteria at the Straits Facility, within sixty (60) days of receipt of the denial, Straits shall submit a response activity plan that addresses only those areas of the Straits Facility that do not satisfy applicable cleanup criteria and provides an implementation schedule for conducting response activities.

(b) The response activity plan will be reviewed in accordance with Paragraph 14.2. Within thirty (30) days after receipt of MDEQ approval of the response activity work plan, Straits shall perform the response activities contained in the plan in accordance with the approved implementation schedule.

(c) Within ninety (90) days after completion of the response activities, Straits shall resubmit a new or amended NFA for the Straits Facility that meets the requirements of Paragraph 7.3. The new or amended NFA will be reviewed in accordance with Paragraph 14.4.

14.6 If the NFA, including any required postclosure plan and postclosure agreement, is approved, the MDEQ will issue a no further action letter to Straits.

14.7 If any initial Submission, including a NFA, contains significant deficiencies such that the Submission is not in the judgment of the MDEQ a good faith effort by Straits to deliver an acceptable Submission that complies with Part 201 and this Decree, the MDEQ will notify Straits of such and will deem Straits to be in violation of this Decree. Stipulated penalties, as set forth in Section XVI (Stipulated Penalties), shall begin to accrue on the day after the Submission was

due and continue to accrue until an approvable Submission is provided to the MDEQ.

14.8 Upon approval by the MDEQ, any Submission and attachments to Submissions required by this Decree shall be considered part of this Decree and are enforceable pursuant to the terms of this Decree. If there is a conflict between the requirements of this Decree and any Submission or an attachment to a Submission, the requirements of this Decree shall prevail.

14.9 An approval or approval with conditions of a Submission shall not be construed to mean that the MDEQ concurs with all of the conclusions, methods, or statements in any Submission or warrants that the Submission comports with law.

14.10 Informal advice, guidance, suggestions, or comments by the MDEQ regarding any Submission provided by Straits shall not be construed as relieving Straits of its obligation to obtain any formal approval required under this Decree.

XV. REIMBURSEMENT OF COSTS

15.1 Straits shall pay MDEQ a total of three hundred and fifty thousand dollars ($350,000.00) to resolve all State claims for Past Response Activity Costs relating to matters covered in this Decree. Payments shall be made as follows:

(a) Within sixty (60) days of the Effective Date of this Decree, Straits shall pay the MDEQ fifty thousand dollars ($50,000.00).

(b) No later than the second anniversary of the Effective Date of this Decree, Straits shall pay the MDEQ one hundred thousand dollars ($100,000.00).

(c) No later than the third anniversary of the Effective Date of this Decree, Straits shall pay the MDEQ one hundred thousand dollars ($100,000.00).

(d) No later than the fourth anniversary of the Effective Date of this Decree, Straits shall pay the MDEQ one hundred thousand dollars ($100,000.00).

Payment shall be made pursuant to the provisions of Paragraph 15.4.

15.2 Straits shall reimburse the State for all Future Response Activity Costs incurred by the State associated with the Straits Facility and LPC Facility Following the Effective Date of this Decree, the MDEQ will annually provide Straits with a written demand for payment and summary report that identifies all Future Response Activity Costs that have been lawfully incurred by the State through the dates specified in the summary report. Any such demand will set forth, with reasonable specificity, the nature of the costs incurred. Except as provided by Section XVII (Dispute Resolution), Straits shall reimburse the MDEQ for such costs within sixty (60) days of Straits' receipt of a written demand from the MDEQ.

15.3 Straits shall have the right to request a full and complete accounting of all MDEQ demands made hereunder, including time sheets, travel vouchers, contracts, invoices, and payment vouchers as may be available to the MDEQ. The MDEQ's provision of these documents to Straits may result in the MDEQ incurring additional Future Response Activity Costs, which will be included in the annual demand for payment of Future Response Activity Costs.

15.4 All payments made pursuant to this Decree shall be by certified check, made payable to the "State of Michigan – Environmental Response Fund," and shall be sent by first class mail, overnight delivery, or hand delivery to the Revenue Control Unit at the address listed in Paragraph 13.1(a)(iv) of Section XIII (Project Coordinators and Communications/Notices). Straits Facility, the Court Case No. 10-1186-CE, and the RD Account Number RRD 3012 shall be designated on each check. A copy of the transmittal letter and the check shall be provided simultaneously to the MDEQ Project Coordinator at the address listed in Paragraph 13.1(a)(i), the Compliance and Enforcement Section Chief, RD, at the address listed in Paragraph 13.1(a)(iii), and the MDAG at the address listed in Paragraph 13.1(b). Costs recovered pursuant to this Section and payment of stipulated penalties pursuant to Section XVI (Stipulated Penalties) shall be deposited into the Cleanup and Redevelopment Fund in accordance with the provisions of Section 20108(3) of the NREPA.

15.5 If Straits fails to make full payment to the MDEQ for Past Response Activity Costs or Future Response Activity Costs as specified in Paragraphs 15.1, 15.2, and 15.4, interest, at the rate specified in Section 20126a(3) of the NREPA, shall begin to accrue on the unpaid balance on the day after payment was due until the date upon which Straits makes full payment of those costs and the accrued interest to the MDEQ. In any challenge by Straits to an MDEQ demand for reimbursement of costs, Straits shall have the burden of establishing that the

MDEQ did not lawfully incur those costs in accordance with Section 20126a(1)(a) of the NREPA.

XVI. STIPULATED PENALTIES

16.1 Straits shall be liable for stipulated penalties in the amounts set forth in Paragraphs 16.2 and 16.3 for failure to comply with the requirements of this Decree, unless excused under Section XI (*Force Majeure*) or Section XVII (Dispute Resolution). "Failure to Comply" by Straits shall include failure to complete Submissions and notifications as required by this Decree, and failure to perform response activities in accordance with MDEQ-approved plans under this Decree and all applicable requirements of law within the specified implementation schedules established by or approved under this Decree.

16.2 The following stipulated penalties shall accrue per violation per day for any violation of Section VII (Performance of Response Activities):

Penalty Per Violation Per Day	Period of Noncompliance
$250	1st through 14th day
$500	15th through 30th day
$1,000	31st day and beyond

16.3 Except as provided in Paragraph 16.2 and Section XI (*Force Majeure*) and Section XVII (Dispute Resolution), if Straits fails or refuses to comply with any other term or condition of this Decree, Straits shall pay the MDEQ stipulated penalties of two hundred fifty dollars ($250.00) a day for each and every failure or refusal to comply.

16.4 All penalties shall begin to accrue on the day after performance of an activity was due or the day a violation occurs, and shall continue to accrue through the final day of completion of performance of the activity or correction of the violation. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Decree.

16.5 Except as provided in Section XVII (Dispute Resolution), Straits shall pay stipulated penalties owed to the State no later than thirty (30) days after Straits' receipt of a written demand from the State. Payment shall be made in the manner set forth in Paragraph 15.4 of Section XV (Reimbursement of Costs). Interest, at the rate provided for in Section 20126a(3) of the NREPA, shall begin to accrue on the unpaid balance at the end of the sixty (60)-day period on the day after payment was due until the date upon which Straits makes full payment of those stipulated penalties and the accrued interest to the MDEQ. Failure to pay the stipulated penalties within sixty (60) days after receipt of a written demand constitutes a further violation of the terms and conditions of this Decree.

16.6 The payment of stipulated penalties shall not alter in any way Straits' obligation to perform the response activities required by this Decree.

16.7 If Straits fails to pay stipulated penalties when due, the State may institute proceedings to collect the penalties, as well as any accrued interest. However, the assessment of stipulated penalties is not the State's exclusive remedy if Straits violates this Decree. For any failure or refusal of Straits to comply with the requirements of this Decree, the State also reserves the right to pursue any

other remedies to which it is entitled under this Decree or any applicable law including, but not limited to, seeking civil fines, injunctive relief, the specific performance of response activities, reimbursement of costs, exemplary damages pursuant to Section 20119(4) of the NREPA in the amount of three (3) times the costs incurred by the State as a result of Straits' violation of or failure to comply with this Decree, and sanctions for contempt of court. MDEQ will not seek both stipulated penalties and statutory fines for the same violations.

16.8 Notwithstanding any other provision of this Section, the State may waive, in its unreviewable discretion, any portion of stipulated penalties and interest that has accrued pursuant to this Decree.

XVII. DISPUTE RESOLUTION

17.1 Unless otherwise expressly provided for in this Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Decree. However, the procedures set forth in this Section shall not apply to actions by the State to enforce any of Straits' obligations that have not been disputed in accordance with this Section. Engagement of dispute resolution pursuant to this Section shall not be cause for Straits to delay the performance of any other response activity required under this Decree.

17.2 The State shall maintain an administrative record of any disputes initiated pursuant to this Section. The administrative record shall include the information Straits provides to the State under Paragraphs 17.3 and 17.4 and any

documents the MDEQ and the State rely on to make the decisions set forth in Paragraphs 17.3 and 17.4.

17.3 Except for undisputable matters identified in Paragraph 17.1 and disputes related to the NFA which are addressed under Paragraph 17.4, any dispute that arises under this Decree with respect to the MDEQ's disapproval, modification, or other decision concerning requirements of this Decree shall in the first instance be the subject of informal negotiations between the Project Coordinators representing the MDEQ and Straits. A dispute shall be considered to have arisen on the date that a Party to this Decree receives a written Notice of Dispute from the other Party. The Notice of Dispute shall state the issues in dispute; the relevant facts upon which the dispute is based; factual data, analysis, or opinion supporting the Party's position; and supporting documentation upon which the Party bases its position. In the event Straits objects to any MDEQ notice of disapproval, modification, or decision concerning the requirements of this Decree that is subject to dispute under this Section, Straits shall submit the Notice of Dispute within twenty (20) days of receipt of the MDEQ's notice of disapproval, modification or decision. The period of informal negotiations shall not exceed twenty (20) days from the date a Party receives a Notice of Dispute, unless the time period for negotiations is modified by written agreement between the Parties. If the Parties do not reach an agreement within twenty (20) days or within the agreed-upon time period, the RD District Supervisor will thereafter provide the MDEQ's Statement of Position, in writing, to Straits. In the absence of initiation of formal

dispute resolution by Straits under Paragraph 17.4, the MDEQ's position as set forth in the MDEQ's Statement of Position shall be binding on the Parties.

17.4 If Straits and the MDEQ cannot informally resolve a dispute under Paragraph 17.3 or if the dispute involves a NFA, Straits may initiate formal dispute resolution by submitting a written Request for Review to the RD Chief, with a copy to the MDEQ Project Coordinator, requesting a review of the disputed issues. This Request for Review must be submitted within twenty (20) days of Straits' receipt of the Statement of Decision issued by the MDEQ pursuant to Paragraph 17.3. If the dispute is in regard to a NFA, either Party may initiate formal dispute resolution by filing a Request for Review with the other Party. The Request for Review shall state the issues in dispute; the relevant facts upon which the dispute is based; factual data, analysis, or opinion supporting the Party's position; and supporting documentation upon which the Party bases its position. When the MDEQ issues a Request for Review, Straits will have twenty (20) days to submit a written rebuttal to the RD Chief, with copy to the MDEQ Project Coordinator. Within twenty (20) days of the RD Chief's receipt of Straits' Request for Review or Straits' rebuttal, the RD Chief will provide the MDEQ's Statement of Decision, in writing, to Straits, which will include a statement of his/her understanding of the issues in dispute; the relevant facts upon which the dispute is based; factual data, analysis, or opinion supporting his/her position; and supporting documentation he/she relied upon in making the decision. The time period for the Parties' submission of documents pursuant to this paragraph may be extended by written agreement between the

Parties. The MDEQ's Statement of Decision shall be binding on the Parties unless Straits files a Motion pursuant to Paragraph 17.5.

17.5 The MDEQ's Statement of Decision pursuant to Paragraph 17.4 shall be binding on the Parties unless, within twenty (20) day after Straits' receipt of the MDEQ's Statement of Decision, Straits files with this Court a motion for resolution of the dispute, which sets forth the matter in dispute, the efforts made by the Parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to insure orderly implementation of this Decree. Within thirty (30) day of Straits 's filing of a motion asking the Court to resolve a dispute, MDEQ will file with the Court the administrative record that is maintained pursuant to Paragraph 17.2.

17.6 Any judicial review of the MDEQ's Statement of Decision shall be limited to the administrative record except as provided in Section 20137(7) of the NREPA. In proceedings on any dispute relating to the selection, extent, or adequacy of any aspect of the response activities that are subject of this Decree, Straits shall have the burden of demonstrating on the administrative record that the position of the MDEQ is arbitrary and capricious or otherwise not in accordance with law. In proceedings on any dispute, Straits shall bear the burden of persuasion on factual issues under the applicable standards of review. Nothing herein shall prevent MDEQ from arguing that the Court should apply the arbitrary and capricious standard of review to any dispute under this Decree.

17.7 Notwithstanding the invocation of a dispute resolution proceeding, stipulated penalties shall accrue from the first day of Straits' failure or refusal to comply with any term or condition of this Decree, but payment shall be stayed pending resolution of the dispute. In the event, and to the extent that Straits does not prevail on the disputed matters, the MDEQ may demand payment of stipulated penalties and Straits shall pay stipulated penalties as set forth in Paragraph 16.5 of Section XVI (Stipulated Penalties). Straits shall not be assessed stipulated penalties for disputes that are resolved in their favor. The MDAG, on behalf of the MDEQ, may take civil enforcement action against Straits to seek the assessment of civil penalties or damages pursuant to Sections 20119(4) and 20137(1) of the NREPA or other statutory and equitable authorities.

17.8 Notwithstanding the provisions of this Section and in accordance with Section XV (Reimbursement of Costs) and Section XVI (Stipulated Penalties), Straits shall pay to the MDEQ that portion of a demand for reimbursement of costs or for payment of stipulated penalties that is not the subject of an ongoing dispute resolution proceeding.

XVIII. INDEMNIFICATION AND INSURANCE

18.1 The State of Michigan does not assume any liability by entering into this Decree. This Decree shall not be construed to be an indemnity by the State for the benefit of Straits or any other person.

18.2 Straits shall indemnify and hold harmless the State of Michigan and its departments, agencies, officials, agents, employees, contractors, and

representatives for any claims or causes of action to the extent that they arise from, or on account of, acts or omissions of Straits, its officers, employees, agents, or any other person acting on its behalf or under its control, in performing the activities required by this Decree and not as a result of gross negligence, including reckless, willful, or wanton misconduct, or intentional misconduct by the State.

18.3 Straits shall indemnify and hold harmless the State of Michigan and its departments, agencies, officials, agents, employees, contractors, and representatives for all claims or causes of action for damages or reimbursement from the State that arise from, or on account of, any contract, agreement, or arrangement between Straits and any person for the performance of response activities at the Straits Facility or the LPC Facility, including any claims on account of construction delays, and not as a result of gross negligence, including reckless, willful, or wanton misconduct, or intentional misconduct by the State.

18.4 The State shall provide Straits notice of any claim for which the State intends to seek indemnification pursuant to Paragraphs 18.2 or 18.3.

18.5 Neither the State of Michigan nor any of its departments, agencies, officials, agents, employees, contractors, or representatives shall be held out as a party to any contract that is entered into by or on behalf of Straits for the performance of activities required by this Decree. Neither Straits nor any Straits contractor shall be considered an agent of the State.

18.6 Straits waives all claims or causes of action against the State of Michigan and its departments, agencies, officials, agents, employees, contractors,

and representatives for damages, reimbursement, or set-off of any payments made or to be made to the State that arise from, or on account of, any contract, agreement, or arrangement between Straits and any other person for the performance of response activities at the Straits Facility or the LPC Facility, including any claims on account of construction delays, except if a result of gross negligence, including reckless, willful, or wanton misconduct, or intentional misconduct by the State.

18.7 Prior to commencing any response activities pursuant to this Decree and for the duration of this Decree, Straits shall secure and maintain comprehensive general liability insurance with limits of one million dollars ($1,000,000) combined single limit, which names the MDEQ, the MDAG and the State of Michigan as additional insured parties. If Straits demonstrates by evidence satisfactory to the MDEQ that any contractor or subcontractor maintains insurance equivalent to that described above, then with respect to that contractor or subcontractor, Straits needs to provide only that portion, if any, of the insurance described above that is not maintained by the contractor or subcontractor. Regardless of the insurance method used by Straits, and prior to commencement of interim response activities pursuant to this Decree, Straits shall provide the MDEQ Project Coordinator and the MDAG with certificates evidencing said insurance and the MDEQ, the MDAG, and the State of Michigan's status as additional insured parties. In addition, and for the duration of this Decree, Straits shall satisfy, or shall ensure that its contractors or subcontractors satisfy, all applicable laws and

regulations regarding the provision of Workers' Disability Compensation Insurance for all persons performing response activities on behalf of Straits in furtherance of this Decree.

XIX. COVENANTS NOT TO SUE BY THE STATE

19.1 In consideration of the actions that will be performed and the payments that will be made by Straits under the terms of this Decree, and except as specifically provided for in this Section and Section XX (Reservation of Rights by the State), the State of Michigan hereby covenants not to sue or to take further administrative or judicial action against Straits for:

(a) Performance of response activities related to the releases of hazardous substances originating prior to the Effective Date at and from the Straits Facility provided that the performance objectives included in the MDEQ-approved NFA are being met by Straits and Straits complies with Paragraph 7.5 (Placement and Monitoring of Land Use and Resource Use Restrictions) as it pertains to the Straits Facility.

(b) Performance of response activities related to the releases of hazardous substances originating prior to the Effective Date at and from the LPC Facility provided Straits complies with Paragraph 7.5 (Placement and Monitoring of Land Use and Resource Use Restrictions) as it pertains to the LPC Facility, including assuring the effectiveness and integrity of an exposure control mechanisms.

(c) Recovery of Past Response Activity Costs associated with the Straits Facility and LPC Facility satisfied by payment as set forth in Paragraphs 15.1, 15.4, and 15.5 of Section XV (Reimbursement of Costs) of this Decree.

(d) Recovery of Future Response Activity Costs associated with the Straits Facility and LPC Facility that Straits has paid as set forth in Paragraphs 15.2, 15.4, and 15.5 of Section XV (Reimbursement of Costs) of this Decree.

(e) Any other claims that were asserted in the Amended Complaint filed herein, including but not limited to the closure of the underground storage tank on the Straits Property pursuant to Section 21303 of the NREPA.

19.2 The covenants not to sue shall take effect under this Decree as follows:

(a) With respect to Straits' liability for response activities related to the Straits Facility, the covenant not to sue shall take effect upon issuance of the NFA letter approving the NFA submitted pursuant to Section VII (Performance of Response Activities), provided that the performance objectives identified in the NFA are being met and provided that Straits complies with Paragraph 7.5 (Placement and Monitoring of Land Use and Resource Use Restrictions) as it pertains to the Straits Facility.

(b) With respect to response activities associated with the LPC Facility, the covenant not to sue shall take effect upon compliance with

Paragraph 7.5 (Placement and Monitoring of Land Use and Resource Use Restrictions) of this Decree, provided that the exposure control mechanisms are maintained as required under Paragraph 7.5.

(c) With respect to Straits' liability for Past Response Activity Costs and Future Response Activity Costs associated with the Straits Facility and LPC Facility incurred and paid by the State, the covenants not to sue shall take effect upon the MDEQ's receipt of payments for those costs, including any applicable interest that has accrued in accordance with Paragraph 15.6 of this Decree.

(d) With respect to all other Amended Complaint claims settled hereby, upon the Effective Date.

19.3 The covenants not to sue extend only to Straits, and its successors and assigns (pursuant to Paragraph 3.1), provided that they are in compliance with the terms of this Decree relevant to the covenant(s) not to sue at issue. The covenants not to sue do not extend to any other person.

XX. RESERVATION OF RIGHTS BY THE STATE

20.1 The covenants not to sue apply only to those matters specified in Paragraph 19.1 of Section XIX (Covenants Not to Sue by the State). The State reserves, and this Decree is without prejudice to, all rights to take administrative action or to file a new action pursuant to any applicable authority against Straits with respect to all other matters, including, but not limited to, the following:

(a) With respect to the Straits Facility, the failure to perform response activities that are required to comply with Part 201 and to satisfy the performance objectives specified in the MDEQ-approved NFA.

(b) With respect to the LPC Facility, the failure to perform response activities that are required to assure compliance with the land use or resource use restrictions required for the LPC Facility, including any action necessary to assure the effectiveness and integrity of any exposure control mechanisms.

(c) With respect to the Straits Facility and LPC Facility, Future Response Activity Costs that Straits has not paid.

(d) The past, present, or future treatment, handling, disposal, release, or threat of release of hazardous substances that occur outside of the Straits Facility or the LPC Facility and that are not attributable to the Straits Facility or the LPC Facility.

(e) The past, present, or future treatment, handling, disposal, release, or threat of release of hazardous substances taken from the Straits Facility or the LPC Facility, except to the extent such removal was by MDEQ.

(f) Damages for injury to, destruction of, or loss of natural resources, and the costs for any natural resource damage assessment.

(g) Criminal acts.

(h) Any matters for which the State is owed indemnification under Section XVIII (Indemnification and Insurance) of this Decree.

(i) The unpermitted release or threatened release of hazardous substances or violations of state or federal law that occur during or after the performance of response activities required by this Decree.

In the event that the State asserts any reserved claims as set forth in this Section, Straits reserves its right to assert any and all defenses and claims in response to any such reserved claims.

20.2 The State reserves the right to take action against Straits if it discovers at any time that any material information provided by Straits prior to or after entry of this Decree was false or misleading.

20.3 The MDEQ and the MDAG expressly reserve all of their rights and defenses pursuant to any available legal authority to enforce this Decree or to compel Straits to comply with the NREPA.

20.4 In addition to, and not as a limitation of any other provision of this Decree, the MDEQ retains all of its authority and reserves all of its rights to perform, or contract to have performed, any response activities that the MDEQ determines are necessary.

20.5 In addition to, and not as a limitation of any provision of this Decree, the MDEQ and the MDAG retain all information gathering, inspection, access and enforcement authorities and rights under Part 201 and any other applicable statute or regulation.

20.6 Failure by the MDEQ or the MDAG to enforce any term, condition, or requirement of this Decree in a timely manner shall not:

(a) Provide or be construed to provide a defense for Straits' noncompliance with any such term, condition, or requirement of this Decree.

(b) Estop or limit the authority of the MDEQ or the MDAG to enforce any such term, condition, or requirement of the Decree, or to seek any other remedy provided by law.

20.7 This Decree does not constitute a warranty or representation of any kind by the MDEQ that the response activities performed by Straits in accordance with the MDEQ-approved response activity plans required by this Decree will result in the achievement of the performance objectives stated in Section VII (Performance of Response Activities) or the remedial criteria established by law, or that those response activities will assure protection of public health, safety, or welfare, or the environment.

20.8 Except as provided in Paragraph 19.1(a) of Section XIX (Covenants Not to Sue by the State), nothing in this Decree shall limit the power and authority of the MDEQ or the State of Michigan, pursuant to Section 20132(8) of the NREPA, to direct or order all appropriate action to protect the public health, safety, or welfare, or the environment; or to prevent, abate, or minimize a release or threatened release of hazardous substances, pollutants, or contaminants on, at, or from the Straits Facility, the LPC Facility, or any other property.

