- Technical Proposal -

EC-AOP Facility:
Tar Creek Remediation

Preliminary & Conceptual

Proposal: QP-EA0653

V1.0 – April 02, 2025

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TO: Mr. Wade Eno – Turtle Island Group

April 02, 2025

RE: Technical Proposal – EC-AOP Facility – Tar Creek Remediation

1. Introduction

The Tar Creek Superfund Site in northeastern Oklahoma is one of the most toxic legacy mining sites in North America, with over four decades of limited progress in addressing widespread contamination from lead, cadmium, zinc, manganese, and other heavy metals. The ongoing environmental and health risks continue to impact surrounding communities, particularly those within the Quapaw Nation and affiliated Tribal lands.

Turtle Island Group, in partnership with various Tribal and Aboriginal organizations, is actively seeking alternative, effective, and scalable technologies to accelerate the remediation of contaminated water and restore affected lands to safe, productive use. Lotic Technologies proposes a phased approach that will lead to the deployment of a 1000 gpm Electro-Catalytic Advanced Oxidation Process (EC-AOP) system to support these efforts.

The EC-AOP process has been successfully used to treat a wide range of contaminated waters, with demonstrated removal of hydrocarbons, organics, suspended solids, and most critically—heavy metals—through advanced oxidation, electrocoagulation, and in-situ hydroxyl radical generation.

Phased Implementation Strategy

To ensure treatment effectiveness, regulatory acceptance, and community alignment, the proposal includes the following three stages:

- **Phase 1 – Bench Testing:** Contaminated water from Tar Creek is shipped to Lotic Technologies' facility in Canada for small-scale EC-AOP testing. These tests will verify the technology's ability to remove site-specific contaminants (metals, organics, etc.) and generate verified third-party lab data.
- **Phase 2 – On-Site Pilot Project (25 gpm):** A mobile EC-AOP pilot unit will be deployed to Tar Creek for in-field testing and validation. This unit can be used to support EPA review, community demonstration, and permitting activities.

- **Phase 3 – Full-Scale Treatment Facility (1000 gpm):** Based on successful outcomes from Phases 1 and 2, Lotic Technologies will design and build a 1000 gpm EC-AOP remediation plant to continuously treat contaminated water from the site.

This proposal outlines the project scope, technology benefits, and potential outcomes of deploying EC-AOP as a powerful tool in the long-delayed cleanup of Tar Creek.

1.1 Background Information

The **Tar Creek Superfund Site** spans 47 square miles in northeastern Oklahoma and includes large portions of the **Quapaw Nation Reservation**. It is one of the oldest and most complex remediation sites under the EPA's Superfund program, stemming from decades of lead and zinc mining across the **Tri-State Mining District**, which includes parts of Oklahoma, Kansas, and Missouri. Mining operations ceased in the 1970s, but toxic drainage from mine shafts, tailings piles (locally referred to as "chat"), and contaminated runoff continues to impact **surface water, soil, and surrounding ecosystems**.

The site was added to the **National Priorities List in 1983**, and despite multiple efforts, much of the landscape remains visibly contaminated. Numerous creeks, tributaries, and agricultural lands within and beyond the Superfund boundary are affected, and cleanup efforts have progressed slowly, often constrained by federal funding, regulatory delays, and fragmented oversight.

Turtle Island Group, working in partnership with Tribal leadership and local stakeholders, has taken an active role in identifying **alternative remediation technologies** that can address contamination more effectively and with greater community involvement. The goal is to **restore impacted lands to safe and productive use**, particularly in support of **agricultural revitalization and Tribal food sovereignty**.

Key contaminants of concern include:

- Lead
- Cadmium
- Zinc
- Arsenic
- Manganese
- Iron and other metals
- Suspended solids and sediments
- Low-level hydrocarbons and organics from runoff and waste materials

Lotic Technologies has proposed its EC-AOP treatment system as a scalable solution that can directly treat contaminated surface or mine-influenced waters, removing metals and other pollutants efficiently, while producing minimal waste and requiring limited chemical input. The proposed three-phase implementation allows stakeholders—including the EPA and Tribal environmental departments—to validate performance, confirm regulatory alignment, and scale the solution responsibly.