XXI. COVENANT NOT TO SUE BY STRAITS

21.1 Straits hereby covenants not to sue or to take any civil, judicial, or administrative action against the State, its agencies, or their authorized

representatives acting within the scope of their employment, for any claims or causes of action against the State that arise from this Decree, including, but not limited to, any direct or indirect claim for reimbursement from the Cleanup and Redevelopment Fund pursuant to Section 20119(5) of the NREPA or any other provision of law, except as provided in Section 20126(5) of the NREPA.

21.2 After the Effective Date of this Decree, if the MDAG initiates any administrative or judicial proceeding for injunctive relief, recovery of response activity costs, or other appropriate relief relating to the Straits Facility or LPC Facility, Straits agrees not to assert and shall not maintain any defenses or claims that are based upon the principles of waiver, *res judicata*, collateral estoppel, issue preclusion, or claim-splitting, or that are based upon a defense that contends any claims raised by the MDEQ or the MDAG in such a proceeding were or should have been brought in this case; provided, however, that nothing in this paragraph affects the enforceability of the covenants not to sue set forth in Section XIX (Covenants Not to Sue by the State).

XXII. CONTRIBUTION PROTECTION

Pursuant to Section 20129(5) of the NREPA, and Section 9613(f)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510, as amended (CERCLA or Superfund), 42 USC 9613; and to the extent provided in Section XIX (Covenants Not to Sue by the State), Straits shall not be liable for claims for contribution for the matters set forth in Paragraph 19.1 of Section XIX (Covenants Not to Sue by the State) of this Decree, to the extent

allowable by law. Entry of this Decree does not discharge the liability of any other person that may be liable under Section 20126 of the NREPA, or Sections 9607 and 9613 of the CERCLA. Pursuant to Section 20129(9) of the NREPA, any action by Straits for contribution from any person that is not a Party to this Decree shall be subordinate to the rights of the State of Michigan if the State files an action pursuant to the NREPA or other applicable state or federal law.

XXIII. MODIFICATIONS

23.1 The Parties may only modify this Decree according to the terms of this Section. The modification of any Submission required by this Decree, excluding a MDEQ-approved NFA, may be made only upon written approval from the MDEQ Project Coordinator. An amended NFA must be approved in accordance with Paragraphs 7.3(b)-(d) of this Decree.

23.2 Modification of any other provision of this Decree shall be made only by written agreement between Straits' Project Coordinator, the RD Chief, or his or her authorized representative, and the designated representative of the MDAG.

XXIV. SEPARATE DOCUMENTS

24.1 The Parties may execute this Decree in duplicate original form for the primary purpose of obtaining multiple signatures, each of which shall be deemed an original, but all of which together shall constitute the same instrument.

XXV. SEVERABILITY

25.1 The provisions of this Decree shall be severable. If a court of competent jurisdiction declares that any provision of this Decree is inconsistent

with state or federal law and therefore unenforceable, the remaining provisions of this Decree shall remain in full force and effect.

25.2 The Court retains jurisdiction to enforce this Consent Decree and resolve disputes hereunder, but may administratively close this file.

IT IS SO STIPULATED AND AGREED BY:

Bill Schuette
Attorney General
Attorney for Plaintiffs

By: _____ Date: 6/21/12
Margaret Bettenhausen (P75046)
Danielle Allison-Yokom (P70950)
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JoAnn Mensch Acting for Date: 6/21/12
Anne Couture, Acting Chief
Remediation Division
Michigan Department of Environmental Quality

(Signatures continued on following page)

Date: 6/20/2012

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By: Brian K. Calhoun
Print Name: BRIAN CALHOUN
Print Title: CORPORATE ENVIRONMENTAL DIRECTOR
Straits Steel & Wire Company

Date: 6-19-12

IT IS SO ORDERED, ADJUDGED AND DECREED THIS 21st day of June, 2012.

JOYCE DRAGANCHUK
Honorable Joyce A. Draganchuk

P-39417

S/ENRA/AC/Cases 1993/Industrial Plating/1993-200084-B/SSW Consent Decree 2012-06-11

Exhibit A

ATTACHMENT A

Legal Description for 902 North Harrison Street (LPC Property):

Parcel 1: Property No. Liber 244, Page 181

The East Half (E 1/2) of Lots twenty-five (25) and twenty-six (26), Block Seventeen (17) Manufacturers Addition to the City of Ludington, Mason County, Michigan.

Parcel 2: Property No. Liber 296, Page 806*

Lots 1, 2, 3, and 4, and Lots 27, 28, and the West 1/2 of Lots 25 and 26, Block 17, Manufacturer's Addition to the City of Ludington, Mason County, Michigan.

*Modified for purposes of this settlement only to include all of Lots 27 and 28.

Exhibit B

ATTACHMENT B

Legal Description for 902 North Rowe Street (Straits Property):*

Parcel 1: Property No. Liber 142, Page 158

Lots One (1) to Eleven (11), both inclusive, of Block Eighteen (18) of Manufacturer's Addition to the City of Ludington according to the recorded plat thereof, being located on a part of the East one-half (E 1/2) of the Southeast one-quarter (SE 1/4) of Section Ten (10) Township Eighteen (18) North, Range Eighteen (18) West, Mason County, Michigan. Subject to a right of way consisting of a strip of land Twenty (20) feet wide across Block Eighteen (18) for railroad purposes only given to the Flint and Pere Marquette Railway as appears in the records in the Office of the Register of Deeds for Mason County in Liber 290 of Deeds at page 575.

Parcel 2: Property No. Liber 243, Page 142

Lots Twenty-three (23) and Twenty-four (24), Block Seventeen (17), Manufacturers Addition to the City of Ludington, Mason County, Michigan

Parcel 3: Property No. Liber 242, Page 575

Lot Nine (9), and Lots Nineteen (19) through Twenty-two (22), inclusive, Block Seventeen (17), Manufacturer's Addition to the City of Ludington, according to the recorded plat thereof.

Parcel 4: Property No. Liber 218, Page 171

Lots Twelve (12), Thirteen (13), Fourteen (14), Fifteen (15), Sixteen (16), and Seventeen (17), of Block Eighteen (18), Manufacturer's Addition to the City of Ludington, AND ALSO that portion of Longfellow Street lying North of Block Eighteen (18) and South of the Railroad tracks along the centerline of said Longfellow Street as originally platted, EXCEPT a strip of land 20 feet wide across said Block Eighteen (18) for railroad right of way as recorded in Liber 29 of Deeds, Page 575, Mason County Records, all in the City of Ludington, Mason County, Michigan.

Parcel 5: Property No. Liber 242, Page 511

Lots Ten (10) through Nineteen (19) inclusive, Block Twelve (12) of Manufacturer's Addition to the City of Ludington.

*Modified for purposes of this settlement only to exclude all of Lots 27 and 28.

Exhibit C

Groundwater Sampling and Analysis Plan Straits Steel & Wire Company 902 Rowe Street Ludington, Michigan

February 4, 2011
Project No. G04467

fTC&h
Fishbeck, Thompson, Carr & Huber
engineers • scientists • architects • constructors

fTC&h

GROUNDWATER SAMPLING AND ANALYSIS PLAN
STRAITS STEEL & WIRE COMPANY
902 ROWE STREET
LUDINGTON, MICHIGAN

FEBRUARY 4, 2011
PROJECT NO. G04467

Fishbeck, Thompson, Carr & Huber, Inc. Engineers • Scientists • Architects • Constructors
1515 Arboretum Drive, SE, Grand Rapids, MI 49546 Telephone: 616-575-3824

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LIST OF ABBREVIATIONS/ACRONYMS

µg/L	micrograms per liter
COC	chain-of-custody
FTC&H	Fishbeck, Thompson, Carr & Huber, Inc.
GSI	Groundwater Surface Water Interface
LCS	laboratory control sample
LFB	laboratory fortified blank
LPC site	Ludington Plating Company
MDEQ	Michigan Department of Environmental Quality
MDNRE	Michigan Department of Natural Resources and Environment
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
PCOC	Potential Contaminants of Concern
QA/QC	quality assurance/quality control
RL	reporting limit
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SSW	Straits Steel & Wire
TriMatrix	TriMatrix Laboratories, Inc.
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to provide the field procedures, sampling protocols, and monitoring locations for the ongoing groundwater monitoring activities as part of the remedial action for the Straits Steel & Wire Company (SSW) site at 902 Rowe Street, Ludington, Michigan (Figure 1). Data collected under this plan will be used to verify the effectiveness of groundwater extraction in containing and reducing residual inorganic contaminants in groundwater in the study area.

1.1 GENERAL BACKGROUND

SSW has conducted manufacturing at the referenced site since the 1940s. Part of the SSW business at the site included plating of refrigerator racks. Plating operations ceased by the early 1990s, after which, refrigerator racks were electrostatically powder-coated. The first documented environmental concern relating to the site was discovered on or about May 4, 1972, when Michigan Department of Natural Resources and Environment (MDNRE) (formerly the Michigan Department of Environmental Quality) staff sampled and analyzed groundwater from a dewatering project at the rear of the SSW plant. The dewatering was accomplished using a sump at the base of an excavation that was part of the construction of a new wastewater treatment system for the plating operations. The groundwater sample indicated the presence of certain metals/inorganics. The rear area of the SSW building was excavated from the surface to below the water table for removal of the historical impacts.

SSW also currently owns the real property of another former plating operation (previously known as the Ludington Plating Company and Industrial Plating and Manufacturing, Inc.), herein referred to as the LPC site located at 902 Harrison Street, Ludington, Michigan. The two properties are contiguous as indicated on Figure 2. LPC also conducted a wire plating operation. SSW purchased the property in 1982 but did not engage in any plating operations at the LPC site. The first documented environmental problem impacting the LPC site occurred on or about May 13, 1968, when a nearby sanitary sewer collapsed, and plating wastes were allegedly discharged to earthen pits. In 1974, 2,000 gallons of cyanide solution were reportedly spilled at the LPC site, and MDNRE documents indicate that in 1976 plating sludge was dumped by LPC into a pit on the north side of the main building. Dry wells for the containment pit under the LPC plating line may also have leaked. Soils were excavated from the LPC site by the MDNRE in 1998, and the excavated area was covered with clean soil. The MDNRE demolished the LPC site building in 2002 and removed additional soils and other materials from under the building; this area was also covered with clean soil.

The MDNRE has conducted site-wide investigations between 1993 and 2002 to aid in the determination of the nature and extent of groundwater contamination. The MDNRE also designed, installed, and tested a groundwater extraction well (PW 200) in 1998 for the purpose of capturing contaminated groundwater originating from the LPC site. This extraction well was never put into operation by the MDNRE. The

groundwater plume emanating from the LPC property migrates generally west/northwest. Figure 3 shows the locations of the site-wide monitoring wells and groundwater extraction wells.

SSW completed numerous phases of a remedial investigation in the 1990s to determine the nature and extent of groundwater and soil contamination that may be associated with the SSW property. The groundwater investigations delineated an area of groundwater with concentrations of chromium, zinc and cyanide downgradient from the SSW site. In 1994, the MDNRE approved SSW's remedial cleanup plan for this groundwater contamination, and SSW designed and installed a groundwater extraction well at the downgradient end of the impacted area. The extraction well (PW-1) has been operating continuously since 1997. The extracted groundwater is discharged, under permit, to the Ludington POTW. SSW has conducted and is currently conducting ongoing groundwater and system performance monitoring. The estimated extent of the groundwater capture zone, based on modeling and testing, is shown on Figure 3.

Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H), on behalf of SSW, conducted additional groundwater investigative activities in June 2005 by performing an extensive groundwater sampling and analysis event. This study is documented in the Predesign Technical Memorandum, Ludington Plating Groundwater (Predesign Tech Memo, FTC&H, August 31, 2005) and was submitted to the MDNRE. This study was performed to assess the current nature and extent of the metals and cyanide in groundwater and to provide information necessary to evaluate the cleanup alternatives for the LPC plume and the effectiveness of the existing SSW cleanup program. The results of this study indicated the following:

- Based on the concentrations of the potential contaminants of concern (PCOCs) that exceeded any potentially relevant Part 201 cleanup criteria, there was divisibility between the impacted groundwater downgradient of the LPC site and the SSW site.
- The SSW extraction well PW-1 captures and contains the impacted groundwater downgradient of the SSW site.
- The chemical distribution (vertical and horizontal) downgradient of the SSW site has been determined. The only PCOC apparently reaching PW-1 above any potentially relevant cleanup criteria is available cyanide at a very low concentration (6 micrograms per liter [µg/L]). All other PCOCs, especially hexavalent chromium and available cyanide, are only present upgradient of the extraction well. Given the expected groundwater flow velocity, it appeared the PCOCs in the groundwater downgradient of the SSW site are significantly attenuated prior to groundwater transport to the extraction well.
- The difference in historical total cyanide results, which were higher than the available cyanide results, is attributed to the presence of iron. Cyanide forms very stable complex ions with iron resulting in an "unavailable" cyanide complex ion. Unavailable cyanide exhibits considerably less toxicity than the available form. Part 201 cleanup criteria focus on the available form of cyanide and the sampling data indicate that this form of cyanide is not widespread in the area.

- In regard to the contaminants detected downgradient of the LPC site, few of the samples exceeded potentially applicable Part 201 cleanup criteria. None of the plating-related PCOCs were detected above the parameter reporting limits in any of the far downgradient monitoring wells. It appears the LPC site groundwater contamination is naturally attenuating and is in a stable and possibly shrinking condition.

1.2 PURPOSE AND OBJECTIVES

This groundwater sampling and analysis plan is designed to effectively monitor the groundwater contamination downgradient from the SSW site to the groundwater extraction well PW-1. SSW has been performing quarterly monitoring as well as operations and maintenance of the groundwater extraction system since the installation of the extraction well in or about 1997. The MDNRE has requested that SSW formalize and update the remedial system sampling and analysis plan.

The purpose for this sampling and analysis plan is to provide a monitoring program that will provide data and information for meeting the following objectives:

- Verify that the capture zone effectively contains chemicals of concern that may exceed potentially applicable cleanup concentrations.
- Monitor the contaminant concentration trends.
- Verify temporal groundwater flow conditions.

1.3 CONTAMINANTS OF CONCERN

SSW has historically sampled groundwater for chromium (total), cyanide (total) and zinc (total). The comprehensive groundwater sampling event conducted as part of the Predesign Tech Memo included the analysis of total metals (cadmium, chromium, iron, nickel, and zinc), hexavalent chromium; dissolved chromiumavailable cyanide; and field parameters (pH, specific conductance, Eh, dissolved oxygen and turbidity). The same study included a separate sampling investigation to determine the appropriate sampling and analysis method for cyanide.

The results of this 2005 study concluded that the only contaminants downgradient from the SSW site above the Part 201 drinking water or GSI criteria were chromium, cadmium (only at MW-24 at 3.2 µg/L), copper (only at MW-49 at an estimated concentration of 341 µg/L) and available cyanide (only at MW-49 at 252 µg/L). Most of the chromium that is dissolved in the groundwater is in the form of hexavalent chromium. A copy of the Predesign Tech Memo Table 2 – Groundwater Data Summary is provided in Appendix 1.

A summary of the historical quarterly sampling results from 2007 through 2010 is provided in Table 1. A review of these results indicates only detection of chromium and cyanide above either the Part 201 drinking water or GSI criteria in the last three years.

The primary chemicals of concern are hexavalent chromium and available cyanide. Other contaminants present in the area that are either at very low concentrations or appear to be very isolated include: cadmium, trivalent chromium (as determined by the difference between hexavalent and total chromium), copper, and zinc. Based on the low concentration and limited distribution of these other contaminants (cadmium, trivalent chromium, copper, and zinc) they are not included in the ongoing monitoring program but will be considered for closure monitoring when the primary chemicals of concern (hexavalent chromium and available cyanide) meet applicable cleanup standards.

2.0 GROUNDWATER SAMPLING AND ANALYSIS

The following section describes the sampling procedures, analytical methods, and quality assurance/quality control (QA/QC) protocols that will be implemented under this SAP.

2.1 MONITORING WELLS AND LOCATIONS

Groundwater monitoring will be performed on a quarterly basis at 16 well locations for the parameters specified in Section 2.3. The sample locations included in this SAP were selected to monitor conditions and also verify the lateral and downgradient extent of PCOCs. The well locations and sampling rationale are summarized in Table 2. The sample locations are shown on Figure 3.

Groundwater sampling will be conducted on a quarterly basis. After one year, the frequency of groundwater sampling will be evaluated based on the documented concentrations of the PCOCs in the area. Proposed changes in sampling frequency will be submitted to the MDNRE as an amendment to this SAP.

2.2 GROUNDWATER SAMPLING METHODOLOGY

2.2.1 EQUIPMENT CALIBRATION

Water quality parameters, which include pH, Eh, dissolved oxygen, specific conductance, and temperature, will be measured during sampling activities with a multi-parameter meter (flow-cell) connected in-line to the purged groundwater. Turbidity will be measured from discrete samples using an external or stand-alone turbidimeter (not in-line). The field meters will be calibrated for the specified parameters at the beginning of each day of sampling. Verification of the instrument calibration will be performed approximately mid-day and at the end of each day of sampling. Equipment calibration will be

performed according to FTC&H SOPs 11-08 and 11-10. The field activities SOPs are provided in Appendix 2.

2.2.2 SAMPLE COLLECTION

Prior to the collection of groundwater samples, water level measurements will be obtained at each well using the electric tape method described in FTC&H SOP 18-04. Groundwater samples from the 15 monitoring well locations (all locations except the purge well [PW-1]) will be collected using a low-flow minimal drawdown techniques. Groundwater will be purged using either a peristaltic pump (FTC&H SOP 10-06) or a portable bladder pump (FTC&H SOP 10-09) at a rate of 100 to 500 mL per minute. The low-flow sampling procedure is described in detail in FTC&H SOP 10-02. Water quality parameters will be monitored with the flow cell and turbidimeter and recorded every 3 to 5 minutes during purging to check for stabilization. Field parameter measurements will be made in accordance with FTC&H SOPs 11-08 and 11-10. Stabilization will be achieved when the field parameters are stable for three successive readings using the following criteria:

- ± 0.1 standard unit for pH
- ± 3% for temperature
- ± 3% for specific conductance
- ± 10 millivolt for Eh
- ± 10% for dissolved oxygen
- ± 10% for turbidity values >20 NTU
- Drawdown <0.3 feet

Upon stabilization, groundwater samples will be collected in accordance with FTC&H SOP 10-10. The field activities SOPs are provided in Appendix 2.

Groundwater samples from PW-1 will be collected at Outfall 01 (sewer manhole on Bryant Road between Beechwood Drive and William Street) where the extraction well discharges to the sanitary sewer. The sample will be collected with a dedicated dip-bucket. An additional grab sample will be obtained for measurement of field parameters for the quarterly event samples.

2.2.3 EQUIPMENT DECONTAMINATION

During field work, decontamination procedures will be implemented to prevent cross-contamination of the groundwater samples. Sampling pumps and flow cells used for field parameter measurement will be decontaminated in accordance with the FTC&H SOPs presented in Appendix 2. With the exception of PW-1, dedicated tubing will be installed in the 15 monitoring wells selected for sampling to reduce potential of cross-contamination.

2.2.4 Disposal of Investigation-Derived Waste

All purge water will be containerized during field sampling and discharged to the Ludington sanitary sewer system, at Outfall 01, in compliance with Wastewater Discharge Permit No. 006.

2.3 SAMPLE ANALYSIS

Groundwater samples collected under this SAP will be submitted to Trimatrix Laboratories, Inc. (Grand Rapids, Michigan) and analyzed for the following PCOCs:

- Hexavalent chromium using USEPA Method 7196.
  - The reporting limit (RL) for hexavalent chromium samples will be 5 µg/L.
- Available cyanide using USEPA Method OIA-1677.
  - The RL for available cyanide samples will be 2 µg/L.

2.4 QUALITY CONTROL

2.4.1 FIELD SAMPLING

Field duplicates will be collected at a rate of 1 per 10 investigative samples. The field duplicates will be collected immediately after the investigative sample. MS/MSD samples will be collected at a rate of 1 per 20 investigative samples. The sampling network, summarizing the number of investigative samples, field duplicates, and MS/MSD samples to be collected per event, is summarized in Table 3.

2.4.2 LABORATORY

Method blank, duplicate, LFB/LCS, and MS samples will be prepared and analyzed to assess the quality of the data resulting from the laboratory analytical program.

Method blank samples will be prepared and analyzed at the frequency specified in the referenced methods to assess potential sample contamination during the analytical process.

Duplicate samples will be analyzed to check for analytical reproducibility. The frequency of laboratory duplicate preparation and analysis is specified in the referenced USEPA methods.

LFB/LCS samples will be prepared and analyzed as a primary demonstration of the ability of the laboratory to analyze samples with acceptable qualitative and quantitative accuracy. The frequency of LFB/LCS sample preparation is specified in the referenced USEPA methods. Matrix spike determinations will be performed in duplicate (MS/MSD) and will serve as an indication of the effect of sample matrix on

precision and accuracy. Typically, one LFB/LCS and MS/MSD pair will be prepared per batch (20 or fewer samples).

2.5 SAMPLING DOCUMENTATION AND HANDLING

2.5.1 FIELD DOCUMENTATION

Records of the field activities and sampling information will be maintained in field notebooks created for the project. The field notebooks will consist of project specific forms which direct documentation of the field activities including sample locations, sampling times, types of samples collected, and other information pertinent to the monitoring event. Additional information regarding documentation of groundwater sampling activities is provided in FTC&H SOPs 3-01 and 10-03 in Appendix 2.

2.5.2 SAMPLE LABELING

A unique number will be assigned to each field sample collected. Sample identification will include a site identifier, year and month of sample collection, sample location and sample type (investigative, duplicate, or MS/MSD. For example, SSW-10-11-MW-8(I) would represent an investigative groundwater sample collected in November 2010 from MW-8 at the SSW site.

Pre-printed sample labels will be provided to the field staff, which will include: project number, sample identification, type of bottle and preservative, and required analyses. At the time of sample collection, the field staff will record the the date/time and their initials on the sample labels using waterproof ink.

2.5.3 CHAIN-OF-CUSTODY

Chain-of-custody (COC) procedures are intended to document sample possession from collection to disposal in accordance with federal guidelines. A separate COC record will accompany each sample shipment or cooler from the field to the laboratory and will serve as a record for the receipt of samples by the laboratory. The chain-of-custody protocol is described in detail in FTC&H SOP 3-02 (Appendix 2) and summarized below.

- The field sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- As few people as possible will handle the samples.
- A COC record will be completed for all samples. The following information will be included on the COC forms:
  - Sample identification

- Date and time of sampling
- Project location
- Sample matrix type
- Number of containers, preservative, and required analyses
- Names or initials of persons involved in sample collection.

- When transferring possession of samples, individuals relinquishing and receiving samples will sign, date, and note the time on the COC.

2.5.4 SAMPLE STORAGE AND TRANSPORT

All samples will be held on ice in an insulated cooler during the collection process. Samples will be packaged, shipped, and handled in accordance with the procedures outlined in SOP 10-10 (Appendix 2).

3.0 EXTRACTION WELL MONITORING

Discharges from the extraction well (PW-1) to the sanitary sewer will be monitored in accordance with the Wastewater Discharge Permit No. 006, issued by the City of Ludington to SSW. A copy of the discharge permit is provided in Appendix 3. A summary of the sampling details are as follows:

- Monthly sampling of the extraction well's discharge to Outfall 01 (sewer manhole on Bryant Road, between Beechwood Drive and William Street)
- Samples collected for the following analysis
  - Total chromium
  - Total zinc
  - Total cyanide
- All samples will be collected, preserved, and analyzed in accordance with procedures established in 40 CFR Part 136 and Amendments.
- Samples will be submitted to TriMatrix following the sample documentation and handling procedures described in Section 2.5.
- SSW or their representative will notify the Ludington Wastewater Plant of any significant change to the permitted groundwater discharge.
- Discharge limitations are listed on page 3 of Wastewater Discharge permit (Appendix 3)

During the monthly sampling activities at PW-1, field sampling personnel will also record the extraction well's flow meter reading (City of Ludington water meter).

4.0 GROUNDWATER FLOW MAPPING

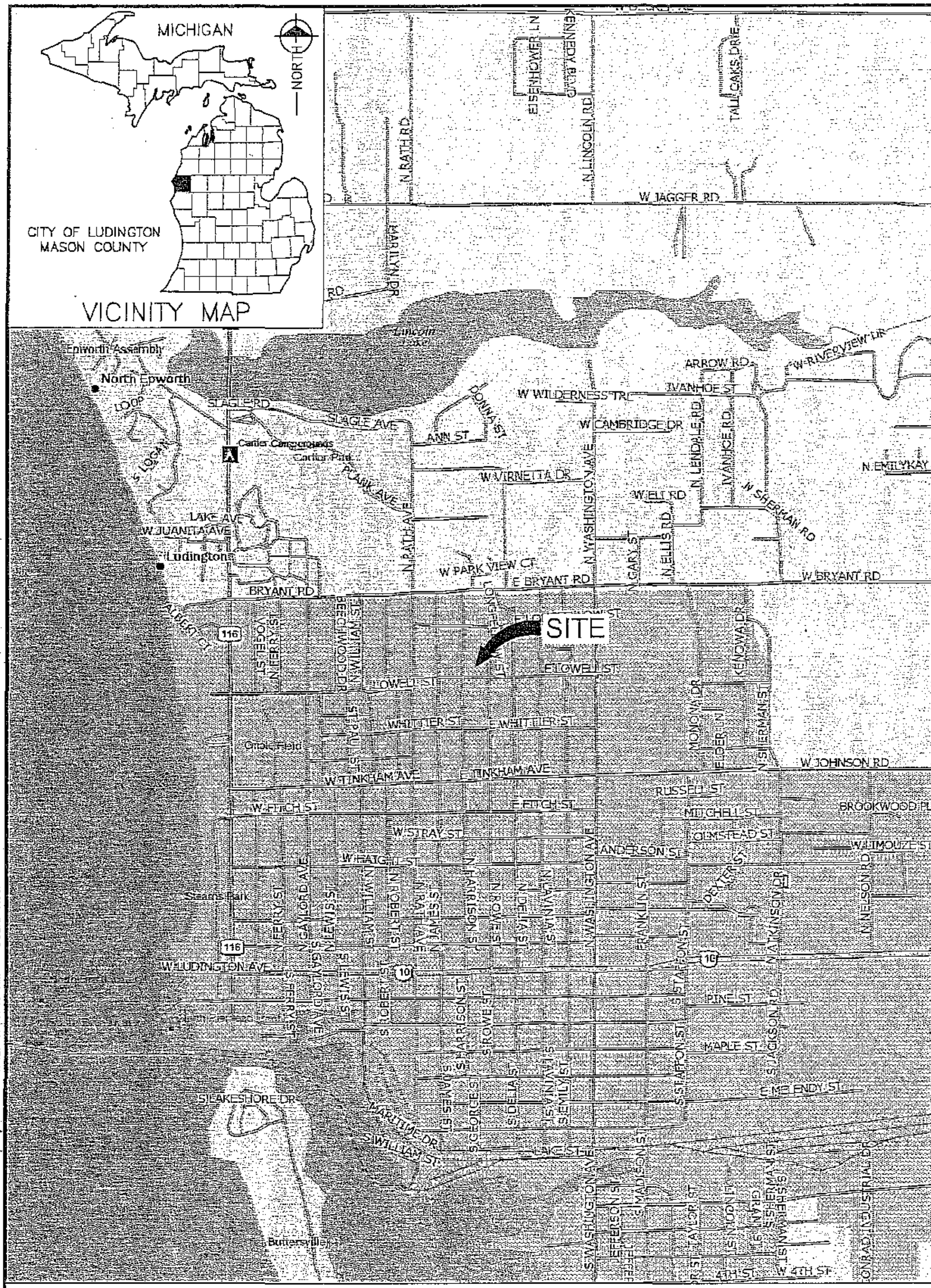
Water level measurements will be obtained quarterly from the 16 sample locations and 7 additional monitoring wells using the electric tape method described in FTC&H SOP 18-04 (Appendix 2). The well locations for static water level measurements are summarized in Table 2 and presented on Figure 3. The water level data will be used to construct groundwater potentiometric surface figures to verify the groundwater flow direction and verify that the extraction well is effectively capturing impacted groundwater.

5.0 REPORTING

A quarterly report will be submitted to the MDNRE within 45 days following receipt of all analytical data reports from the laboratory. The quarterly reports will include:

- A copy of the laboratory analytical reports (including the monthly groundwater discharge reports).
- A table summarizing the analytical data.
- Figure with groundwater contours and posted concentrations of PCOCs.
- A SAP compliance evaluation.

Figures



REFERENCE:
DeLORME STREET ATLAS
USA – 2009

Scale: 1" = 2000'

0 1000 2000

SITE LOCATION MAP

ftc&h

engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 8.5"x11" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Straits Steel & Wire
Ludington, Michigan
Groundwater Sampling and Analysis Plan

PROJECT NO.
G04467

FIGURE NO.
1

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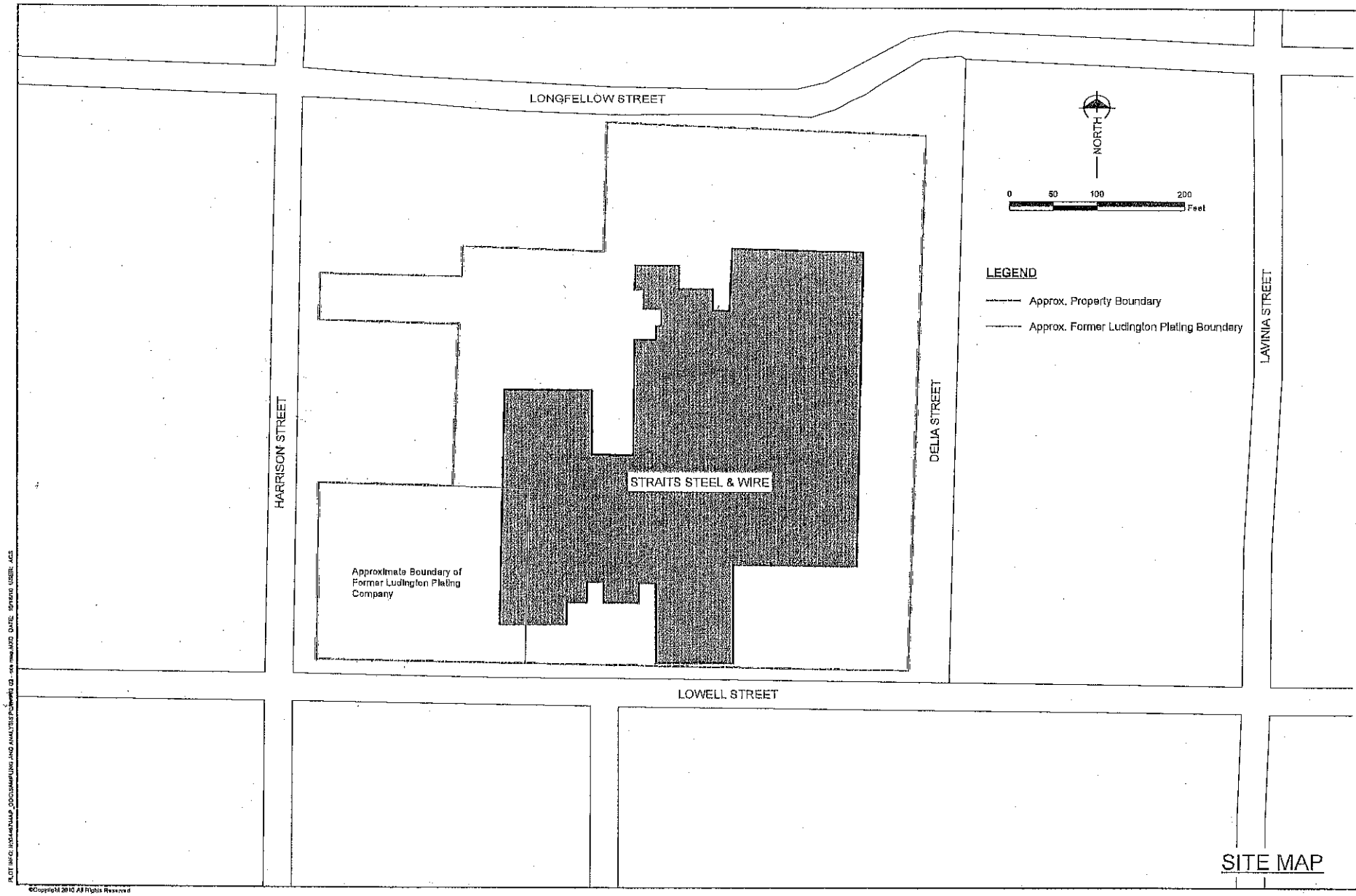


SITE MAP

frc&h
engineers
scientist
architects
constructors

fishbeck, thompson, carr & huber, inc.

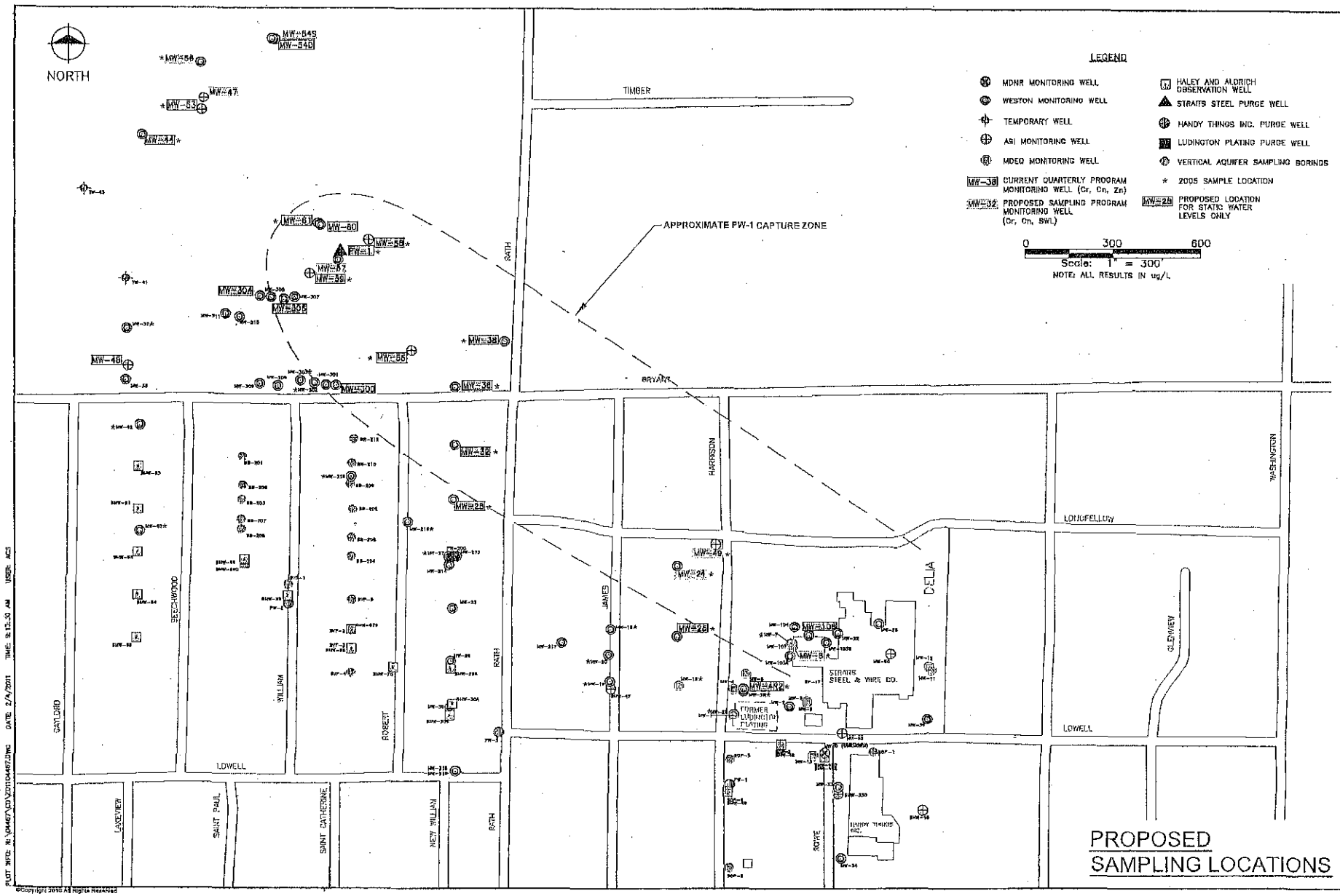
Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Straits Steel & Wire
Ludington, Michigan

Groundwater Sampling and Analysis Plan

PROJECT NO.
G04457

FIGURE NO.
2



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fr&h
engineers
scientists
architects
constructors

Fishbeck, Thompson, Carr & Huber, Inc.

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Straits Steel & Wire
Ludington, Michigan

Groundwater Sampling and Analysis Plan

PROJECT NO.
G04467

FIGURE NO.
3

Tables

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-32		09/19/07	0.01 U	--	0.0083	0.5
		12/18/07	0.01 U	--	0.0058	0.61
		03/27/08	0.01 U	--	0.0052	0.4
		06/26/08	0.01 U	--	0.005 U	0.36
		09/17/08	0.01 U	--	0.006	0.37
	X	09/17/08	0.01 U	--	0.005 U	0.36
		12/30/08	0.01 U	--	0.005 U	0.05 U
		03/17/09	0.01 U	--	0.0052	0.05 U
		06/16/09	0.03	--	0.0086	0.05 U
		09/22/09	0.014	--	0.02	0.05 U
		11/30/09	0.01 U	--	0.02	0.05 U
		03/16/10	0.01 U	0.002 U	--	0.05 U
		06/14/10	0.019	0.002 U	--	0.05 U
		09/13/10	0.012	0.002 U	--	0.05 U
		11/30/10	0.17	0.002 UJ	0.027	0.05 U
MW-36		09/19/07	3.2	--	0.0083	0.053
		12/18/07	3.3	--	2.5	0.05 U
		03/27/08	3.1	--	2.2	0.05 U
		06/27/08	1.9	--	3.1	0.05 U
		09/17/08	1.8	--	3	0.05 U
		12/30/08	2	--	3.6	0.05 U
		03/17/09	1.8	--	3.9	0.05 U
		06/16/09	1.7	--	3.6	0.05 U
		09/22/09	1.6	--	4	0.05 U
		11/30/09	0.82	--	4.4	0.05 U
		03/16/10	1.2	0.054	--	0.05 U
		06/14/10	0.9	0.019	--	0.05 U
		09/15/10	0.73	0.033	--	0.05 U
	X	09/15/10	0.73	0.034	--	0.05 U
		11/30/10	0.64	0.014 J	4.9	0.05 U
MW-38		09/19/07	0.01 U	--	0.012	0.05 U
		12/18/07	0.01 U	--	0.013	0.05 U
	X	12/18/07	0.01 U	--	0.014	0.05 U
		03/27/08	0.01 U	--	0.017	0.05 U
		06/27/08	0.01 U	--	0.02	0.05 U
		09/17/08	0.025	--	0.015	0.05 U
		12/30/08	0.01 U	--	0.017	0.05 U
		03/17/09	2.8	--	0.016	0.05 U
		06/15/09	0.01 U	--	0.018	0.05 U
	X	06/15/09	0.01 U	--	0.017	0.05 U
		09/22/09	0.01 U	--	0.011	0.05 U
	X	09/22/09	0.01 U	--	0.012	0.05 U
		11/30/09	0.01 U	--	0.014	0.05 U
	X	11/30/09	0.01 U	--	0.014	0.05 U
		03/16/10	0.01 U	0.002 U	--	0.05 U
	X	03/16/10	0.01 U	0.002 U	--	0.05 U
		06/14/10	0.01 U	0.002 U	--	0.05 U
	X	06/14/10	0.01 U	0.002 U	--	0.05 U

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Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-38		09/13/10	0.01 U	0.002 U	--	0.05 U
	X	09/13/10	0.01 U	0.002 U	--	0.05 U
		11/30/10	0.01 U	0.002 U	0.013	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.019	0.05 U
MW-44		09/17/07	0.01 U	--	0.017	0.73
		12/17/07	0.01 U	--	0.016	0.9
		03/26/08	0.01 U	--	0.0055	0.089
		06/26/08	0.01 U	--	0.07	0.05 U
		09/16/08	0.01 U	--	0.066	0.05 U
	X	09/16/08	0.01 U	--	0.065	0.05 U
		12/29/08	0.01 U	--	0.036	0.05 U
		03/17/09	0.01 U	--	0.039	0.05 U
		06/16/09	0.01 U	--	0.046	0.05 U
		09/22/09	0.01 U	--	0.044	0.05 U
		11/30/09	0.01 U	--	0.032	0.05 U
		03/16/10	0.01 U	0.006	--	0.05 U
		06/14/10	0.01 U	0.038	--	0.05 U
	X	06/15/10	0.01 U	0.038	--	0.05 U
		09/15/10	0.01 U	0.014	--	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.025	0.05 U
MW-48		09/17/07	0.01 U	--	0.005 U	0.55
		12/17/07	0.01 U	--	0.025	0.65
		03/26/08	0.01 U	--	0.012	0.3
		06/26/08	0.01 U	--	0.005 U	0.39
		09/16/08	0.01 U	--	0.0089	0.14
		12/29/08	0.01 U	--	0.005 U	0.05 U
	X	12/29/08	0.01 U	--	0.005 U	0.05 U
		06/16/09	0.01 U	--	0.012	0.05 U
		09/22/09	0.01 U	--	0.005 U	0.05 U
		11/30/09	0.01 U	--	0.005 U	0.05 U
		03/16/10	0.01 U	0.004 U	--	0.05 U
		06/14/10	0.01 U	0.02	--	0.05 U
		09/15/10	0.01 U	0.002 U	--	0.05 U
		12/03/10	0.01 U	0.002 U	0.005 U	0.05 U
	X	12/03/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-53		09/17/07	0.01 U	--	0.005 U	0.05 U
		12/17/07	0.01 U	--	0.0065	0.05 U
	X	12/17/07	0.012	--	0.005 U	0.05 U
		03/26/08	0.01 U	--	0.005 U	0.05 U
		06/26/08	0.01 U	--	0.005 U	0.05 U
		09/16/08	0.01 U	--	0.005 U	0.05 U
		12/29/08	0.01 U	--	0.005 U	0.05 U
		03/17/09	0.01 U	--	0.005 U	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-53		06/16/09	0.01 U	–	0.005 U	0.05 U
	X	06/16/09	0.01 U	–	0.005 U	0.05 U
		09/23/09	0.01 U	–	0.005 U	0.05
		12/02/09	0.01 U	–	0.005 U	0.05 U
		03/16/10	0.01 U	0.002 U	–	0.05 U
		06/15/10	0.01 U	0.002 U	–	0.05 U
		09/13/10	0.01 U	0.002 U	–	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-54D		09/17/07	0.01 U	–	0.005 U	0.18
		12/17/07	0.01 U	–	0.0054	0.094
		03/26/08	0.01 U	–	0.005 U	0.083
		06/27/08	0.01 U	–	0.005 U	0.05 U
		09/16/08	0.01 U	–	0.005 U	0.05 U
		12/30/08	0.01 U	–	0.005 U	0.05 U
		03/19/09	0.01 U	–	0.005 U	0.05 U
		06/16/09	0.01 U	–	0.005 U	0.05 U
		09/23/09	0.01 U	–	0.005 U	0.05 U
		12/02/09	0.01 U	–	0.005 U	0.05 U
		03/16/10	0.01 U	0.004 U	–	0.11
		06/14/10	0.01 U	0.002 U	–	0.05 U
		09/17/10	0.01 U	0.002 U	–	0.05 U
	X	09/17/10	0.01 U	0.002 U	–	0.05 U
		12/03/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-55		09/19/07	0.22	–	0.49	0.095
		12/18/07	0.096	–	0.28	0.085
		03/27/08	0.12	–	0.42	0.054
		06/27/08	0.1	–	0.52	0.05 U
		09/17/08	0.11	–	0.52	0.05 U
		12/31/08	2.4	–	0.83	0.05 U
		03/17/09	2.8	–	0.84	0.05 U
		06/15/09	2.7	–	0.77	0.05 U
		09/29/09	2.9	–	1	0.05 U
	X	09/29/09	2.9	–	1	0.05 U
		12/02/09	2	–	0.92	0.05 U
	X	12/02/09	1.9	–	0.92	0.05 U
		03/17/10	1.6	0.016	–	0.05 U
	X	03/17/10	1.6	0.013	–	0.05 U
		06/15/10	1.1	0.007	–	0.05 U
	X	06/15/10	1.1	0.007	–	0.05 U
		09/13/10	1.1	0.010	–	0.05 U
		12/03/10	1.1	0.005 J	0.98	0.05 U
MW-58		09/17/07	0.01 U	–	1.2	0.08
		12/17/07	0.01 U	–	1.3	0.18
		03/27/08	0.01 U	–	2.5	0.05 U