This background provides the foundation for a treatment approach that combines proven technology with Indigenous-led environmental stewardship, offering a path forward for one of the longest-standing remediation challenges in the United States.

1.2 Proposal Overview & Methodology

Lotic Technologies proposes a three-phase approach to support the treatment of contaminated water at the Tar Creek Superfund Site, leveraging its patented Electro-Catalytic Advanced Oxidation Process (EC-AOP). This methodology allows for early-stage validation, pilot-scale demonstration, and ultimately full-scale deployment—all while engaging regulatory agencies and Tribal leadership in a structured, results-driven process.

Phase 1 – Bench Testing (Offsite, Lotic Lab in Alberta, Canada)

The first phase involves shipping contaminated water samples from Tar Creek to Lotic Technologies' laboratory in Leduc, Alberta. Controlled bench testing will be performed on small volumes to assess the EC-AOP system's ability to remove:

- Heavy metals (e.g., lead, cadmium, zinc, arsenic, manganese)
- Suspended solids and turbidity
- Hydrocarbons or organic residues (if present)
- Other site-specific contaminants identified in collaboration with stakeholders

Treated and untreated samples will be sent for third-party laboratory analysis, and results will be compiled into a formal Bench Test Report to support Phase 2 planning and regulatory engagement.

Phase 2 – On-Site Pilot Deployment (25 gpm EC-AOP Unit)

If requested by the EPA, the Quapaw Nation, or other decision-making entities, Lotic Technologies will deploy its 25 gpm mobile EC-AOP pilot system to Tar Creek for an on-site treatment demonstration. This pilot phase will:

- Validate system performance under field conditions
- Generate data on sludge characteristics and waste handling requirements
- Demonstrate scalability, operational simplicity, and flexibility
- Build confidence with regulators and the community

Pilot operations typically run for several weeks and are fully supported by Lotic's engineering and field operations teams.

Phase 3 – Full-Scale Deployment (1000 gpm EC-AOP Facility)

Following successful testing and stakeholder alignment, Lotic Technologies will design, fabricate, and commission a permanent 1000 gpm EC-AOP treatment facility to provide continuous remediation of contaminated water at Tar Creek. The system will be:

- Engineered for long-term operation with modular components
- Designed to integrate into existing or planned site infrastructure
- Capable of treating a wide range of water qualities and flow rates
- Supported by Lotic's long-term service and technical support

The EC-AOP technology combines advanced oxidation, electrocoagulation, and catalytic processes to deliver broad-spectrum contaminant removal with low chemical consumption and minimal waste generation. The methodology prioritizes transparency, performance validation, and phased investment—ensuring the approach remains aligned with community goals and environmental compliance at each step.

1.3 Project Theory

The Electro-Catalytic Advanced Oxidation Process (EC-AOP) is a patented, hybrid electrochemical treatment technology that combines multiple oxidative and coagulative mechanisms within a single continuous-flow reactor. The system is uniquely suited to address the complex and persistent contamination observed at Tar Creek, particularly the presence of heavy metals, inorganic colloids, and residual organics resulting from mining operations.

EC-AOP integrates three primary mechanisms:

1. **Electrocoagulation (EC):**
   Direct current is applied across sacrificial anodes and inert cathodes, typically composed of aluminum or iron-based alloys. This initiates in-situ release of metal cations (e.g., Al^{3+} or Fe^{2+}), which rapidly hydrolyze to form amorphous hydroxide flocs. These flocs have high surface area and charge-neutralizing capacity, promoting:
   - **Adsorption and entrapment of dissolved metals**
   - **Charge destabilization of suspended solids**
   - **Facilitated settling of colloidal particulates**
2. **Advanced Oxidation Processes (AOP):**
   Simultaneous with electrocoagulation, the reactor environment promotes the generation of hydroxyl radicals (•OH) via:
   - Direct water electrolysis at the anode
   - In-situ ozone injection and decomposition ($O_3 \rightarrow O_2 + \bullet O + \bullet OH$)