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Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-58		06/27/08	0.01 U	–	0.17	0.05 U
		09/16/08	0.01 U	–	0.17	0.05 U
		12/31/08	0.01 U	–	0.52	0.05 U
		03/19/09	0.01 U	–	0.42	0.05 U
		06/15/09	0.028	–	0.41	0.05 U
		09/23/09	0.01 U	–	0.48	0.05 U
		11/30/09	0.01 U	–	0.25	0.05 U
		03/17/10	0.01 U	0.004 U	–	0.05 U
		06/15/10	0.01 U	0.002	–	0.05 U
		09/13/10	0.01 U	0.002 U	–	0.05 U
		12/03/10	0.01 U	0.002 UJ	0.078	0.05 U
MW-59		09/17/07	0.01 U	–	0.011	0.063
		12/17/07	0.01 U	–	0.012	0.072
		03/27/08	0.01 U	–	0.016	0.05 U
	X	03/27/08	0.01 U	–	0.011	0.05 U
		06/27/08	0.01 U	–	0.0071	0.05 U
		09/16/08	0.01 U	–	0.0072	0.05 U
		12/30/08	0.01 U	–	0.0071	0.05 U
	X	12/30/08	0.01 U	–	0.007	0.05 U
		03/19/09	0.022	–	0.0074	0.64
		06/15/09	0.01 U	–	0.0092	0.05 U
		09/23/09	0.01 U	–	0.0055	0.05 U
	X	09/23/09	0.01 U	–	0.0067	0.05 U
		11/30/09	0.01 U	–	0.0089	0.05 U
		03/17/10	0.01 U	0.006	–	0.05 U
		06/15/10	0.01 U	0.026	–	0.05 U
		09/13/10	0.01 U	0.005	–	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-60		09/17/07	0.01 U	–	0.005 U	0.51
		12/17/07	0.01 U	–	0.0056	0.21
		03/26/08	0.01 U	–	0.005	0.05 U
		06/27/08	0.01 U	–	0.005 U	0.16
		09/16/08	0.01 U	–	0.005 U	0.05
		12/31/08	0.01 U	–	0.005 U	0.05 U
	X	12/31/08	0.01 U	–	0.005 U	0.05 U
		03/19/09	0.01 U	–	0.005 U	0.072
		06/15/09	0.01 U	–	0.006	0.05 U
		09/29/09	0.01 U	–	0.005 U	0.05 U
		12/02/09	0.01 U	–	0.005 U	0.05 U
		03/17/10	0.01 U	0.12	–	0.05 U
		03/23/10	0.01 U	0.002 U	–	0.05 U
		06/15/10	0.01 U	0.022	–	0.05 U
	X	06/15/10	0.01 U	0.011	–	0.05 U
		09/15/10	0.01 U	0.002 U	–	0.05 U
		12/03/10	0.01 U	0.002 UJ	0.005 U	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-61		09/17/07	0.01 U	–	0.0078	0.51
		12/17/07	0.01 U	–	0.0072	0.41
		03/26/08	0.01 U	–	0.0067	0.05 U
	X	03/26/08	0.01 U	–	0.0098	0.05 U
		09/17/08	0.01 U	–	0.005 U	0.05 U
		12/29/08	0.01 U	–	0.005 U	0.05 U
		03/19/09	0.01 U	–	0.005 U	0.05 U
		06/15/09	0.01 U	–	0.0057	0.05 U
		09/22/09	0.01 U	–	0.005 U	0.05 U
		12/02/09	0.01 U	–	0.0059	0.05 U
		03/17/10	0.01 U	0.13	–	0.05 U
		06/15/10	0.01 U	0.16	–	0.05 U
		09/15/10	0.01 U	0.067	–	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.005 U	0.05 U
Purge Well		07/24/07	0.01 U	–	0.47	0.02 U
		08/21/07	0.01 U	–	0.48	0.02 U
		09/17/07	0.05 U	–	0.46	0.02 U
		10/31/07	0.05 U	–	0.48	0.02 U
		11/29/07	0.05 U	–	0.47	0.02 U
		12/17/07	0.05 U	–	0.48	0.022
		01/29/08	0.05 U	–	0.48	0.02 U
		02/28/08	0.05 U	–	0.52	0.02 U
		03/26/08	0.05 U	–	0.48	0.02 U
		04/28/08	0.05 U	–	0.48	0.02 U
		05/20/08	0.05 U	–	0.49	0.02 U
		06/27/08	0.05 U	–	0.46	0.02 U
		08/19/08	0.05 U	–	0.48	0.025
		09/04/08	0.05 U	–	0.48	0.02 U
		10/06/08	0.05 U	–	0.48	0.02 U
		11/11/08	0.05 U	–	0.58	0.02 U
		12/03/08	0.05 U	–	0.52	0.02 U
		01/13/09	0.05 U	–	0.53	0.02 U
		02/04/09	0.05 U	–	0.54	0.02 U
		03/05/09	0.05 U	–	0.57	0.02 U
		04/06/09	0.05 U	–	0.51	0.02 U
		05/11/09	0.05 U	–	0.58	0.02 U
		06/09/09	0.05 U	–	0.56	0.02 U
		07/08/09	0.05 U	–	0.54	0.02 U
		08/07/09	0.05 U	–	0.59	0.02 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
Purge Well		09/02/09	0.05 U	–	0.61	0.02 U
		10/07/09	0.05 U	–	0.47	0.02 U
		11/09/09	0.05 U	–	0.47	0.02 U
		12/02/09	0.05 U	–	0.44	0.02 U
		01/07/10	0.05 U	–	0.43	0.031
		02/08/10	0.05 U	–	0.45	0.02 U
		03/04/10	0.05 U	–	0.43	0.02 U
		03/15/10	–	0.002 U	–	–
		04/19/10	0.05 U	0.002 U	–	0.02 U
		05/13/10	0.05 U	0.002 U	–	0.02 U
		06/01/10	0.05 U	0.002 U	0.40	0.02 U
		07/15/10	0.05 U	0.003	0.30	0.035
		08/05/10	0.05 U	0.002 U	–	0.02 U
		09/08/10	0.05 U	0.002 U	–	0.02 U
		11/02/10	0.05 U	0.002 U	0.35	0.027
		12/03/10	0.05 U	0.002 U	0.20	0.021
		12/09/10	0.05 U	0.002 U	0.31	0.023
Equipment Blank		09/17/07	0.01 U	–	0.005 U	0.05 U
		09/19/07	0.01 U	–	0.005 U	0.05 U
		12/17/07	0.01 U	–	0.0073	0.05 U
		12/18/07	0.01 U	–	0.0097	0.05 U
		03/26/08	0.01 U	–	0.005 U	0.05 U
		03/27/08	0.01 U	–	0.0062	0.05 U
		06/26/08	0.01 U	–	0.005 U	0.05 U
		06/27/08	0.01 U	–	0.005 U	0.05 U
		09/16/08	0.01 U	–	0.03	0.05 U
		09/17/08	0.1	–	0.53	0.05 U
		12/29/08	0.01 U	–	0.005 U	0.05 U
		12/30/08	0.01 U	–	0.005 U	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
Equipment Blank		12/31/08	0.01 U	–	0.005 U	0.05 U
		03/17/09	0.01 U	–	0.005 U	0.05 U
		03/19/09	0.01 U	–	0.005 U	0.05 U
		06/15/09	0.01 U	–	0.005 U	0.05 U
		06/16/09	0.01 U	–	0.005 U	0.05 U
		09/22/09	0.01 U	–	0.0083	0.05 U
		09/23/09	0.01 U	–	0.005 U	0.05 U
		09/29/09	0.01 U	–	0.005 U	0.05 U
		11/30/09	0.01 U	–	0.005 U	0.05 U
		12/02/09	0.01 U	–	0.005 U	0.05 U
		03/16/10	0.01 U	0.002 U	–	0.05 U
		03/17/10	0.01 U	0.004 U	–	0.05 U
		06/14/10	0.01 U	0.002 U	–	0.05 U
		06/15/10	0.01 U	0.002 U	–	0.05 U
		09/13/10	0.01 U	0.002 U	–	0.05 U
		09/15/10	0.01 U	0.002 U	–	0.05 U
		09/17/10	0.01 U	0.002 U	–	0.05 U
		11/30/10	0.01 U	0.002 U	0.0063	0.05 U
		12/03/10	0.01 U	0.002 U	0.005 U	0.05 U
		12/03/10	0.01 U	0.002 U	0.005	0.05 U
Field Blank		09/17/07	0.01 U	–	0.005 U	0.05 U
		09/19/07	0.01 U	–	0.0061	0.05 U
		12/17/07	0.01 U	–	0.005 U	0.05 U
		12/18/07	0.01 U	–	0.0078	0.05 U
		03/26/08	0.01 U	–	0.005 U	0.05 U
		03/27/08	0.01 U	–	0.005 U	0.05 U
		06/26/08	0.01 U	–	0.005 U	0.05 U
		06/27/08	0.01 U	–	0.005 U	0.05 U
		09/16/08	0.01 U	–	0.03	0.05 U
		09/17/08	0.01 U	–	0.03	0.05 U
		12/29/08	0.01 U	–	0.005 U	0.05 U
		12/30/08	0.01 U	–	0.017	0.05 U
		12/31/08	0.01 U	–	0.005 U	0.05 U
		03/17/09	0.01 U	–	0.005 U	0.05 U
		03/19/09	0.01 U	–	0.005 U	0.05 U
		06/15/09	0.01 U	–	0.005 U	0.05 U
		06/16/09	0.01 U	–	0.005 U	0.05 U
		09/22/09	0.01 U	–	0.005 U	0.05 U
		09/23/09	0.01 U	–	0.005 U	0.05 U
		09/29/09	0.01 U	–	0.005 U	0.05 U
		11/30/09	0.01 U	–	0.0084	0.05 U
		12/02/09	0.01 U	–	0.0051	0.05 U
		03/16/10	0.01 U	0.004 U	–	0.05 U
		03/17/10	0.01 U	0.002 U	–	0.05 U
		03/23/10	0.01 U	0.002 U	–	0.05 U
		06/14/10	0.01 U	0.002 U	–	0.05 U
		06/15/10	0.01 U	0.002 U	–	0.05 U
		09/13/10	0.01 U	0.002 U	–	0.05 U
		09/15/10	0.01 U	0.002 U	–	0.05 U
		09/17/10	0.01 U	0.002 U	–	0.05 U
		12/03/10	0.01 U	0.002 U	0.005 U	0.05 U

Data Qualifiers:
U - Not detected above the given limit.
J - Estimated value.

Table 2 - Groundwater Sampling and Static Water Level Measurement Locations
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Location	Purpose	TOC Elevation (ft)	Well Depth (ft)	Static Water Level	Available Cyanide	Hexavalent Chromium
MW-8	Near SSW Plant	PA	620.50	26.4	X	X	X
MW-24	Downgradient of SSW Plant	PA	613.15	54.5	X	X	X
MW-32	Downgradient of SSW Plant	LPB	625.06	84.5	X	X	X
MW-36	Downgradient of SSW Plant	PA	625.84	85.8	X	X	X
MW-38	Downgradient of SSW Plant	LPB	614.15	52.8	X	X	X
MW-44	Downgradient of PW-1 Capture Zone	DG	612.33	93.1	X	X	X
MW-47	Downgradient of PW-1 Capture Zone	DG	621.05	97.2	X	X	X
MW-49	Downgradient of SSW Plant	PA	619.23	59.7	X	X	X
MW-54S	Downgradient of PW-1 Capture Zone	DG	610.91	18.5	X	X	X
MW-55	Downgradient of SSW Plant	PA	603.86	132	X	X	X
MW-56	Downgradient of PW-1 Capture Zone	DG	604.45	78	X	X	X
MW-57	Downgradient of SSW Plant	PA	619.88	77.5	X	X	X
MW-58	Downgradient of SSW Plant	LPB	619.30	85.6	X	X	X
MW-59	Downgradient of SSW Plant	LPB	619.07	83.8	X	X	X
MW-61	Downgradient of PW-1 Capture Zone	DG	614.13	85	X	X	X
PW-1	Purge Well	PA	618.38 *	na	X	X	X
MW-4R2	Near SSW Plant	WL	616.11	na	X	--	--
MW-25	Downgradient of SSW Plant	WL	613.36	22.1	X	--	--
MW-28	Downgradient of SSW Plant	WL	631.55	105.2	X	--	--
MW-108	Near SSW Plant	WL	na	na	X	--	--
MW-300	Downgradient of SSW Plant	WL	na	98	X	--	--
MW-304	Downgradient of SSW Plant	WL	na	94	X	--	--
MW-306	Downgradient of SSW Plant	WL	na	88	X	--	--

Notes:
PA - Plume axis monitoring location
LPB - Lateral plume boundary monitoring location
DG - Downgradient monitoring location
WL - Water level measurement
"--" - Not Applicable
na - Not available currently
*Ground elevation

Table 3 - Sampling Network
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Event	Parameters	Investigative Samples			Field Duplicate			MS/MSD			Matrix Total[1]
		No.	Events	Total	No.	Events	Total	No.	Events	Total	
Quarterly (15 monitoring wells and PW-1)	*Laboratory*										
	Hexavalent Chromium	16	4	64	2	4	8	1	4	4	80
	Available Cyanide	16	4	64	2	4	8	1	4	4	80
	Field										
	Dissolved oxygen	16	4	64	NA	NA	NA	NA	NA	NA	64
	Eh	16	4	64	NA	NA	NA	NA	NA	NA	64
	pH	16	4	64	NA	NA	NA	NA	NA	NA	64
	Specific Conductance	16	4	64	NA	NA	NA	NA	NA	NA	64
	Temperature	16	4	64	NA	NA	NA	NA	NA	NA	64
	Turbidity	16	4	64	NA	NA	NA	NA	NA	NA	64
Monthly Wastewater Discharge Sampling (PW-1)	*Laboratory*										
	Total Chromium	1	12	12	0	12	0	0	12	0	12
	Total Zinc	1	12	12	0	12	0	0	12	0	12
	Total Cyanide	1	12	12	0	12	0	0	12	0	12

[1]Matrix spikes count as 2 samples when calculating sample total.

Appendix 1

Predesign Technical Memo
Table 2 – Groundwater
Data Summary

Table 2 - Groundwater Data Summary
Straits Steel & Wire, Ludington, Michigan
June 2005

Sampling Location	Collection Date	Total Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Dissolved Chromium (µg/L)	Total Chromium (µg/L)	Trivalent Chromium* (µg/L)	Total Copper (µg/L)	Available Cyanide (µg/L)	Total Iron (µg/L)	Total Nickel (µg/L)	Total Zinc (µg/L)	pH (s.u.)	Specific Conductance (µmhos/cm)	Eh (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
MW-2R	06/20/05	0.3	5 U	20	28	28	11	2 U	100 U	4.4 J	611	6.4	370	395	3.4	2.5
MW-3R	06/20/05	0.2 U	30	68	113	83	14 J	2 U	1740	24	880	6.3	210	361	2.5	19.4
MW-4R2	06/20/05	0.2 U	30	24	58	28	1.6	2 U	110	6 J	77	7.3	480	339	2.9	2.86
MW-7	06/20/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1.2 J	2 U	100 U	1 UJ	50 U	7.3	980	321	0.3	1.99
MW-8	06/20/05	1.2	210	202	235	25	5.6	2 U	100 U	5.8 J	50 U	7.1	770	451	0.8	4.9
MW-15	06/24/05	2.2	5 U	2.1 J	37	37	2.8	2 U	470	3.8 J	274	7.2	570	286	0.1	8.12
MW-16	06/23/05	0.2 U	5 U	1.6 J	3.7	3.7	1 UJ	2 U	3930	1 UJ	50 U	7.4	590	36	0.1	14.7
MW-19	06/24/05	0.2 U	5 U	1 U	1 U	1 U	1.5 J	2 U	100 U	1 UJ	50 U	7.4	1300	234	0.2	7.13
MW-20	06/24/05	0.2 U	5 U	1 UJ	7.4	7.4	1 J	2 U	350	14 J	50 U	6.8	1120	177	0.1	12.7
MW-24	06/24/05	3.2	100	115	169	69	11	2 U	220	9.6 J	68	12.1	3180	62	3.5	11.4
MW-25	06/24/05	0.2 U	5 U	1 UJ	3.1	3.1	1 UJ	2 U	7230	1 UJ	80 U	7.2	850	57	0.2	31.9
MW-27	06/22/05	0.4	5 U	1 UJ	140	140	5.2	2 U	1780	4.3 J	50 U	7.3	610	164	0.3	132
MW-28	06/22/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1 UJ	2 U	890	1.5 J	50 U	8.6	600	130	1.8	18.1
MW-32	06/22/05	0.3	5 U	1 U	1.6	1.6	5.7	2 U	800	2.5 J	55	7.4	470	216	0.2	7.01
MW-36	06/21/05	0.2 U	1000	1120	1180	180	3.8 J	5	1290	4.9 J	50 U	7.8	1030	442	0.1	18.7
MW-37	06/23/05	1.2	5 U	1 UJ	2.5	2.5	2 J	2 U	2640	17 J	50 U	7.0	1630.0	80.0	0.3	19.6
MW-38	06/21/05	0.2 U	5 U	1 U	1.5	1.5	1 UJ	2 U	4310	1 UJ	50 U	7.4	740	59	0.3	17.9
MW-40	06/22/05	0.4	5 U	1 U	4.3	4.3	2.5	2 U	1840	4 J	50 U	7.8	700	35	0.4	130
MW-42	06/22/05	0.4	5 U	1 U	1.3	1.3	8.5	2 U	2270	11 J	50 U	7.1	1190	62	0.2	26.6
MW-44	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 UJ	2 U	760	1.8 J	50 U	7.2	820	68	0.3	8.12
MW-44 (D)	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 UJ	2 U	810	1.7 J	50 U					
MW-48	06/23/05	0.2 U	5 U	1 U	1 UJ	1 UJ	2.1 J	2 U	1020	23	50 U	7.2	1280	86	0.2	9.86
MW-49	06/20/05	0.2 U	5 U	4.8	28	28	34 J	252	4500	46	78	9.2	1130	304	0.4	46.9
MW-53	06/22/05	0.2 U	5 U	1 U	1 UJ	1 UJ	2.5	2 U	170	1 UJ	50 U	7.0	150.0	262.0	3.0	2.9
MW-53 (D)	06/22/05	0.2 U	5 U	1 U	1 UJ	1 UJ	2.5	2 U	180	1 UJ	50 U					
MW-55	06/21/05	0.2 U	520	581	615	95	3.8 J	4	710	4.8	50 U	7.4	740	414	0.3	6.56
MW-55 (D)	06/21/05	0.4	560	508	647	97	3.6 J	6	710	4.4	50 U					
MW-56	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 UJ	2 U	2510	1 UJ	50 U	7.6	670	66	1.4	8.07
MW-58	06/21/05	0.2 U	5 U	1 U	1.2	1.2	1.1 J	5	3630	4 J	50 U	7.4	1080	66	0.1	12.9
MW-59	06/21/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	1460	1 UJ	50 U	7.3	570	19	0.2	3.06
MW-61	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	310	1 UJ	50 U	7.4	530	56	0.2	3.5
MW-215	06/22/05	1.3 J	5 U	1 UJ	61	61	86	10	45100	103	308	7.2	1140	132	2	146
MW-216	06/22/05	0.2 U	5 U	1 UJ	81	81	5	2 U	1510	10 J	50 U	7.0	1190.0	301.0	0.2	51.8
MW-302	06/21/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2	840	4.1 J	50 U	7.3	560	69	0.7	3.72
MW-303	06/21/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1 U	2 U	810	1.3 J	50 U	7.3	550	63	0.2	5.31
MW-303 (D)	06/21/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1 U	2 U	890	1 UJ	50 U					
PW-1 Sump	06/23/05	0.2 U	5 U	7	9.3	9.3	1.6 J	6	680	2.4 J	50 U	7.4	790	56	0.2	0.98
MWEB-1	06/20/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
MWEB-2	06/21/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
MWEB-3	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
MWEB-4	06/24/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
*Residential & Commercial I Drinking Water***		*5.0*	*100*			*100*	*1000*	*200*	*300*	*100*	*2400*	*6.5 to 8.5*				
*Groundwater Surface Water Interface***		*2.2*	*11*			*74*	*9.0*	*5.2*	*NA*	*52*	*120*	*6.5 to 9.0*				

Footnotes:
(D) - Indicates a field duplicate sample.
MWEB - Indicates an equipment blank.

Data Qualifiers:
U - Not detected.
J - Estimated value.

*Calculated values (total chromium concentration less hexavalent chromium concentration)
**Part 201 Residential Generic Cleanup Criteria, RRD Operational Memorandum No. 1; December 10, 2004; reported in µg/L.

Appendix 2

FTC&H Field SOPs

STANDARD OPERATING PROCEDURE **SOP 03-01**
Documentation of Field Activities
05/18/1998; Revised 06/24/2004

Scope: This SOP provides guidance for documentation of field activities.

Equipment: Project field notebook
Calculator
Pen with waterproof, nonerasable ink
Watch (for time of day)

Procedure:

1. A field notebook must be prepared for each project. The notebook provides for documentation of all field activities, including sample collection and handling, and visual observations.

2. All records must be legible and should be made in waterproof, nonerasable ink. All entries should contain accurate and inclusive documentation of the project activities.

3. If errors are made, corrections must be made by crossing a single line through the error and entering the correct information. All corrections should be initialed and dated. If possible, the correction should be made by the individual making the error.

4. All entries should be dated and the time of the entry recorded. At the end of each day's activity (or entry of a particular event, if appropriate), a diagonal line should be drawn at the conclusion of the entry and initialed, indicating the conclusion of the entry or activity. The daily field notes section of the notebook should be completed in chronological order. No blank pages should be found within this section.

5. Field notebook records should include the following information where applicable:

   - Sample collection equipment used.
   - Field analytical equipment used.
   - Equipment used for physical measurements.
   - Calculations, calibration data, and results for field sampling, analytical, and physical measurement equipment.
   - Type and number of samples collected along with sample location and identification number.
   - Sample handling, packaging, labeling, and shipping information, including destination.

6. The field notebook should be kept in a secure place during the field activities (e.g., in hand, in sight, locked in field vehicle). Upon completion of the activity, the field notebook should be checked for completeness, and signed and dated by appropriate field personnel. The field notebook will become part of the project file.

Scope: This SOP describes the procedures and documentation required to trace possession and handling of samples from time of collection through receipt by the laboratory.

Equipment:
Sample labels
Custody seals
Chain-of-Custody (COC) Record
Pen with waterproof, nonerasable ink

Definition:

A sample is considered to be in custody if:

1. It is in one's actual possession.
2. It is in one's view after being in one's possession.
3. It was in one's possession and then secured to prevent tampering.
4. It is placed in a designated secure area.

Procedure:

1. The field team leader or designate is responsible for proper handling and custody of field samples until they are formally transferred to another person or facility. As few people as possible should handle the samples during the field event.

2. Sample labels (Figure 1) must be completed in waterproof, nonerasable ink and securely affixed to sample containers at the time of collection. All samples must be documented in the field notebook.

3. Samples should be securely wrapped in bubble packing or other suitable packaging material and placed in an insulated shipping container. Samples should be packed in such a way as to minimize the chance for breakage. Bagged ice should be placed on top of the samples to maintain a temperature of 2° to 6°C during transport.

4. Following sample collection, a COC Record (Figure 2) must be completed. The COC Record must accompany the samples to the laboratory. If more than one sample shipping container is used, a separate COC Record should be completed for each container.

5. The COC Record must be completed in waterproof, nonerasable ink. If errors are made, corrections should be made by crossing a single line through the error and entering the correct information. All corrections should be initialed and dated.

6. The COC Record should include the following information:

   - Project name, number, and location.
   - Sampler(s) name(s).
   - Name of project manager along with telephone and fax number.
   - Sample date, time, identification, and matrix type.
   - Total number of containers for each sample and type of preservative added.

7. Transfer of the samples listed on the COC Record must be documented in the spaces provided at the bottom of the form. One of the samplers listed under the sampler(s) section, or a designated field sample custodian who receives secured samples from the sampling team and maintains the samples under secure conditions, must be the person that originally relinquishes the samples. Both the person relinquishing the samples and the person receiving them must sign the form. Typically, the last person receiving the samples should be the laboratory sample custodian.

8. The COC Record is a multipage form. The three copies should be distributed as follows:

   Pink Copy — Removed by FTC&H sampling personnel once sample transfer has been documented. Retained in the project file.

   Yellow Copy — Retained by analytical laboratory.

   White Copy — Accompanies final data package from laboratory. Retained with data in project file.

9. The completed COC Record should be placed in a resealable plastic bag and placed inside the sample shipment container.

10. Custody seals (Figure 3) should be used to seal sample shipping containers that are ready to be transported by means other than the FTC&H sampling team. Custody seals must be completed in waterproof, nonerasable ink and should include the following information:

    - Project name.
    - Project number.
    - Date sealed.
    - Signature of person relinquishing the samples.

    Custody seals should be placed on the shipping container so that it cannot be opened without breaking the seals. If shipping by common carrier (e.g., UPS, Federal Express), the shipping container should also be securely taped shut.

11. Samples should be delivered to the laboratory as soon as possible after collection. There are three basic routes by which samples are transported to the laboratory:

    a. Hand delivered by a member of the FTC&H sampling team.

    b. Samples are placed in the secured sample area at the FTC&H offices, and the field sample custodian arranges for delivery to the laboratory.

    c. Samples are shipped via common carrier to the laboratory. In this case, the method of shipment and associated bill of lading number must be recorded in the appropriate block on the COC Record.

Project No./Name G00492

Sample I.D. BLF-03-07-MW-1 (I)

Date/Time 3/15/07 16:30

Collected By TKP

Bottle/Preservative 40 mL G/HCl

Parameters 8260 VOCs

FIGURE 1

FIGURE 2

ftc&h

Chain of Custody Record

Fishbeck, Thompson, Carr & Huber, Inc.
1515 Arboretum Drive, SE, Grand Rapids, MI 49546, (616) 575-3824 | 7402 Westshire Dr., Ste. 110, Lansing, MI 48917-9764, (517) 627-1141 | 4775 Campus Drive, Kalamazoo, MI 49008, (269) 375-3824 | 39255 Country Club Dr., Ste. B-25, Farmington Hills, MI 48331, (248) 324-2090 | 11353 Reed Hartman Hwy., Ste. 500, Cincinnati, OH 45241, (513) 469-2370

PROJECT NAME: BW Phase II	PROJECT NO.: G00549
PROJECT LOCATION: Sparta, MI	SAMPLER(S) NAME: CDH
PROJECT MANAGER: JAS	PHONE: 616 464 3749
	FAX: 616 464 3992
ADDITIONAL INFORMATION:	

PAGE 1 OF 1
STD TAT ☑
RUSH TAT ☐
DATE DUE: ______

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	MATRIX TYPE: AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	REQUIRED ANALYSES: metals* % solid (Preservative: NPW)	VOCs (Preservative: MeOH)									REMARKS
2/15/03	15:00	BW-03-02-SB-3 (I)		✓			1	1									* metals: Cd, Cr, Zn

NUMBER OF CONTAINERS SUBMITTED

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING
CHuizen	2/15/03	16:00	S Smith	2/16/03	10:00	—			Fed Ex 7731 4601 2375
RECEIVED BY	**DATE**	**TIME**	**RECEIVED BY**	**DATE**	**TIME**	**RECEIVED BY**	**DATE**	**TIME**	**RECEIVED FOR LAB / DATE / TIME**
S Smith	2/15/03	16:00	—			—			

WHITE Copy — Return with data package. YELLOW Copy — Forward to laboratory. PINK Copy — Field File / Project Documentation.

G 28973

Project No. _____

Signature _____ Date _____

FIGURE 3

frC&h **STANDARD OPERATING PROCEDURE** **SOP 10-01**
Groundwater Sampling—General Overview
06/10/1998; Revised 06/24/2004

Scope: Procedures outlined in the SOP are intended to provide general instruction for groundwater sampling activities. Field personnel should consult the project work plan for additional information.

Reference: Minnesota Pollution Control Agency, *Groundwater Sampling Guidance: Development of Sampling Plans, Protocols and Reports*, January 1995.

New Jersey Department of Environmental Protection and Energy, *Field Sampling Procedures Manual*, May 1992.

U.S. Environmental Protection Agency-Region IV, *U.S. EPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, February 1, 1991.

Selection of Sampling Equipment:

Factors to consider in selection of appropriate sampling equipment for a project should be based on technical performance of the equipment. A listing of several sampling devices, in order of preference, and their expected degree of sampling alteration are contained in the following table:

Device	Purging	Sampling	Comments
Bladder Pump	Minimal to slight	Minimal to slight	Acceptable for all analyte groups Maximum depth: 100 ft plus Minimum well diameter: 1.5 inches Requires portable power source (compressed gas)
Submersible Centrifugal Pump (Grundfos)	Minimal to slight	Minimal to slight	Acceptable for all analyte groups Maximum depth: 200 ft plus Minimum well diameter: 1.75 inches Portable use may require winch or reel system
Submersible Helical Rotor Pump (Keck)	Minimal to slight	Minimal to slight	Acceptable for all analyte groups Maximum depth: Up to 100 ft Minimum well diameter: 2 inches Flow rate controller required
Suction Lift Pump (Peristaltic)	Slight to moderate	Moderate	Not suitable for VOC, SVOC, or dissolved gas sample collection Maximum depth: Up to 25 ft Minimum well diameter: 0.5 inch
Bailer	High to very high	Moderate to High	Can cause substantial alteration of water chemistry; highly dependent on sampler's ability to minimize turbulence and aeration Maximum depth: 200 ft Minimum well diameter: 0.5 inch

Procedure:

1. Determine the order in which the wells should be sampled. Typically, sampling order should proceed from the cleanest well to the most contaminated. When no historical water quality data are available, sample background wells first followed by the farthest downgradient wells. The wells expected to be most significantly contaminated should be sampled last. Sampling order is not as critical when a peristaltic pump is used, as the pump tubing is replaced after each use.

2. Obtain the following information prior to the sampling event:

   a. Well depth. If not previously measured, determine by subtracting the distance between ground surface and top-of-casing (stick-up) and add this distance to the installation screen depth.
   b. Screen length.
   c. Depth to bottom of screen and depth to top of screen from top-of-casing. Using this information, determine the depth to the midpoint of the well screen.

3. Record the condition of the well in the field notes. Additional information may be required for documentation before, during, and after groundwater sampling. Refer to the project work plan and SOP 10-03 for additional information.

4. Determine static water level using SOP 18-04. Record in the field notebook. Minimize disturbances of the stagnant water column during water level measurement.

   Water levels are measured prior to and possibly during a groundwater sampling event for the following reasons:

   a. To assess whether the static water column length is sufficient to allow purging and sampling to proceed in the normal manner, provided that drawdown is moderate.
   b. To select the depth to which the pump intake, bailer, or other purging or sampling device should be lowered.
   c. To monitor the water level during purging and sampling.
   d. To determine groundwater flow directions.

   Unless stated in the work plan, groundwater from monitoring wells containing free product will not be sampled. (Free product refers to a mobile regulated substance that is present as a nonaqueous phase liquid.) If the groundwater must be sampled, use disposable equipment.

5. Rinse reusable sampling equipment with deionized water before inserting the equipment into the monitoring well.

6. Calibrate field measurement equipment as required by the project work plan.

7. Determine the volume of water to be purged prior to sample collection. The U.S. EPA guidelines recommend that a minimum of three well volumes be purged before a representative sample can be collected.

   Calculate the volume of water constituting three well volumes, first calculating the linear feet of water in the well (total depth of the well, ft - depth to water, ft). Then, calculate the amount of water within the well casing by multiplying the linear feet of water by the volume per foot for the proper diameter casing. The capacity of common casing diameters are as follows:

Casing Diameter	Gallons/Linear Foot
2-inch	0.1632
4-inch	0.6528
6-inch	1.4688
8-inch	2.6112
10-inch	4.0800
12-inch	5.8752

Example:

Total depth of well casing	100 ft
Depth to water	-20 ft
Linear feet of water	80 ft
2-inch casing	x 0.1632
Amount of water in casing (gallons)	13.06

Multiply the volume of water in the casing by three (3) to determine the minimum volume to be purged from the well prior to sample collection. Record data in the field notes.

8. Rinse the sampling equipment with deionized water prior to inserting the equipment into the well. Dispose of all rinse water in accordance with the project work plan.

9. Insert the sampling equipment into the well and begin extracting groundwater. When using a sampling pump, the pump should be lowered into the well and set just below the water surface.

   During purging, lowering of the water level causes cascading of water into the well if the purge rate is greater than the recovery rate of the well. Keep cascading to a minimum by not drawing the water level in the well below the top of the screen. If the water level is already at the top of or within the well screen, select a purging rate that results in minimum drawdown while allowing the well to be purged in a reasonable length of time.

   If the pump begins to pump dry, lower it further into the well. Allow the well to recover to provide sufficient water to completely fill the appropriate sample containers, and collect the sample.

10. Record purging start time in the field notes. A calibrated 5-gallon bucket should be used to monitor the volume of water purged. Dispose of all purge water in accordance with the project work plan.

11. Obtain the necessary field parameter measurements after 1 well volume, 2 well volumes, and 3 well volumes have been purged.

12. Fill required sample containers in accordance with the procedures described in SOP 10-10. Record the type of bottle filled, preservatives added, and the time and date of collection in the field notebook. Samples should be collected in the following order:

    a. Field parameters.
    b. Volatile organics.
    c. Semivolatile organics (includes samples for pesticides, herbicides, and PCBs).
    d. General chemistry parameters.
    e. Metals.

    Refer to the project work plan for sample requirements.

13. Decontaminate the equipment after each use in accordance with procedures described in the equipment-specific SOPs. Dispose of all decontamination water in accordance with the project work plan.

STANDARD OPERATING PROCEDURE SOP 10-02
Low-Flow (Minimal Drawdown) Groundwater Sampling
06/10/1998; Revised 06/12/2006

Scope: This SOP describes a low-flow (minimal drawdown) technique used for groundwater sample collection. Procedures outlined in this SOP are intended to provide general instruction for groundwater sampling activities. Field personnel should consult the project work plan for additional information.

Discussion: Contaminant studies account for interaction between the mobile aqueous and immobile solid phase. The mobile, reactive solid phase (colloidal-size particles) is not accounted for and may be present in sufficient mass, possess high sorption reactivity, and remain stable in suspension; and thus, serve as an important mechanism to facilitate contaminant transport. Collection and processing of groundwater samples is required to determine the significance of collodial-size particles.

Colloidal-size particles (secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials; and viruses and bacteria) are reactive particles that have been shown to be mobile and may be required to be included in monitoring programs to identify the total mobile contaminant loading (dissolved + naturally suspended particles) at a site.

Conventional sampling methods (purging 3 to 5 well volumes) can cause an increase in turbidity, thus affecting the sample quality. Filtering to decrease turbidity of the sample may remove contaminant-associated mobile particles, thus artificially biasing contaminant concentrations low.

Purging is performed to remove water in the casing for the following reasons: oxygen concentration gradient between the top of the water column at the air interface to the bottom of the water column; loss of volatile compounds up the water column; leaching from or sorption to the casing or filter pack; chemical changes due to clay seals; or backfill and surface infiltration. Low-flow purging minimizes mixing between the overlying stagnant casing water and water within the screened interval.

Low-flow refers to the velocity of water from the pore water of the formation, through the well screen and into the pump intake. It does **not** necessarily refer to the flow rate of water discharged at the surface. Flow rates of 0.1 to 0.5 L/min (0.026 to 0.13 gpm or 100 to 500 mL/min) are typically used. If the pump intake is located within the screened interval, most of the water pumped will be drawn directly from the formation with little mixing of casing water or disturbance to the sampling zone.

Advantages of low-flow purging include:

- Representative samples (dissolved and colloid-associated).
- Minimal disturbance of the sampling point.
- Less operator variability; greater operator control.
- Less mixing of stagnant casing water with formation water.
- Smaller purging volume decreasing waste disposal costs.
- Increased sample consistency; reduced artificial sample variability.

Equipment:
Pump (Bladder, Fultz, or Peristaltic)
Plastic graduated cylinder
Electric water level meter
Flowcell for field parameter measurements
Turbidimeter
Stop watch
Polyethylene bucket, 5-gallon

FID or PID (if appropriate)
Decontamination supplies
Precleaned, pre-preserved sample containers
Sample labels
Field notebook

References: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540/S-95/504, April 1996.

Minnesota Pollution Control Agency, *Groundwater Sampling Guidance: Development of Sampling Plans, Protocols and Reports*, January 1995.

New Jersey Department of Environmental Protection and Energy, *Field Sampling Procedures Manual*, May 1992.

U.S. Environmental Protection Agency-Region IV, *U.S. EPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, February 1, 1991.

Selection of Sampling Equipment

Factors to consider in selection of appropriate sampling equipment for a project should be based on technical performance of the equipment (e.g., how the equipment affects the chemistry of the water sample), and on how well the equipment will perform for the project.

Device	Comments
Bladder pump	Acceptable for all analyte groups Maximum depth to water: 250 ft. plus Minimum well diameter: 2 inches Requires portable power source (compressed gas)
Fultz pump	Submersible positive displacement pump Acceptable for all analyte groups (with exception of hydrogen) Maximum depth to water: 150 – 200 ft.(dependent on pump model) Minimum well diameter: 2 inches Requires portable power source (24 volts direct current power supply)
Peristaltic pump	Suction lift pump May not be acceptable for VOC sample collection; special collection technique may be required. Maximum depth to water: 25 ft Minimum well diameter: 0.5 inch

Procedure:

1. Determine the order in which the wells should be sampled. Typically, sampling order should proceed from the cleanest well to the most contaminated. When no historical water quality data are available, sample background wells first, followed by the farthest downgradient wells. The wells expected to be most significantly contaminated should be sampled last. Sampling order is not as critical when a peristaltic pump is used as the pump tubing may be dedicated to the well location or replaced after each use.

2. Obtain the following information prior to the sampling event:

   a. Well depth. If not previously measured, determine by subtracting the distance between ground surface and top-of-casing (stick-up) and add this distance to the installation screen depth.

   b. Screen length.

   c. Depth to bottom of screen and depth to top of screen from top-of-casing. Using this information, determine the depth to the midpoint of the well screen.

3. Record the condition of the monitoring well in the field notes. Additional information may be required for documentation before, during, and after groundwater sampling. Refer to the project-specific work plan and SOP 10-03 for additional information.

4. Determine static water level using SOP 18-04 and record in the field notebook. Every effort should be made to minimize disturbances of the stagnant water column during water level measurement.

   Water levels are measured prior to and during a groundwater sampling event for the following reasons:

   a. To assess whether the static water column length is sufficient to allow purging and sampling to proceed in a normal manner, provided that drawdown is moderate.

   b. To select the depth to which the pump intake or other purging or sampling device should be lowered.

   c. To monitor the water level during purging and sampling and determine the optimum pumping rate to minimize drawdown.

   d. To determine groundwater flow direction.

5. Rinse reusable sampling equipment with deionized water before inserting the equipment into the monitoring well. (This assumes full equipment decontamination was performed after last use.)

6. Calibrate field measurement equipment as required by the project work plan.

7. Note the depth to the top and bottom of the well screen (if known) from top-of-casing. Depth of the well should **not** be measured prior to purging as this may cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure the well depth after sample collection. Compare the static water level to the depth to the top of the screen. If the water level is above the screen, insert the pump intake to the middle or slightly above the middle of the screened interval. If the water level is across the well screen, place the pump near the top (within 0.5 ft) of the water column.

8. Lower the pump into the well slowly (to minimize disturbance) to the desired depth and begin to purge at a rate (0.026 to 0.13 gpm or 100 to 500 mL/min) that will minimize drawdown (<0.3 ft). Monitor drawdown during purging using an electric tape. Adjustments are best made in the first 5 to 15 minutes of pumping in order to minimize purging time.

   When purging wells screened in low-permeability formations (<0.1 L/min recharge), lowering of the water level can cause cascading of water into the well if the purge rate is greater than the

recovery rate of the well. Cascading of water into the well can accelerate alteration of the water. Cascading should be kept to a minimum by not drawing the water level in the well below the top of the screen. If the water level is already at the top of or within the well screen, select a purging rate that results in minimum drawdown while allowing the well to be purged in a reasonable length of time.

Record purge start time in the field notebook. Monitor and record the water level and pumping rate every 3 – 5 minutes (or as appropriate) during purging. Use a plastic graduated cylinder or beaker to monitor the pumping rate and a 5-gallon bucket to monitor the volume of water purged. Dispose of purge water in accordance with the project work plan. Record any pumping rate adjustments on the sample collection form.

During pump start-up, drawdown may exceed the 0.3 ft. target and then recover as the pump flow adjustments are made. Purge volume calculations should utilize the stabilized drawdown value, not the initial drawdown.

9. If the minimal drawdown that can be achieved exceeds 0.3 ft but remains stable, continue purging until the field parameters stabilize. Drawdown should not proceed below the top of the pump. If a sustained pumping rate cannot be achieved and the monitoring well is evacuated, shut the pump off and allow the well to recover. When the well has recovered to the point that there is a sufficient volume of water stored, restart the pump and collect samples for field and laboratory analysis.

10. Monitor water quality parameters (pH, temperature, specific conductance, Eh, dissolved oxygen, and turbidity) every 3 to 5 minutes during purging to check for stabilization. These parameters should be recorded in conjunction with time, drawdown, flow rate, and volume pumped. Temperature and pH commonly have the same signature between stagnant casing water and formation water, but should be measured. Turbidity is a very conservative parameter and will require longer purge times for stabilization. Stabilization is reached when the field parameters are stable for three successive readings using the following criteria:

- ±0.1 s.u. for pH
- ±3% for temperature
- ±3% for specific conductance
- ±10 mV for Eh
- ±10% for dissolved oxygen
- ±10% for turbidity values >20 NTU

Field personnel should watch for particulate buildup within the flowcell. This buildup may affect the indicator parameter values measured within the cell and may cause an overestimation of turbidity values measured after the flowcell. If the cell requires cleaning during purging operations, continue pumping and disconnect the flowcell for cleaning. Reconnect the flowcell after cleaning and continue monitoring activities.

If stabilization of the field parameters is not achieved after 45 minutes of purging and all attempts have been made to minimize drawdown, check instrument condition and calibration, purging flow rate, and ability to achieve stable measurements. All measurements made during the attempt should be documented. A field decision must then be made to either continue purging or to collect the samples. If it is determined that significant stabilization can be achieved, continue purging until stabilization occurs or until it is determined that a reasonable effort has been made to maximize stabilization.

If the monitoring well is sampled repeatedly (quarterly, annually, etc.) for assessment of temporal variations in water quality with time, the pump should be set to the same depth, and purged at approximately the same rate and for the same volume of water during each subsequent sampling event. If the same purging criteria does not result in stabilization in subsequent sampling events, consider the following:

- Groundwater chemistry has changed over time.
- The monitoring well may need rehabilitation (redeveloped, replaced, etc.).
- Errors in field measurements may have been made during one or more sampling events.
- Collect a set of samples at the normal purging time and also collect time-series samples to compare with changes in field parameters.

It may not be possible in certain situations to reach stabilization due to:

- Nonuniform distribution of chemical and physical parameters in the water-yielding zone(s) being monitored.
- Previously undetected coalescing plumes.
- Multiple water-yielding zones screened by the monitoring well(s).
- Leaky confining layers, perched zones, etc., nearby.
- Poor well development (excessive fines in purge water)

11. Record field parameters (pH, temperature, specific conductance, Eh, turbidity, and dissolved oxygen) after stabilization.

12. Fill the required sample containers in accordance with the procedures described in SOP 10-10. Record the type of bottle filled, preservatives added, and the time and date of collection on the sample collection form. Samples should be collected in the following order:

a. Field parameters.
b. Volatile organics.
c. Semivolatile organics (includes samples for pesticides, herbicides, and PCBs).
d. General chemistry parameters.
e. Metals.

Fill all containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. Water samples for laboratory analysis should be collected before water has passed through the flowcell.

Refer to the project work plan for sample requirements.

13. Decontaminate the equipment after each use in accordance with the procedures described in the equipment-specific SOPs.

14. Before securing the well, measure and record the well depth on the sample collection form.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE **SOP 10-06**
Sample Collection Using Peristaltic Pump
06/10/1998; Revised 02/18/2000

Scope: The following SOP outlines the technique to be used to acquire groundwater samples from monitoring wells using a self-priming suction lift pump. This SOP is intended to provide general instruction. Consult the equipment manual and project work plan for additional information.

References: New Jersey Department of Environmental Protection and Energy, *Field Sampling Procedures Manual*, May 1992

USEPA Environmental Compliance Branch, *Standard Operating Procedures and Quality Assurance Manual*, February, 1991

Operators Manual, Masterflex Easy-Load Pump Head, Model 7518 Series, Cole-Parmer Instrument Company

Operating Manual, Masterflex L/S Portable Sampling Pump Drive, Model 7570-10, Cole-Parmer Instrument Company

Procedure:

1. Check pump tubing for cracks or leaks. Replace if necessary.
2. Feed a new piece (approximately 3 feet in length) of the flexible tubing through the rotor opening.
3. Lock the tubing (approximately mid-length) in place by pushing the loading lever 180° to the right. Allow the discharge end of the tubing to extend into a bucket.
4. Release the 2 tubing retainers from the retracted position by pushing them slightly into the body, then downward and firmly against the tubing. Adjust as necessary.
5. Unroll and cut off a new piece of rigid tubing with length equal to the well depth plus an additional 5 to 10 feet.
6. Insert the free end of the rigid tubing into the well just below the water surface, leaving the excess extending out of the well.
7. Secure the rigid tubing to the well casing or other suitable object to prevent the tubing from dropping in the well should the tubing come loose from the pump head.
8. Attach the rigid tubing to the piece of flexible tubing connected to the pump.
9. Turn on the pump to produce a vacuum on the well side of the pump head and begin purging. Observe the pump direction to ensure that a vacuum is being applied to the sample/purge line.
10. Refer to SOP 10-1 for guidance on standard groundwater sampling. Refer to SOP 10-2 for guidance on low-flow groundwater sampling.
11. Pump tubing must be replaced after each use. Place used tubing in a plastic trash bag for disposal. Wipe the pump unit down with a Liquinox® soap and water solution, followed by a deionized water wipe.

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STANDARD OPERATING PROCEDURE SOP 10-09
Low-Flow Groundwater Sample Collection Using a Bladder Pump
11/15/2002; Revised 00/00/0000

Scope: This SOP outlines a low-flow sampling technique for collecting groundwater samples from monitoring wells using a variable speed positive displacement bladder pump. This SOP is to be used in conjunction with other SOPs for the collection of water samples for analysis of specific parameters as stated in the project work plan.