- Catalytic enhancement via transition metal oxides on the electrode surface

Hydroxyl radicals are highly non-selective oxidants with a redox potential of +2.8 V, capable of degrading:

- Complex organic molecules, including PAHs and hydrocarbon residues
- Low molecular weight organics contributing to COD/BOD
- Biological contaminants, if present (though not a primary concern at Tar Creek)

3. **Electrochemical Metal Precipitation:**
   The reducing conditions at the cathode surface facilitate the precipitation of certain metals (e.g., Pb^{2+}, Cd^{2+}, Zn^{2+}) through:
   - pH shift-induced hydroxide formation (e.g., $Pb(OH)_2$, $Zn(OH)_2$)
   - Reduction to zero-valent metal (e.g., As^{5+} to As^{3+} or As^0 under specific configurations)
   - Co-precipitation and incorporation into floc matrices for effective removal via sedimentation or filtration

Contaminant-Specific Removal Theory

- **Lead (Pb^{2+}), Cadmium (Cd^{2+}), Zinc (Zn^{2+}), Manganese (Mn^{2+}):**
  Removed via simultaneous adsorption to metal hydroxide flocs and precipitation as insoluble hydroxides. Removal efficiency is enhanced under EC-AOP due to dynamic pH elevation and strong floc generation.
- **Arsenic (As^{3+}/As^{5+}):**
  EC-AOP supports redox cycling of arsenic species and subsequent co-precipitation with iron or aluminum hydroxides. Oxidized arsenate (As^{5+}) is more readily removed via adsorption and precipitation than arsenite (As^{3+}), which is converted in-situ under oxidative conditions.
- **Suspended Solids & Turbidity:**
  Colloidal particles are destabilized via electrostatic charge neutralization and physically enmeshed within growing floc aggregates. These aggregates settle out rapidly in post-treatment clarification.
- **Organic Compounds (if present):**
  Hydroxyl radicals generated in the reactor are capable of non-selective oxidation of organic contaminants, including:
  - Polycyclic aromatic hydrocarbons (PAHs)
  - Residual hydrocarbons or diesel-range organics
  - Chelating agents that may otherwise interfere with metal removal
- **pH & Conductivity Management:**
  The EC-AOP system is tolerant to a wide range of feedwater pH values and automatically adjusts the redox and pH conditions within the reactor. It does not require significant pre-neutralization. Conductivity is typically elevated in mining-impacted waters, which enhances treatment efficiency by lowering electrical resistance and improving current distribution.

Waste Stream Characteristics

The process generates a compact, mineral-rich sludge composed of:

- Metal hydroxides (e.g., $Al(OH)_3$, $Fe(OH)_3$)
- Precipitated target metals (e.g., Pb, Zn, Cd, As)
- Entrapped particulates and inert silts

Sludge is dewaterable via conventional means and suitable for offsite disposal in accordance with RCRA or local hazardous waste regulations. The volume and mass of the residuals are significantly lower than traditional chemical coagulation methods.

2. Project Scope

The scope of this project encompasses three distinct phases, each contributing to the overall objective of implementing an EC-AOP facility for the treatment of contaminated water. These phases include the Pilot Project, Design of the Commercial Facility, and Manufacture and Delivery of the Facility.

Phase 1: Pilot Project

The initial phase of the project focuses on conducting a small-scale pilot project to validate the effectiveness of the EC-AOP technology in treating produced water. The Pilot Unit, a 25gpm EC-AOP unit, will be shipped to the designated location where it will be installed and operated. The pilot project will provide critical data on the technology's performance, including its ability to remove contaminants, achieve water clarity, and meet regulatory standards. The project team will closely monitor the pilot project, collecting data, and analyzing the results to optimize the treatment process for commercial applications.