Discussion: A bladder pump allows water to flow through an inlet check valve into the interior of the pump bladder due to the pressure gradient exerted by the hydrostatic head of the water it is submerged in. After the interior of the bladder is filled with water, compressed gas is applied to the exterior of the bladder to force the water to flow through an outlet check valve at the top of the pump and toward the surface. The compressed gas is delivered to the pump through a gas supply tube connected to a compressed gas source with a control device located at the wellhead, and the pump liquid discharge is delivered to the well head through a water discharge tube with both tubes terminated in a wellhead cap. The water is pumped and conveyed in a manner to minimize alteration of water quality in any way. When the pump bladder is squeezed sufficiently to empty it of water, the compressed gas control device stops the flow of compressed gas and vents the pump's gas supply tube to the atmosphere. This venting allows the pressure on the outside of the pump bladder to decrease to less than that of the hydrostatic head present a the pump inlet due to the pump's submergence. The pump bladder can thereby refill and repeat the cycle as needed to achieve desired flow for purging and sampling the well. The pump controller at the wellhead controls the sequencing of applying compressed gas to and venting of the pump. A compressed gas source at the wellhead provides the necessary flow of compressed gas to the controller. A water level meter is used to measure water levels in the well before and during pumping. A flow cell connected to the water discharge tube measures water quality parameters and provides indication of completion of well purging.

The Portable MicroPurge® pump is manufactured by QED Environmental Systems, P.O. Box 3726, Ann Arbor, MI 48106-3726, U.S., 1-800-624-2026. The pump has a diameter of 1.75 inches, a length of 14.76 inches, and weighs approximately 4 pounds. The pump body is constructed of 316 stainless steel. The inlet and discharge housing is 303 stainless steel, bladder is Teflon® or polyethylene (PE), and O-rings are Viton.

A 5 lb. compressed air cylinder provides enough gas for up to 3 hours of sampling and is refillable. An air compressor can also be used when a power source is available.

The pump is controlled by the Micropurge basics™ MP10 controller.

References: User's Guide for Sample Pro Portable MicroPurge pump, Part No. 95181, Revision 3-19-01

User's Guide for MicroPurge Model MP10 Controller, Part No. 95177, Revision 11-9-01

Ground-Water Data–Collection Protocols and Procedures for the National Water-Quality Assessment Program: Collection and Documentation of Water-Quality Samples and Related Data, Michael T. Koterba, et al., U.S. Geological Survey, Open-File Report 95-399, 1995.

Expendable Supplies:

Polyethylene bladder kit (10 per pkg)	Part No. 38360
O-Rings (10 per pkg)	Part No. 38362
Stainless steel screens (10 per pkg)	Part No. 38361
Teflon® check balls (5 per pkg)	Part No. 38408

Procedure:

A. Preparing the Pump

1. Install the following O-rings on the pump: 2 discharge O-rings, air tube O-ring, inlet O-ring, and 2 head O-rings. Refer to Figure 3 of the User's Guide for location of these O-rings.

2. Connect the bladder to the pump head. If a PE bladder will be used, push the bladder onto the pump head barb until the bladder fully covers the barb. Use a clamping collar (white ring) when the pump will be submerged over 50 feet to assure a leak-tight seal of the bladder. Pull the clamp collar over the pump head barb before pushing the bladder on, then pull the collar back down firmly over the bladder and barb. If a Teflon bladder is to be used, install it by inserting the cartridge nipple into the center hole in the bottom of the pump head barb.

3. Attach the pump head to the pump body by engaging the bayonet dimples into the grooves and twisting them together until the engagement snap is felt and the head and body alignment marks line up.

4. With the pump on its side, insert the inlet check ball into the side of the pump head, then press in the inlet valve seat by pushing and twisting with your thumb.

5. With the pump vertical, insert the discharge check ball into the top of the pump head, then press in the discharge ball seat by pushing and twisting with your thumb.

6. For the push-in fittings, place the thin metal lock disk in the "TOP" up position on the top of the pump head, with the lock disk edge slots lined up with the posts on the pump head. Place the upper plate on top of the lock disk with slots and posts lined up. Twist the pump cap onto the pump head until the engagement snap is felt and the hole in the side of the pump cap lines up with the inlet port. The cover and body alignment marks should line up.

7. For the compression nut fittings, place the compression fitting plate on the top of the pump head, with slots and posts lined up. Rotate or remove the fitting nuts to allow the pump cap to be placed over the compression fitting assembly. Twist the pump cap on to the pump head until the engagement snap is felt and the hole in the side of the pump cap lines up with the inlet port. The cover and body alignment marks should line up.

8. Use a new lock plate and fresh cut end of tubing to ensure proper pull-out strength of the tubing connection. The upper plate is marked "W" for water discharge, and "A" for the air supply tube. QED air supply tubing is shaded gray to distinguish it from the water discharge tube which is clear. Insert each tube separately into the proper opening in the pump head, pushing firmly so that the tube penetrates beyond first resistance at least ½-inch into the pump. To check, pull back on each tube to check that it is secure.

9. Connect the light blue coiled pump hose to the fitting labeled AIR OUT on the MP-10. Connect the red air supply hose to the compressed air source and connect it to the fitting labeled AIR IN on the MP-10.

B. Well Purging

1. Calibrate the flow-cell in accordance with SOP 11-10.

2. Determine the order in which the wells should be sampled. Typically, sampling order should proceed from the cleanest well to the most contaminated. When no historical water quality

data are available, sample background wells first, followed by the farthest downgradient wells. The wells expected to be most contaminated should be sampled last.

3. Determine the depth to the midpoint of the well screen . Record the condition of the monitoring well in the field notes. Additional information may be required for documentation before, during, or after groundwater sampling. Refer to the project work plan and SOP 10-03 for additional information.

4. Determine static water level using SOP 18-04 and record in the field notes. Minimize disturbances of the stagnant water column during water level measurement.

5. Note the depth to the top and bottom of the well screen (if known) from top-of-casing. Depth of the well should not be measured prior to purging as this may cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure the well depth after sample collection. Compare the static water level to the depth to the top of the screen. If the water level is above the screen, insert the pump to the middle or slightly above the middle of the screened interval. If the water level is across the screen, place the pump at the top of the water column.

6. Slowly insert the pump into the well to the desired depth. Open the lid on the MP10 to power it on. At this point, the MP 10 is in the micropurge mode (MP) but is not cycling the pump. Select the desired Cycles per Minute (CPM) with the arrow keys on the MP-10, turn the throttle to set depth on the gauge to 10 – 20 feet deeper than the pump location in the well, and press CYCLE to start pumping. Purge at a rate (100 mL to 500 mL/min) that will minimize drawdown (<0.1 m or <0.33 ft). Monitor drawdown during purging using an electric tape. Make adjustments to stabilize the flow rate as soon as possible.

7. When purging wells screened in low-permeability formations (<0.1 L/min recharge), lowering of the water level can cause cascading of water into the well if the purge rate is greater than the recovery rate of the well. Cascading of water into the well can accelerate alteration of the water. Cascading should be kept at a minimum by not drawing the water level in the well below the top of the screen. If the water level is already at the top of or within the well screen, select a purging rate that results in minimum drawdown while allowing the well to be purged in a reasonable length of time.

8. Record purge start time in the field notes. Use a plastic graduated cylinder or beaker to monitor the pumping rate and a 5-gallon bucket to monitor the volume of water purged. Dispose of purge water in accordance with the project work plan.

9. If drawdown is excessive during low-flow pumping, and the low-flow method is not feasible without dewatering the stored water in the well casing, the following procedure should be used:

   a. Pump the well down to the maximum extent possible with the pump set at the existing setting.

   b. Allow the pumping rate to increase to maximize removal of stored water in the well casing. Drawdown should not proceed below the top of the pump. (Maximum pumping rate with the bladder pump is 1 L/min.)

   c. If a sustained pumping rate can be achieved with drawdown not exceeding the depth to the top of the pump, continue pumping until three stored casing volumes have been excavated. Collect samples for field and laboratory analysis.

d. If a sustained pumping rate cannot be achieved and the monitoring well is evacuated, shut the pump off and allow the well to recover. When the well has recovered to the point that there is a sufficient volume of water stored, restart the pump and collect samples for field and laboratory analysis.

10. Monitor water quality parameters (pH, temperature, specific conductance, Eh, dissolved oxygen, and turbidity) every 3 to 5 minutes during purging to check for stabilization. These parameters should be recorded in conjunction with the time, drawdown, flow rate, and volume pumped. Temperature and pH commonly have the same signature between stagnant casing water and formation water, but should be measured. Turbidity is a very conservative parameter and will require longer purge times for stabilization. Stabilization is reached when at least three parameters are stable for three successive readings using the following criteria:

- ± 0.1 s.u. for pH
- ± 3% for specific conductance
- ± 10 mV for Eh
- ± 10% for dissolved oxygen
- ± 10% for turbidity

If stabilization of three field parameters is not achieved after three stored casing volumes have been evacuated, a field decision must be made to either continue purging or to collect the samples. If it is determined that significant stabilization can be achieved, continue purging until stabilization occurs or until it is determined that a reasonable effort has been made to maximize stabilization.

If the monitoring well is sampled repeatedly (quarterly, annually, etc.) for assessment of temporal variations in water quality with time, the pump should be set to the same depth, and purged at approximately the same rate and for the same volume of water during each sampling event. If the same purging criteria do not result in stabilization in subsequent events, consider the following:

- Groundwater chemistry has changed over time.
- The monitoring well may need rehabilitation (redeveloped, replaced, etc.).
- Errors in field measurements may have been made during one or more sampling events.
- Collect a set of samples at the normal purging time and also collect time-series samples to compare with changes in field parameters.

It may not be possible in certain situations to reach stabilization due to:

- Non-uniform distribution of chemical and physical parameters in the water-yielding zone(s) being monitored.
- Previously undetected coalescing plumes.
- Multiple water-yielding zones screened by the monitoring wells.
- Leaky confining layers, perched zones, etc., nearby.

11. Record field parameters after stabilization.

C. Sample Collection

1. Disconnect the flow cell and its tubing from the pump line before collecting samples. Use the PAUSE key to freeze the controller action, allowing time to collect a sample. When the PAUSE key is pressed, the controller enters the HOLD state, drive air is vented from the

pump and the pump fills and waits. Pressing the PAUSE key a second time causes the controller to immediately enter the SAMPLE state. Drive air is directed to the pump causing the pump to discharge its volume of liquid. Using the HOLD and SAMPLE states, fill required sample containers in accordance with the procedures described in SOP 10-10. Samples should be collected in the following order:

a. Field parameters
b Volatile organics
c. Semivolatile organics (includes samples for pesticides, herbicides, and PCBs)
d. General chemistry parameters
e. Metals.

Refer to the project work plan for sample requirements. Record the type of bottle filled, preservatives added, and the time and date of collection in the field notes.

2. When sampling is complete using a dedicated pump, remove the water level tape, disconnect the air supply line and water discharge line from the wellhead and close the wellhead assembly/protective casing. During cold weather months, insert the 0.125-inch OD flexible polyethylene tubing into the pump discharge tube at the well head, then connect the quick connect fitting to the compressed gas source and apply low pressure to force the water near the surface out of the water discharge line.

After completing sample collection using a non-dedicated pump, remove the water level tape, disconnect the air supply line, remove the pump and tubing from the well, and close the wellhead assembly/protective casing. Store dedicated tubing in a large zip-lock bag with the well location clearly labeled. Non-dedicated tubing should be bagged for proper disposal.

D. Equipment Decontamination

1. Decontaminate non-dedicated pumps between each use. Decontamination should consist of cleaning the pump casing, Teflon checkball, and the inlet and outlet valves with a mild phosphate-free laboratory grade detergent solution and the supplied brushes. Rinse all parts with deionized water and flush deionized water through the Teflon checkball until the discharge water runs clear (no surfactant observed). When rinsing is complete, reassemble the pump with a new disposable bladder and new grab plate. Store the pump in an untreated plastic bag to eliminate potential contamination during transport and storage.

2. Decontaminate the water level tape after each use by wiping down the equipment body, probe, and cable with phosphate-free laboratory grade detergent solution, rinsing thoroughly with tap water, followed by a deionized water rinse. Store the water level meter in an untreated plastic bag to eliminate potential contamination during transport and storage.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE **SOP 10-10**
Groundwater Sample Handling and Preparation
05/13/1998; Revised 06/07/2002

Scope: This SOP outlines procedures for groundwater sample handling and preservation. Procedures outlined in this SOP are intended to provide general instruction for groundwater sampling activities. Refer to the project work plan for additional information.

References: *Minnesota Pollution Control Agency, Groundwater Sampling Guidance: Development of Sampling Plans, Protocols and Reports*, January 1995.

U.S. Environmental Protection Agency-Region IV, *USEPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, February 1, 1991.

Procedure:

1. An appropriate volume of groundwater must be removed from the monitoring well prior to sample collection. Refer to SOP 10-01 for a general overview of groundwater sampling using the conventional (3 to 5 well volumes) purge method. Refer to SOP 10-02 for a general overview of low-flow purge method.
2. Field parameters (pH, specific conductance, Eh, dissolved oxygen, turbidity, and temperature) should be measured using a flow-through cell when possible. When ambient measurements are required, use a groundwater containment vessel of sufficient size to allow for temperature equilibration with the atmosphere but with a relatively small surface area exposed to the atmosphere. Measurements should be taken as soon as practical after the groundwater has been removed from the well.
3. After field parameters have been measured, groundwater samples may be collected. Samples should be collected in the following order:
   a. Volatile organics:
      (1) Three 40 mL vials with Teflon septa should be filled with the groundwater to be tested. Vials are pre-preserved with 1:1 hydrochloric acid solution. Hydrochloric acid is corrosive; gloves should be worn. If the sample preservative comes in contact with the skin, flush with water. Seek medical attention if necessary.
      (2) Tilt the vial slightly and with minimum turbulence; fill the vial until it just overflows.
      (3) Carefully set the cap in place and screw on firmly.
      (4) Invert the vial to check for air bubbles. If air bubbles are present, a new sample vial must filled until a sample is obtained with no trapped air.
      (5) Label each vial and place samples on ice in an insulated container to maintain sample temperature at 2° to 6°C.
   b. Semivolatile organics (includes samples for acid/base-neutral extractables, pesticides, herbicides, and PCBs):
      (1) A minimum of 1 liter amber-glass bottle is required per scan. No chemical preservation is required.
      (2) Fill bottle with the groundwater to be tested, allowing minimal headspace for expansion.
      (3) Label each bottle and place samples on ice in an insulated container to maintain sample temperature at 2° to 6°C.

c. General chemistry parameters:

(1) Container size and type and chemical preservative are dependent upon the analyses to be performed. Table 1 provides general information for routinely performed analyses. Refer to the project work plan for specific requirements. The laboratory will provide the required containers and preservatives for the project. Some preservatives are corrosive; gloves should be worn. If the sample preservative comes in contact with the skin, flush with water. Seek medical attention if necessary.

(2) Fill each bottle to the shoulder with the groundwater to be tested and cap tightly.

(3) Label each bottle and place samples on ice in an insulated container to maintain sample temperature at 2° to 6°C.

d. Metals:

(1) Typically, a 500 mL plastic bottle pre-preserved with 1:1 nitric acid will be supplied by the laboratory for metals. Nitric acid is corrosive; gloves should be worn. If the sample preservative comes in contact with the skin, flush with water. Seek medical attention if necessary.

(2) Samples for dissolved metals must be field-filtered prior to preservation.

(a) Attach a 0.45 µm in-line filter cartridge unit onto the discharge line from the sampling device and adjust the discharge and flow rate with a three-way valve system, if necessary. A new cartridge must be used at each sampling location.

(b) Discharge the required volume of filtered groundwater to waste as specified by the filter manufacturer.

(c) Fill the required sample container to the bottle shoulder with the filtered groundwater and cap tightly.

(d) Label the bottle and place sample on ice in an insulated container to maintain sample temperature at 2° to 6°C.

(3) When total metals are required, fill the sample container provided to the bottle shoulder with the groundwater to be tested and cap tightly.

(4) Label the bottle and place sample on ice in an insulated container to maintain sample temperature at 2° to 6°C.

Table 1 – Sample Container Type, Size, and Preservative Routine – Groundwater Analyses

Analysis	Container Type	Required Volume	Chemical Preservative
Alkalinity (all forms)	Plastic	100 mL	None
BOD	Plastic	500 mL	None
Chloride	Plastic	100 mL	None
COD	Plastic	50 mL	1:1 sulfuric acid
Chromium, Hexavalent	Plastic	100 mL	None
Cyanide	Plastic	250 mL	Sodium hydroxide
Fluoride	Plastic	100 mL	None
N, Ammonia	Plastic	250 mL	1:1 sulfuric acid
N, Total Kjeldahl	Plastic	250 mL	1:1 sulfuric acid
N, Nitrate	Plastic	100 mL	None
N, Nitrite	Plastic	100 mL	None
Phenols, Recoverable	Glass	500 mL	1:1 sulfuric acid
Phosphorus	Plastic	100 mL	1:1 sulfuric acid
Solids (all types)	Plastic	250 mL	None
Sulfate	Plastic	250 mL	None
TOC	Plastic	250 mL	1:1 sulfuric acid

Scope: This SOP outlines procedures for the collection of groundwater quality control samples. These samples may include equipment blanks, atmosphere blanks, filter blanks, duplicates, and matrix spike samples. Refer to the project work plan for specific information regarding the QC samples required.

References: Minnesota Pollution Control Agency, *Groundwater Sampling Guidance: Development of Sampling Plans*, Protocols and Reports, January 1995.

Procedure:

A. Equipment Blanks

Equipment blanks are collected to evaluate if the investigative groundwater samples may have been contaminated through contact with the sampling equipment. An impacted equipment blank sample may indicate inadequate decontamination procedures, or that parts of the sampling equipment (e.g., pump tubing) may have become contaminated through continued use and should be replaced. Equipment blanks are typically collected at a rate of 1 equipment blank per 10 investigative samples.

Equipment blank samples are collected by passing deionized water through the sampling equipment using the same procedure used to collect the investigative groundwater samples.

1. Prior to collecting the equipment blank sample, be sure that the sampling equipment has been decontaminated following standard procedures.

2. If a pump is used for sample collection, prepare the equipment blank by pumping deionized water from the final rinse container into the appropriate sample containers.

3. If a bailer is used for sample collection, pour deionized water (with as little agitation as possible) into the top of the bailer. The length of time the blank water has contact with the bailer should simulate the length of time that an actual groundwater sample would contact the bailer. If a disposable bailer is used, do not rinse it with deionized water prior to collection of the equipment blank.

4. Equipment blanks are analyzed for the same parameters as the groundwater samples and therefore an identical "set" of bottles should be filled. The bottles should be filled in the same order required for the groundwater samples. If field filtering is required, follow the procedures described in Section C below.

5. Standard decontamination procedures should be followed after collection of the equipment blank.

B. Atmosphere Blanks

Atmosphere blanks are collected during sampling events where dedicated equipment is used to collect groundwater samples (such as Well Wizard dedicated pumps). These samples are used to determine if contact with ambient air has impacted the groundwater samples.

1. Collect an atmosphere blank sample by pouring deionized water into the appropriate sample containers at the same rate and duration that it takes to collect a groundwater sample. Atmosphere blanks are analyzed for the same parameters as the groundwater samples and therefore an identical "set" of bottles should be filled.

2. The bottles should be filled in the same order and preserved in the same manner required for the groundwater samples. If field filtering is required, follow the procedures discussed in Section C below.

3. Atmosphere blanks should be collected at a rate of one per 10 investigative groundwater samples.

C. Filter Blanks

Filter blanks are collected when groundwater samples are filtered onsite. These samples are used to evaluate the impact of the filtering equipment on the groundwater samples.

1. Collect a filter blanks by running deionized water through decontaminated filtering equipment fitted with a new filter. Do not pass the sample through the sampling equipment. The filter blank is used to determine whether the filtering equipment has affected the groundwater sample, independent from the sampling equipment

2. Filter blanks will be analyzed for the same parameters as the filtered groundwater samples and therefore an identical "set" of bottles should be filled. The bottles should be filled in the same order required for the groundwater samples.

3. Filter blanks should be collected at a rate of one for every 10 investigative filtered groundwater samples.

D. Field Duplicates

Field duplicates are collected as a check of sampling and analytical reproducibility.

1. Sample duplicates should be collected using the same procedure as for the investigative samples. Sample duplicates will be analyzed for the same parameters as the investigative groundwater samples and therefore an identical "set" of bottles must be filled.

2. The parameter dictated bottle order should be followed, however the sample duplicate bottles for specific parameter analysis should be filled immediately after the "primary" groundwater sample bottles. Following this procedure, the "primary" sample and sample duplicate bottles are filled alternately, and the parameter dictated sampling order is maintained.

3. Field duplicates are typically collected at a rate of one for every 10 investigative groundwater samples.

E. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples are used to evaluate laboratory precision and accuracy. MS/MSD samples are typically analyzed by laboratory as part of their QA/QC program. To insure that project specific matrix spike analysis is performed, it must be requested from the analytical laboratory. Consult the project work plan for sample volume requirements. Typically, triple the normal sample volume is required for analysis.

MS/MSD samples are collected in the same manner as field duplicates. Refer to Section D of this SOP.

F. Trip Blanks

Trip blanks, consisting of deionized water in sealed 40 mL glass vials, are prepared by the laboratory prior to the sampling event and are included in each sample shipping container. Trip blanks must be kept with the investigative samples throughout the sampling event and shipment to the laboratory. Trip blanks are used to assess potential contamination of samples due to compound migration during sample handling, shipment, and storage.

frc&h **STANDARD OPERATING PROCEDURE** **SOP 11-08**
Field Measurement of Turbidity
12/07/1998; Revised 05/09/00

Scope: This SOP outlines the technique required for the accurate field measurement of turbidity using the Cole-Parmer Field Turbidimeter Model 8391-50.

Equipment: Cole Parmer Field Turbidimeter Model 8391-50
Methanol
Sample cuvette
Turbidity standards (.5 NTU and 10 NTU) - DO NOT ALLOW TO FREEZE.
Distilled or Deionized Water
Field Notebook
Kimwipes

Procedure:

A. Primary Calibration

This procedure should be performed quarterly or any time a NEW sample cuvette is put into use.

1. Turn on the turbidimeter and allow to warm up for 5 minutes.

2. Set the range switch to 0-20.0 NTU and prepare the cuvette with the 10 NTU primary standard.

3. Insert the cuvette into the test well, align and cover with the light shield.

4. Adjust the SET/CAL control until the display reads 10.0.

5. Remove the primary standard and replace it with the sealed 10.0 NTU secondary standard. Align the cuvette and cover with the light shield.

6. Record the NTU value of the sealed standard on the label. This value will now be used for daily calibration.

7. Pour the 10 NTU standard out of the sample cuvette and shake out the remaining droplets. Rinse twice with distilled water and wipe the outside of the cuvette with a Kimwipe moistened with a small amount of methanol.

8. Change the range switch to 0-2 NTU range and prepare the sample cuvette with the 0.5 NTU standard.

9. Insert the cuvette into the test well, align and cover with the light shield.

10. Adjust the ZERO NTU adjust screw so that the display reads 0.500. Make sure the reading has stabilized.

11. Remove the primary standard and replace it with the sealed 0.5 NTU secondary standard. Align it and cover with the light shield.

12. Record the NTU value of the sealed standard on the label. This value will now be used for daily calibration.

13. Set the range switch to 0-20.0 NTU. Insert the 10 NTU sealed standard, align and cover.

14. The SET/CAL adjust may require a slight adjustment. Set the meter to read the calibrated value of the sealed standard that was recorded in step 6.

B. Daily Calibration

1. Turn on the turbidimeter and allow it to warm up for 5 minutes.

2. Set the range switch to 0-20.0 NTU.

3. Insert the 10 NTU sealed secondary standard cuvette into the test well, align and cover with the light shield.

4. Using the SET/CAL control, adjust the display to the calibrated standard value obtained during primary calibration.

5. Remove the 10 NTU standard and set the range switch to 0-2.

6. Insert the 0.5 NTU sealed secondary standard into the test well, align and cover with the light shield.

7. Using the zero NTU adjust screw, set the display to the calibrated standard value obtained during primary calibration.

8. Remove the 0.5 NTU standard.

9. Set the range switch back to 0-20.0 NTU, insert the 10 NTU sealed secondary standard, align and cover.

10. The SET/CAL adjust may require a slight adjustment. Set the meter to read the NTU value of the sealed secondary standard. The turbidimeter is now calibrated and ready for sample measurements.

C. Sample Analysis

1. After calibrating the turbidimeter, set the switch to 0-20.0 NTU range.

2. Rinse the cuvette twice with the sample to be tested and then slowly fill the cuvette to the alignment mark. Refill if air bubbles form on the walls of the cuvette.

3. Cap the cuvette and carefully wipe the outside of the sample cuvette with a Kimwipe moistened with a small amount of methanol to remove any fingerprints or moisture.

4. Insert the cuvette into the test well, align and cover with the light shield.

5. Once the reading has stabilized, record in the field notes.

6. If the reading is outside the 0-20.0 NTU calibration range, adjust the range to the appropriate setting (0-2 NTU or 0-200 NTU), allow the sample to stabilize and record the reading in the field notes.

7. Rinse the cuvette thoroughly with deionized water and cap upon completion of testing.

D. Quality Control

1. A sample duplicate should be run at a frequency of 1 per 10 investigative samples. Duplicate readings should agree within ±10%. If values fall outside this range, recalibrate the turbidimeter and reanalyze.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE SOP 11-10
In-line Measurement of Temperature, Specific Conductance, pH, Eh, and Dissolved Oxygen - 05/15/1998; Revised 04/02/2010

Scope: This SOP outlines the technique required for the accurate field measurement of temperature, specific conductance, pH, Eh, and dissolved oxygen (DO), using the YSI Model 556 MPS multi-meter with in-line flow cell. The unit consists of a suite of three probes with five sensors mounted together inside a flow-through cell. As water is pumped through the cell, field parameters are simultaneously measured and displayed.

Equipment: Sampling Pump
YSI Model 556 MPS multi-meter equipped with probe module
3/8-inch diameter polyvinyl discharge tubing
Deionized water

Standards: Conductivity standards (147, 1412, 2765 µS/cm)
pH buffers (4.00, 7.00, 10.00 s.u. @ 25°C)
Eh standard (Zobell's Solution 428 mV @ 25°C)

Replace solutions by expiration date on label.

All solutions should be protected from freezing and physical damage. Zobell's solution will degrade when exposed to excessive temperature variation or light. Store it in a cool, dry area protected from light.

Safety: Review all material safety data sheets (MSDS) for the standard solutions prior to use. Chemical resistant gloves should be worn when handling these solutions.

Eh standard solution waste should be containerized for proper disposal. The solution contains cyanide compounds; contact with acid will liberate hydrogen cyanide, a very toxic, flammable gas.

General Information:

The multi-meter and sonde should be thoroughly checked for proper operation prior to leaving for job site. This should include a check of internal calibration, and any adjustments should be made as required. Procedures for internal calibration meter adjustments can be found in the operation manual.

When installing, removing, or replacing a sensor, the entire probe module and all sensors must be thoroughly dried prior to removal of a sensor or sensor port plug. This will prevent water from entering the port. When a sensor or plug is removed, examine the connector inside the port. If moisture is present, use compressed air to completely dry the connector. Do not use if the connector is corroded; service on the unit will be required.

The YSI multi-meter is capable of displaying the parameters in various units of measure. The desired reporting unit for each parameter should be selected prior to calibration – pH in s.u., dissolved oxygen in mg/L, Eh in mV, specific conductance in µS/cm, and temperature in °C.

Procedure:

A. Electrode Preparation

1. Temperature/Conductivity Probe

Inspect the thermistor and electrodes for corrosion or fouling.

2. Dissolved Oxygen Probe

   Inspect the probe membrane. Replace the probe membrane when it becomes wrinkled, bubbled, dirty, torn, or otherwise damaged.

3. pH/Eh Probe

   Inspect probe for damage or fouling. Gently clean the bulb area with a very soft brush and Liquinox soap solution when obviously coated with oil, sediment, or biological growth. **Caution: The bulb glass is very fragile.**

B. Flow-cell Inspection

1. Inspect flow-cell for cleanliness. Disassemble and clean with a mild soap solution as necessary. Rinse well with clean tap water, followed by a deionized water rinse.

2. Inspect O-rings and O-ring seats for damage that may prevent sealing. Replace as necessary.

C. Meter Connection and Inspection

1. Connect the cable to the meter by lining up the pins and guides on the cable with the holes and indentations on the cable connector at the bottom of the instrument. While holding the cable firmly against the cable connector, turn the locking mechanism clockwise until it snaps into place.

2. Confirm that there is sufficient battery charge remaining (lower right corner of meter window) and that 4 replacement alkaline C batteries are available in the storage case. Typically, the YSI 556 will operate continuously for approximately 180 hours. Assuming a standard usage of 3 hours of "on" time in a typical day, the alkaline cells will last approximately 60 days. See Section 2 of the Operations Manual for battery replacement information.

D. Calibration

Calibration Tips:

Use the transport cup that comes with the probe module as the calibration chamber for all calibrations. Use a clamp or ring stand to secure the probe body and prevent it from tipping over.

With the exception of the dissolved oxygen sensor calibration, ensure that all sensors are immersed in the calibration solution. Many of the calibrations utilize readings from other sensors (e.g., temperature sensor).

Make certain that port plugs are installed in all ports where sensors are not installed. It is extremely important to keep these electrical connectors dry.

1. Dissolved Oxygen

   The membrane covering the tip of the DO probe should be gently wiped free of visible moisture with a Kim wipe before starting the air calibration (% saturation) sequence. Refer to the green calibration reference sheet (*Oxygen Solubility Values in Fresh Water*) provided in the field notebook for the correct DO/temperature correlation. The instrument must be on for at least 20 minutes before calibrating to polarize the DO sensor.

a. Turn the meter on by pressing the **On/off** key in the upper left corner of the key pad (small green vertical dash inside a green circle). The meter will be in Run mode.

b. Screw the calibration cup onto the probe. Pour approximately 1/8" of tap water into the bottom of the calibration cup, avoiding the DO membrane while pouring. Screw the cap onto the cup, engaging only 1 or 2 threads to allow venting to the atmosphere. Ensure that the DO and temperature sensors are not immersed in the water.

c. Allow approximately 10 minutes or more for the air in the cup to become water saturated and for the temperature to equilibrate before proceeding.

d. When the DO% and mg/L readings are stable, the meter is ready for calibration. From the Run mode menu, press the **Escape** key and use the down arrow to highlight **Calibrate**. Press the **Enter** key (a left pointing arrow). Arrow down to highlight **DO 2 mil PE**, and press the **Enter** key. Select *DO%* by pressing enter. The internal barometer's real time measurement in mmHg will be displayed. Press the **Enter** key to accept the calibration of dissolved oxygen.

e. Observe the DO mg/L and DO% readings. When there is no significant change in the readings (after approximately 30 seconds), record the temperature and DO (in mg/L) on the calibration form. The percent dissolved oxygen (DO%), should be within 90 – 110% of the theoretical value for acceptable calibration.

f. Rinse the sonde with deionized water and shake to remove excess water.

g. Calibration of the DO probe should be verified every 4 hours and at the end of each day. If calibration verification values fall outside the acceptance range, check the condition of the probe membrane. Clean or replace if necessary (see H.1), and recalibrate the probe prior to any further sample measurements.

2. Specific Conductance

a. Press the **On/off** key to display the run screen.

b. Rinse the calibration cup and conductivity probe with DI water and discard the rinse water. Rinse the cup and probe a second time using a small volume (10 – 15 mL) of the 1412 µS/cm conductivity standard in the calibration cup. Discard this rinse solution and refill the calibration cup with approximately 60 mL of 1412 µS/cm conductivity standard, ensuring that the calibration cup is sufficiently filled and covering the probe.

c. Press the **Escape** key to display the main menu screen and use the down arrow key to highlight **Calibrate**. Press the **Enter** key. The calibration screen is displayed.

d. Use the arrow keys to highlight the **Conductivity** selection and press **Enter**. Use the arrow key to highlight the **Specific Conductance** selection. Press **Enter**.

e. Use the keypad to enter the calibration value of the standard (1412 µS/cm) and press **Enter**. The conductivity calibration screen is displayed. Allow about 1 minute for temperature equilibration.

f. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The specific conductance calibration will be accepted and display the newly

calibrated reading on the screen. Record the specific conductance reading and temperature on the calibration form

g. Press the **Enter** key and continue to more calibration options, or press the **Escape** key 4 times to exit to the run mode.

h. The calibration standard may be saved for later calibration verification checks or discarded. Rinse the probe module with deionized water and shake to remove excess water.

i. Rinse the calibration cup and probe a second time with a small amount of 147 µS/cm conductivity standard. Discard the rinse solution and refill the calibration cup with the 147 µS/cm conductivity standard. When the reading shows no significant change for approximately 30 seconds, record the reading and temperature on the calibration form. Follow the same protocol for the 2765 µS/cm standard.

j. If any of the readings fall outside of the acceptable calibration verification range indicated on the calibration form, repeat calibration using new standards. If the calibration is still out of range, clean the conductivity probe using the procedure described in H.2, and repeat the calibration sequence.

k. Calibration of the conductivity probe should be verified every 4 hours and at the end of each day using the 1412 µS/cm standard. If the calibration verification value falls outside the acceptance window, repeat the check using a new standard. If the check is still outside the acceptance window, check the condition of the probe, clean if necessary, and recalibrate prior to any further sample measurements.

3. pH

Perform a 2-point calibration as indicated below. The pH buffers selected should bracket the anticipated pH range of the samples to be measured.

a. Press the **On/off** key to display the run screen.

b. With the calibration cup attached to the sonde, rinse the cup and probes with DI water. Discard the rinse water and shake any excess water from cup and probes. Rinse the probe and cup a second time with a small volume of pH 7 buffer and discard the rinse. Add approximately 60 mL of pH 7 buffer to the cup.

c. Press **Escape** and highlight the **Calibrate** selection using the arrow keys. Press **Enter** and use the arrow keys to highlight the **pH** selection. Press **Enter**.

d. Arrow down to highlight **2 point** and press **Enter**. The unit will prompt the entry of the first pH buffer standard to be entered. Using the keypad, press **7.00** and then press **Enter**.

e. Observe the readings for pH and temperature. When they show no significant change for approximately 30 seconds, press the **Enter** key to calibrate.

f. When the display indicates that the 7.00 pH calibration has been accepted, record the reading and temperature on the calibration form. Rinse the cup and probes with deionized water and discard the rinse water. Rinse the cup and probe a second time with small amount of the second (pH 4 or pH 10) buffer and discard the buffer rinse. Add approximately 60 mL of the second buffer to the cup.

g. Press **Enter** to continue. The screen will prompt for the entry of the second pH buffer value. Using the keypad, enter the value for the second pH standard (4.00 or 10.00) and press **Enter**.

h. Observe the readings for pH and temperature. When they show no significant change for approximately 30 seconds, press the **Enter** key to lock in those values.

i. When the display indicates that the second pH buffer calibration has been accepted, record the reading on the calibration form.

j. Rinse the cup and probes with deionized water and discard the rinse water. Rinse the cup and probe a second time using a small volume of the third pH buffer and discard the buffer rinse. Add approximately 60 mL of the third pH buffer to the cup.

k. Observe the readings for pH and temperature. When they show no significant change for approximately 30 seconds, record the readings on the calibration form.

l. Check the recorded readings to ensure that they are within the acceptable calibration verification windows. If pH values are out of the acceptance range following calibration, repeat the calibration using new standards. If the values are still out of range following recalibration, the pH probe may need to be reconditioned. Soak the probe in pH 4 buffer for 2 hours and repeat the calibration procedure.

m. Calibration of the pH probe should be verified every 4 hours and at the end of each day using the pH 7 buffer. If the calibration verification value falls outside the acceptance window, repeat the check using a new standard. If the check is still outside the acceptance window, check the condition of the probe, clean if necessary and recalibrate prior to any further sample measurements.

4. Eh (ORP)

The measurement of Eh is accomplished by using an electrode designed to measure ORP (oxidation reduction potential). Eh is calculated by adding an offset voltage (200mV) to the ORP reading obtained.

Refer to the green calibration reference sheet (*Zobell's Calibration Check Standard Values*) for the acceptance range at various temperatures.

a. Press the **On/off** key to display the run screen.

b. Rinse the cup and probe with a small volume (10 – 15 mL) of Zobell's solution and discard this rinse solution. (Zobell's solution must be containerized for proper disposal). Refill the calibration cup with approximately 60 mL of Zobell's solution, ensuring that the calibration cup is sufficiently filled and covering the probe.

c. Allow for temperature equilibration before proceeding. When the temperature and ORP readings show no significant change for approximately 30 seconds, the meter is ready to calibrate.

d. Press the **Escape** key and highlight the **Calibrate** selection with the arrow keys. Press **Enter**. Use the arrow keys to highlight **ORP** and press **Enter**.

e. With the ORP calibration screen displayed, enter the mV value from the green calibration reference sheet (*Zobell's Calibration Check Standard Values*) for Zobell's solution at the observed temperature (in °C) and press **Enter**.

f. Confirm that the temperature and the Zobell's solution value are correct and press **Enter**. Because the meter and probe are set to recognize the calibration as ORP, the meter will display the following message: "**Out of range, accept anyway? Yes or No**". Select "**Yes**" and press **Enter**. The measurement displayed is Eh (in mV).

g. Record the temperature and Eh values on the calibration form, ensuring that the Eh reading is within the acceptance window for that temperature. If the Eh value is out of the acceptance range following calibration, repeat the calibration using a new standard. If the Eh value is still out of range following recalibration, the Eh probe may need to be reconditioned.

h. Rinse the sonde with deionized water, containerizing all rinse water. The calibration standard may be saved for later use for calibration verification checks or containerized for proper disposal.

i. Calibration of the Eh probe should be verified every 4 hours and at the end of each day using Zobell's solution. If the calibration verification value falls outside the acceptance window, repeat the check using a new standard. If the check is still outside the acceptance window, check the condition of the probe, clean if necessary and recalibrate prior to any further sample measurements.

E. Sample Analysis using In-line Flow-through Cell

Air in the flow-cell will affect the readings, especially specific conductance and DO. To help prevent air in the flow cell, elevate the sonde end of the flow cell to allow any air bubbles to escape. Install the sonde so that the conductivity sensor vent is facing upward when the sonde and flow cell are oriented horizontally. In addition, ensure that all fittings/connections are tight to eliminate potential for air leaking into the system.

If the initial purge water is silty, continue pumping until the discharge water clears before taking in-line measurements.

1. Connect the 3/8" OD Tygon inflow tubing from the pump to the in-port on the flow cell, and the other end of the inflow tubing to the pump. Connect the 1/2" OD Tygon discharge tubing to the out-port of the flow cell; the other end of the outflow tubing may discharge to ground or into an appropriate receptacle if purge water must be containerized. Refer to the project work plan for purge water disposal requirements.

2. Power on the instrument and check the display for readings.

3. Start the sampling pump and check for leaks in the discharge lines or flow-through cell. If leaking is observed, stop the pump and repair the leak.

4. Examine the flow-through cell to determine whether discharge water is entering and exiting the cell properly. Once the air is purged from the pump and discharge hoses, the flow-through cell should be completely filled with water and a steady flow of water should be exiting the outflow line from the cell. Record the initial meter readings on the field form.

5. Continue pumping until the readings stabilize. When low flow sampling, field parameters should be recorded every 3 to 5 minutes until stabilization has been achieved. Record the value for each field parameter on the field form, checking that the units displayed for each parameter are as noted on the field form.

6. Once stabilization of the field parameters has been achieved, disconnect the flow cell inflow tubing from the pump tubing and fill the appropriate sample containers. Samples for laboratory analysis should never be collected from water passing through the flow cell.

7. When sample collection is complete, remove the suite of probes from the flow-through cell and rinse the probes, flow-through cell, and inflow and outflow lines well with deionized water.

8. Attach storage/calibration cup and cap with a wet sponge or trace of tap water inside to keep the probes in a humid environment.

F. Sample Analysis using Calibration Cup

1. Screw the calibration cup onto the multiprobe unit and rinse 2 – 3 times with deionized water.

2. With the sensors pointing up, remove the cap and discard the rinse water. Rinse the sensors twice with a small volume of the sample to be measured and discard the rinse.

3. Fill the cup with the sample to be tested. The multiprobe should be completely immersed.

4. Allow 1 - 3 minutes for the readings to stabilize and record.

5. Repeat Steps F.1 – F.4 for each sample to be measured.

G. Electrode Storage

1. Short term storage

For short term storage, all sensors on the instrument require a moist environment. Immersion of the probes can cause drift or result in shorter sensor lifetime, so store the sensors installed in the sonde with 1/2" of tap water or moistened sponge inside the sealed calibration cup. *Do not store directly in water.*

2. Long term storage

a. Dissolved Oxygen Probe

Remove the sensor, following the instructions provided in the YSI instrument manual. Store the sensor in water with the membrane in place. The membrane cap and KCl solution must be replaced prior to use.

b. Temperature/Conductivity Probe

The temperature/conductivity probe has no special storage requirements; it may be stored wet or dry. The probe should be cleaned thoroughly prior to storage.

c. pH/Eh Probe

Remove the sensor from the sonde, following the instructions provided in the YSI instrument manual. Store the probe in 2M KCl solution in the pH/ORP sensor storage bottle. Insert a port plug into the vacant port on the sonde to keep the electrical connector dry.

H. Electrode Maintenance

1. Dissolved Oxygen Probe

If the DO sensor will not hold a calibration or if gas bubbles appear under the membrane, the membrane cap may need to be changed.

a. Unscrew the old membrane cap and discard.

b. Rinse the sensor tip with DI water and wipe gently with a Kimwipe.

c. Fill a new membrane cap half full with prepared KCl electrolyte and screw the cap onto the sensor tip. The tip should just be tightened so that there are no bubbles visible under the membrane. A small amount of electrolyte should overflow.

d. Rinse the sensor with DI water and proceed with the calibration sequence.

Periodic cleaning of the silver anode and the gold cathode may be necessary. Refer to the YSI instrument manual for these specific procedures.

2. Temperature/Conductivity Probe

Clean the conductivity portion of the electrode with the small brush provided in the maintenance kit. Wet the brush with a Liquinox solution and insert it into each hole 15- 20 times. Rinse well with clean tap water, followed by a deionized water rinse. The temperature portion of the sensor requires no maintenance.

3. pH/Eh Probe

Gently clean the bulb area with a very soft brush or cotton swab and a Liquinox soap solution when coated with oil, sediment, or biological growth is observed. Rinse well with clean tap water, followed by a deionized water rinse.

If the pH is out of range after calibration, the pH probe may need to be reconditioned. Soak the probe in pH 4 buffer for 2 hours and retry the calibration.

If rehydration of the electrode junction is required, soak the probe in 2M KCl solution for eight hours.

Zobell's Calibration Check Standard Values

Temperature (°C)	mV (vs Ag-AgCl electrode)	Acceptance Range (mV)
0	460.5	450.5 - 470.5
1	459.2	449.2 - 469.2
2	457.9	447.9 - 467.9
3	456.6	446.6 - 466.6
4	455.3	445.3 - 465.3
5	454.0	444.0 - 464.0
6	452.7	442.7 - 462.7
7	451.4	441.4 - 461.4
8	450.1	440.1 - 460.1
9	448.8	438.8 - 458.8
10	447.5	437.5 - 457.5
11	446.2	436.2 - 456.2
12	444.9	434.9 - 454.9
13	443.6	433.6 - 453.6
14	442.3	432.3 - 452.3
15	441.0	431.0 - 451.0
16	439.7	429.7 - 449.7
17	438.4	428.4 - 448.4
18	437.1	427.1 - 447.1
19	435.8	425.8 - 445.8
20	434.5	424.5 - 444.5
21	433.2	423.2 - 443.2
22	431.9	421.9 - 441.9
23	430.6	420.6 - 440.6
24	429.3	419.3 - 439.3
25	428.0	418.0 - 438.0
26	426.7	416.7 - 436.7
27	425.4	415.4 - 435.4
28	424.1	414.1 - 434.1
29	422.8	412.8 - 432.8
30	421.5	411.5 - 431.5
31	420.2	410.2 - 430.2
32	418.9	408.9 - 428.9
33	417.6	407.6 - 427.6
34	416.3	406.3 - 426.3
35	415.0	405.0 - 425.0

Oxygen Solubility Values (Fresh Water)

Temperature (°C)	DO Solubility (mg/L)
0	14.62
1	14.22
2	13.83
3	13.46
4	13.11
5	12.77
6	12.45
7	12.14
8	11.84
9	11.56
10	11.29
11	11.03
12	10.78
13	10.54
14	10.31
15	10.08
16	9.87
17	9.67
18	9.47
19	9.28
20	9.09
21	8.92
22	8.74
23	8.58
24	8.42
25	8.26
26	8.11
27	7.97
28	7.83
29	7.69
30	7.56
31	7.43
32	7.31
33	7.18
34	7.07
35	6.95

Appendix 3

Wastewater Discharge Permit

October 5, 2007

Mr. Vernon Campbell
Corporate Director of Environmental Compliance
SSW Holdings Company, Inc.
3501 So. Tulsa
P.O. Box 6537
Fort Smith, AR 72906

RE: Discharge Permit Renewal, Industrial Pretreatment Permit #006

Dear Mr. Campbell:

Enclosed please find the Industrial Pretreatment Permit for Straits Steel & Wire Company Permit No. 006, for the groundwater remediation pump station on Bryant Rd. The new permit expires on midnight October 15, 2012.

Please read the permit carefully, as it contains new requirements and reporting. I want to bring to your attention specifically page 5 "Certification Statement". This statement is required to accompany all reports made to the POTW. The certification is to be made by the authorized employee or officer of the company.

If you have any questions concerning this permit, the City of Ludington Sewer Ordinance, or any other related matter you can call me at 231-843-3190 or e-mail me at ludwwtp@t-one.net.

Sincerely,

Robert Allard Jr.
Superintendent

PC Duane Tyndal, General Manager Straits Steel & Wire
John Shay, City Manager
Jon Kortge, Utilities Maintenance Superintendent

Ludington Wastewater Plant
Wastewater Discharge **Permit No. 006** Expiration Date **10/15/2012**

Issued to: Straits Steel & Wire Company
902 North Rowe Street
Ludington, Michigan 49431
231-843-3416

Contact: Mr. Duane Tyndal

In accordance with all terms and conditions of the Ludington, Michigan Sewer Use Ordinance (SUO), supplement for the Industrial Pretreatment Program, and any applicable provisions of Federal, State and City law or regulation: the above named permittee is hereby authorized to discharge from the groundwater pumping station located between Bryant Rd. and Beachwood Street on the North side of Bryant Rd. To the Ludington Michigan sewer system at: sewer tap into manhole on Bryant Rd. between beechwood Street and William Street. Discharges will be in accordance with effluent limitations, monitoring requirements, and all other conditions set forth within this permit.

This permit and authorization to discharge shall expire at midnight, October 15, 2012. In order to receive authorization to discharge beyond the date of expiration the permittee shall submit such information and forms as are required by the City no later than 180 days prior to the date of expiration.

Issued this 15th day of October 2007 for the City of Ludington, Michigan.

Robert Allard Jr.

Wastewater Plant Superintendent

Permit No. 004

Conditions Chapter 27 Permit Industrial Sewage Pretreatment City of Ludington Sewer Use Ordinance (SUO)

All referenced Articles and Sections are also in EPA 40 CFR 3

1. Article I 2.251 (1) (2) Article 4 2.278

   The Public Owned Treatment Works (POTW) will review the permit annually and reserves the right to re-open the permit, and to deny specific discharges as deemed harmful! to the POTW.

2. Article 4 2.279

   The permit to discharge to the (POTW) is non-transferable without the written consent of the (POTW).

3. Article 4 2.280 (9)

   The permit holder shall notify the (POTW) of any significant change to it's discharge.

4. Article 4 2.280(10)

   The permit holder shall notify the (POTW) as soon as it becomes aware of any (a) Slug load discharge, (b) in the event of a un-contained spill, (c) pretreatment upset,
   (d) Any by-pass of the pretreatment system.

5. Article 5 2.286

   The permit holder is required to keep records as explained in the SUO.

6. Article 6 2.283

   Upon proper notification and identification the (POTW) reserves the right to enter, inspect and sample the permitted industry.

7. Article 6 2.284

   The (POTW) will post in the local newspaper, at least annually, all permitted industrial users who are in significant non-compliance with the (POTW) as it pertains to violations of sampling requirements, periodic compliance reports and the failure to meet time requirements in submitting reports.

8. Article 6 2.295 2.301 2.303

   Permit violations are subject to civil and criminal penalties for violation of pretreatment standards, reporting requirements, periodic compliance reporting schedules. Current SUO fines as required by USEPA are $1000.00.

Permit No. 006

Permit Conditions
Part I

A. Effluent Limitations and Monitoring Requirements

During the period beginning October 15, 2007, and lasting until, October 15, 2012, discharges from outfall 01, at sewer manhole on Bryant Rd. between Beachwood and William St., shall be limited and monitored by the permittee as specified below:

	Discharge Limitations		monitoring requirements		
Effluent Characteristics	30-day Average	Daily maximum	Frequency	sample type	location
Total chromium	1.71mg/l	2.77mg/l	1/month	grab	01
Total zinc	1.48mg/l	2.61mg/l	1/month	grab	01
Total cyanide	0.65mg/l	1.20mg/	1/month	grab	01
Flow *			1/month	Read	

*City water meter

All samples shall be collected, preserved, and analyzed in accordance with the procedures established in 40 CFR Part 136 and amendments.

Permit No. 006

Part II: Schedule of Compliance

The permittee shall achieve compliance with the effluent limitations specified for the outfall at the manhole in accordance with the following:

1. All parameter listed on page 2 of this permit "Permit Conditions"

2. Permittee shall mail to the POTW superintendent a copy of all required sampling analysis within 30 days of receipt of said analysis from their lab provider.

3. Permittee shall notify the POTW within 24 hours of identifying a violation and resample (and provide results) within 30 days of the known violation. 40CFR403.12(g) (2).

4. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or non-compliance. In the case of non-compliance, the notice shall include the cause of non-compliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

5. All non-compliance monitoring reports shall contain a Statement of Certification as contained in 40CFR403.8(f),(l)(iii)(d)&403.12 (e),(g), (h),(l),(n). A copy of which is enclosed.

6. Sampling Schedule:

2007	Monthly
2008	Monthly
2009	Monthly
2010	Monthly
2011	Monthly
2012	Monthly

PERMIT NO. 004

Certification Statement

The following certification statement must be signed by an authorized employee or officer of the company and must accompany all reports filed.

I certify under penalty of law that this document and all attachments were prepared under My direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Exhibit D

ORDINANCE NO: 202-09

CITY OF LUDINGTON

MASON COUNTY, MICHIGAN

AN ORDINANCE TO AMEND THE CODE OF ORDINANCES OF THE CITY OF LUDINGTON BY ADDING ARTICLE VI OF CHAPTER 18 TO REGULATE THE USE OF GROUNDWATER IN CERTAIN AREAS OF THE CITY.

THE CITY OF LUDINGTON ORDAINS:

Section 1: Amendment. The Code of Ordinances of the City of Ludington, Michigan is hereby amended by adding Article VI of Chapter 18, entitled "Water Well Restriction Ordinance" to read as follows:

ARTICLE VI. WATER WELL RESTRICTION ORDINANCE.

SEC. 18-161. FINDINGS. The City Council has been informed and hereby finds that an aquifer in certain areas of the City has been contaminated or otherwise adversely impacted by hazardous substances and that identified public health, safety and welfare risks may affect drinking water drawn from certain areas of such impacted aquifers. The City Council has determined that it is necessary and appropriate to prohibit and/or otherwise restrict the use of wells to supply water in and from the affected areas in order to protect City residents by minimizing the health, safety and welfare risks and minimizing the potential for migration of contaminated groundwater into presently unaffected groundwater.

SEC. 18-162. DEFINITIONS. The following definitions shall apply to terms used in this Article:

(1) "Affected Parcel" means a parcel of land, any part of which is located within a Restricted Zone.

(2) "Applicant" means a person who applies or applied for the establishment of a Restricted Zone pursuant to this Article.

(3) "City" means the City of Ludington.

(4) "City Property" means any interest in real property owned or held by the City
and shall include but not be limited to the following: (i) Real property owned by the City; (ii) Real property leased by the City as Lessee; and (iii) City streets, alleys or other City rights-of-way or easements.

(5) "Contaminated Groundwater" means groundwater in which there is present concentrations of materials that exceed drinking water criteria under the Safe Drinking Water Act, 1976 PA 399, as amended, or the

residential drinking water criteria established by the MDEQ in operational memoranda or rules promulgated pursuant to Part 201, Environmental Remediation (MCL 324.20101 *et seq.*).

(6) "Domestic Use" means the use of water by humans for drinking, cooking, food preparation and other food-related services, cleaning, washing, bathing and similar household-type water uses in any dwelling, or in any building in which commercial/business, governmental/public or industrial activities are conducted. The term does not include water used solely for closed-loop heat pumps, non-contact cooling, or production and/or processing purposes of commercial or industrial enterprises.

(7) "Irrigation Use" means the use of water for lawn, garden, or landscaping irrigation on a residential parcel of land. The term does not include water used for commercial, agricultural or farm irrigation, except as specifically directed by the MDEQ.

(8) "MDEQ" means the Michigan Department of Environmental Quality, or its successor agency.

(9) "Owner" means the holder of record title for a parcel of land and also the occupant of a parcel of land in possession under a land contract or lease.

(10) "Person" means any individual, partnership, corporation, association, club, joint venture, estate, trust, and any other group or combination acting as a unit, and the individuals constituting such group or unit.

(11) "Restricted Zone" means an area or areas described within Section 3 of this Ordinance for which the prohibition of Wells and the use of groundwater applies and includes parcels of land that are legally described on the attached Schedule 1 and that are depicted in the map(s) attached as Schedule 2, as amended from time to time as provided in this Ordinance.

(12) "WB" means the Water Bureau of the MDEQ, or its successor agency.

(13) "Well" means an opening in the surface of the earth for the purpose of removing fresh water through non-mechanical or mechanical means for any purpose other than a public emergency or conducting response actions that are consistent with the Michigan Natural Resources and Environmental Protection Act, 1994 PA 451, as amended ("NREPA"), the Comprehensive Environmental Response, Compensation and Liability Act, the Resource Conservation and Recovery Act, or other applicable statute.

SEC. 18-163. RESTRICTED ZONE. The following described areas in the City shall be Restricted Zones under this Article. They may be referred to by reference to the names provided in the caption preceding their descriptions. Additional Restricted Zones, along

with a map illustrating the Restricted Zone, may be added by amending the Ordinance in accordance with Sections 11 and 12 and all other applicable laws.

(1) Whittier/Delia Restricted Zone – legally described on the attached Schedule 1 and depicted in the map attached as Schedule 2.

SEC. 18-164. PROHIBITION. Except as provided in Section 5, no person shall install or utilize, or allow, permit, or provide for the installation or utilization of a Well on any Affected Parcel. Any existing Well at the time of the enactment of a Restricted Zone on any Affected Parcel within that Restricted Zone shall be plugged/abandoned at the expense of the Applicant for that particular Restricted Zone and as provided for in Section 6 and in accordance with applicable laws, regulations and ordinances, unless such existing Well falls within one of the exceptions listed in Section 5. Except as provided in Section 5, no person shall use any groundwater from an Affected Parcel.

SEC. 18-165. EXCEPTIONS. A person may install or utilize, or allow, permit, or provide for the installation or utilization of a Well in any Restricted Zone if any of the following exceptions applies and the requirements of the exception are complied with. The party proposing an exception to the Well prohibition shall conduct all appropriate inquiry and prepare a due care analysis pursuant to Part 201 of NREPA.

(1) *Proof of No Influence.* If the MDEQ determines based on information provided to it by the person seeking this exception that the use of a Well in a Restricted Zone will not exacerbate existing groundwater contamination, and that water from the proposed Well will not be affected by Contaminated Groundwater, and proof of those determinations is delivered to the City, the Well may be so used.

(2) *Groundwater Monitoring/Remediation.* A Well may be used for groundwater monitoring and/or remediation as part of a response activity approved by the MDEQ or the United States Environmental Protection Agency.

(3) *Construction Dewatering.* A Well may be used for construction dewatering if the following conditions are satisfied: (i) the use of the dewatering Well will not result in unacceptable exposure to Contaminated Groundwater, possible cross-contamination between saturated zones, or exacerbation of Contaminated Groundwater, as defined in Part 201 of NREPA; and (ii) the water generated by that activity is properly handled and disposed of in compliance with all applicable laws, rules, regulations, permit and license requirements, orders and directives of any governmental entity or agency of competent jurisdiction. Any exacerbation caused by the use of the Well under this exception shall be the responsibility of the person operating the de-watering Well, as provided in Part 201 of NREPA.

(4) *Processing Activities.* If the MDEQ determines that the use of a Well for non-contact heating, cooling, production, or processing involved in industrial or commercial activities will not cause migration or exacerbation of Contaminated Groundwater, and proof of that determination is delivered to the City, such use of the Well under terms and conditions specified by the MDEQ will be allowed. All information necessary for the MDEQ determination described in this subsection shall be provided by the person seeking this exception.

(5) *Public Emergencies.* A Well may be used in the event of a public emergency. Notice of such use shall be provided to the MDEQ within a reasonable time thereafter.

SEC. 18-166. SOURCES OF WATER SUPPLIED FOR DOMESTIC USE AND IRRIGATION USE.

(1) For Affected Parcels that are not already connected to the City water system on the day of enactment of a Restricted Zone, the Applicant of the Restricted Zone shall be responsible for the costs to connect those Affected Parcels within that Restricted Zone to the City water system. Furthermore, for Affected Parcels that have a Well on the day of enactment of a Restricted Zone which is used primarily for Irrigation Uses, the Applicant of the Restricted Zone shall be responsible for the costs to connect the irrigation system on the Affected Parcel within that Restricted Zone to the City water system.

(2) This Section shall not be deemed as affecting the rights and remedies of an Owner, or any other person or entity and/or of any federal, state or local government that may exist under any law, regulation, rule, ordinance, order, agreement and or/remedial action plan addressing groundwater within the City.

(3) In no event shall the City be required to incur any expense or cost under this Ordinance, except as may otherwise be approved by the City Council for a public works project or by a separate agreement with the Applicant, Owner, other person or entity, or a governmental body or agency.

SEC. 18-167 ENFORCEMENT. The City Manager, or his/her designee, shall be the official having the authority to enforce this Ordinance. After the Effective Date of this Ordinance, the enforcement official shall contact all Owners of Affected Parcels, which from the information available to the City, appear to have Wells prohibited under this Ordinance, giving written notice of the need to cease using such Wells and of the need for establishment of a Domestic Use water source as prescribed under Section 6, or to obtain approval or acknowledgment of an exception under Section 5. The Owner shall immediately take steps so as to comply with the provisions of this Ordinance with regard to provision of Domestic Use water within sixty (60) days from the date of such notice. Any

existing Well in violation of this Ordinance shall then be plugged or abandoned in conformance with applicable legal requirements. Where, upon information available to the enforcement official, it is suspected that a Well is being used on an Affected Parcel in violation of this Ordinance, the enforcement official may inspect such Affected Parcel and serve an appropriate notice and order of such violation requiring that action be taken promptly by the Owner to bring the Affected Parcel into compliance. If the Owner fails to act in accordance with such order, the enforcement official my seek remedies and penalties as provided in Section 8.

SEC. 18-168. PENALTY. Any person who violates any provision of this Ordinance shall be liable for a municipal civil infraction under the provisions of City Code Sec. 1-7. In addition, the City may seek an order from a court of appropriate jurisdiction requiring compliance with this Ordinance and may also seek collection of costs and attorney fees associated with such enforcement action. Any violation of this Ordinance is a public nuisance, subject to abatement, and any Well in violation of this Ordinance shall be immediately taken out of service and lawfully abandoned in compliance with applicable legal requirements. A court of competent jurisdiction may order any person violating any provision of this Ordinance to properly and lawfully remove or abandon a Well.

SEC. 18-169. BUILDING AND ZONING PERMITS. No permit for the construction or alteration of a building or structure nor any permit for any zoning approval shall be issued by the City Building and Zoning Administrator for any improvement on an Affected Parcel which has, or proposes, a water supply from a Well in violation of this Ordinance.

SEC. 18-170. ADMINISTRATIVE LIABILITY. No officer, agent or employee of the City or member of the City Council shall render himself or herself personally liable for any damage which may occur to any person or entity as the result of any act or decision performed in the discharge of his or her duties and responsibilities pursuant to the Ordinance.

SEC. 18-171. AMENDMENT; REPEAL. The MDEQ, an Applicant, an Owner, an entity involved in a RAP or other interested party may request in writing to add parcels to or delete parcels from a Restricted Zone or to establish an additional Restricted Zone or to otherwise amend or repeal this Ordinance, and shall provide advance notice to the MDEQ and any Applicant for such Restricted Zone of any proposed change hereunder, including the reasons supporting such request. The City on its own motion and upon advance notice to the MDEQ and any Applicant for such Restricted Zone, may also take action to amend or repeal this Ordinance as it deems appropriate. The amendment or repeal of this Ordinance shall be by an appropriate ordinance adopted in the same manner as this Ordinance, and any such action shall be in the sole legislative discretion of the City Council.

SEC. 18-172. NOTIFICATION OF LAPSE, OR INTENT TO AMEND OR REPEAL. At least thirty (30) days prior to any action regarding a proposed amendment or

repeal in whole or in part of this Ordinance, the City shall notify the MDEQ and any Applicant of its intent to so act. The City shall also notify the MDEQ and any Applicant that this Ordinance may lapse at least thirty (30) days prior to the Ordinance being allowed to lapse.

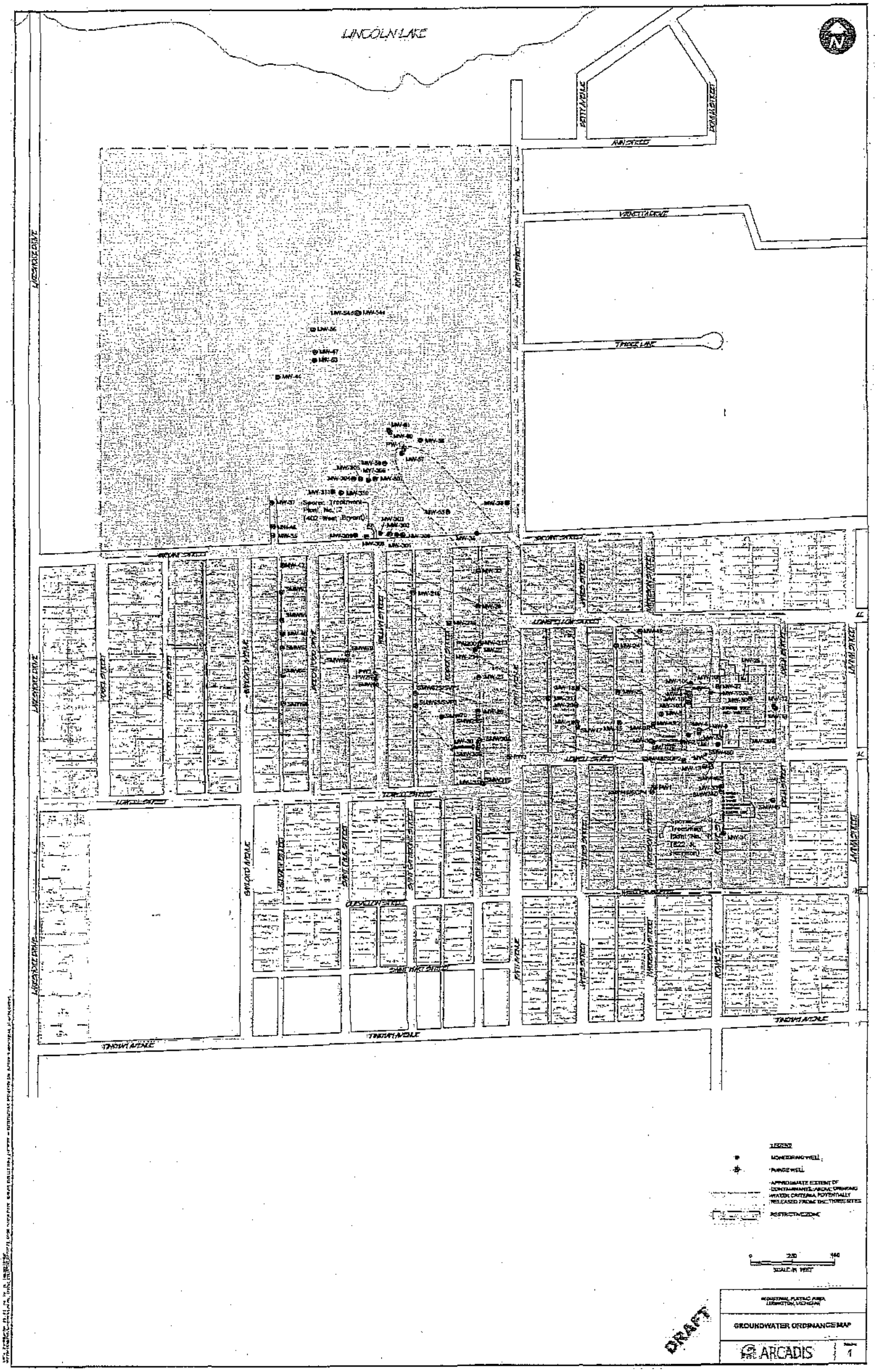
SEC. 18-173. SEVERABILITY AND CAPTIONS. If any article, section, subsection, sentence, clause, phrase, or portion of this Ordinance is held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct, and independent provision and such holding shall not affect the validity of remaining portions of the Ordinance, it being the intent of the City that this Ordinance shall be fully severable. The City shall promptly notify the MDEQ and any Applicant upon the occurrence of any event described in this section. The captions included at the beginning of each section are for convenience only and shall not be considered a part of this Ordinance.

SEC. 18-174. REPEAL. All resolutions, ordinances, orders or parts thereof in conflict in whole or in part with any of the provisions of this Ordinance are, to the extent of such conflict, hereby repealed.

SEC. 18-175. REIMBURSEMENT OF ADDITIONAL CITY CONSTRUCTION COSTS. The Applicant of a Restricted Zone shall reimburse the City for the reasonable additional costs the City incurs for dewatering Contaminated Groundwater or disposing of soils impacted by Contaminated Groundwater in connection with construction activity undertaken by the City on City property in that Restricted Zone, provided that the City supplies the Applicant with documentation confirming the amount and necessity of such additional costs, including the extent to which they exceeded the cost of dewatering or disposing of materials not impacted by Contaminated Groundwater.

SEC 18-176. EFFECTIVE DATE. This Ordinance shall take effect upon November 15, 2009.

This Ordinance is enacted by the City of Ludington, County of Mason, State of Michigan, at a meeting of the City Council held at CITY HALL, this 26TH day of OCTOBER, 2009.


LINCOLN LAKE
LEGEND
MONITORING WELL
PURGE WELL
APPROXIMATE EXTENT OF CONTAMINANTS ABOVE DRINKING WATER CRITERIA POTENTIALLY RELEASED FROM THE THREE SITES
RESTRICTIVE ZONE
0
250
SCALE IN FEET
GROUNDWATER ORDINANCE MAP
ARCADIS
1
DRAFT

CITY OF LUDINGTON
GROUNDWATER ORDINANCE

LEGAL DESCRIPTION OF RESTRICTED AREA

ASSESSORS PLAT OF SIXTH ADDITION:
Lots 14 - 33, Block 3
Lots 7-36,Block 4
Lots 1-40, Block 5
Lots 1-40, Block 6
Lots 1-42, Block 7

QUEVILLION'S ADDITION:
Lots 4 & 5, Block 12
Lots 1-3, Block 13

MANUFACTURER'S ADDITION TO THE CITY OF LUDINGTON:
Lots 1-28, Block 11
Lots 1-28, Block 12
Lots 1-28, Block 13
Lots 5-25, Block 14
Lots 1-28, Block 15
Lots 1-28, Block 16
Lots 1-28, Block 17
Lots 1-28, Block 18

THE NW 1/4 OF SECTION 10, T18N, R18W

City of Ludington, 400 S. Harrison St., Ludington, MI 49431

I, Deborah Luskin, hereby certify that I am the City Clerk, of the City of Ludington; and that the foregoing ordinance is a true and correct copy of the ordinance adopted by the vote of a majority of the members of said City of Ludington, present at meeting of said body on the 26th day of OCTOBER, 2009, at which a quorum was present.

Deborah L. Luskin

Deborah L. Luskin CMC
City Clerk
City of Ludington