Phase 2: Design of the Commercial Facility

Building upon the success of the pilot project, Phase 2 involves the comprehensive design of the commercial-scale EC-AOP facilities. (FEED-Phase) The design phase will consider various factors, including the specific characteristics of the water source, the desired treatment goals (industrial re-use, agricultural irrigation or safe disposal), and the anticipated water volumes. The project team will develop detailed engineering plans, incorporating the necessary infrastructure, treatment equipment, and monitoring systems to ensure the facility's efficiency, reliability, and compliance with regulatory requirements. Ancillary equipment, including applicable and selected polishing equipment will be sourced based on the feasibility and results of the Pilot. Formal Selection of final polishing will also be completed during this phase.

Phase 3: Manufacture and Delivery of the Facility

Once the design phase is complete, Phase 3 entails the manufacturing and delivery of the EC-AOP facility or facilities. Equipment, including the EC-AOP units, will be manufactured or procured according to the design and FEED specifications. The project team will oversee the quality control processes, ensuring that all components meet the required standards. Upon completion, the facility will be shipped to the designated location and installed by a team of qualified technicians. Rigorous testing and commissioning procedures will be carried out to verify the facility's proper functioning and adherence to performance parameters.

2.1 Technology Description

Lotic Technologies Inc. is proposing to Pilot its' proprietary EC-AOP technology, in conjunction with novel follow-up technologies to further polish the produced water to required standards.

Preliminary Commercial Facility:

Magneto-Pre Treatment	EC-AOP	Lamella Clarifier or Floc Tanks	Filter Pot	Activated Carbon (Biochar)
- Reduces ability of water to hold dissolved solids. - Begins breakdown of organics by affecting the Hydrogen Bonds - Improves EC-AOP & RO Efficiencies	- High Oxidation - Breakdown of Organic Constituents - Destruction of Bacteria, Pathogens, Viruses, Micro-Organisms - Breakdown of long chain molecules, such as Aromatics, BTEX, etc. - Reduction of Nitrates, Phosphates, Sulphates - Oxidation and flocculation of Heavy Metals	- Mechanical Separation of clarified Water and Sludge	- Mechanical Separation of clarified Water and Sludge	- Residual Ammonia Removal - Residual Chloride Removal - Residual Heavy Metal Removal

Electro-Catalytic Advanced Oxidation Technology (EC-AOP)

The EC-AOP (Electrocoagulation-Advanced Oxidation Process) technology offers several significant advantages for the treatment of produced water in the context of agricultural irrigation or safe disposal. These advantages can greatly enhance the overall efficiency, effectiveness, and sustainability of the treatment process.

Effective Contaminant Removal: EC-AOP combines electrocoagulation and advanced oxidation processes to effectively remove a wide range of contaminants from produced water. The electrocoagulation process destabilizes and aggregates suspended solids, oils, and greases, facilitating their removal through flotation or sedimentation. The advanced oxidation process then utilizes powerful oxidants to break down organic and inorganic contaminants, including hydrocarbons and various toxic substances. This dual mechanism ensures comprehensive and efficient contaminant removal.

Versatility and Adaptability: EC-AOP is highly versatile and can be tailored to meet specific treatment requirements. The process can handle varying volumes and compositions of produced water, allowing for flexibility in treating different sources of water. The technology can be adjusted to target specific contaminants and adapt to changing water quality conditions. This versatility makes EC-AOP suitable for a wide range of applications, including the treatment of produced water for agricultural irrigation or safe disposal.

Reduced Chemical Usage: EC-AOP minimizes the reliance on chemical additives typically used in conventional treatment methods. The electrocoagulation process utilizes the inherent properties of sacrificial anodes to generate coagulants, eliminating the need for the addition of external coagulants. Furthermore, the advanced oxidation process harnesses powerful oxidants, such as hydroxyl radicals, to degrade contaminants, reducing the dependence on chemical oxidants. This reduction in chemical usage enhances the sustainability of the treatment process and minimizes potential environmental impacts.

Energy Efficiency: The EC-AOP technology is known for its energy efficiency compared to traditional treatment processes. The electrocoagulation process requires low voltage electricity for the generation of coagulants, while the advanced oxidation process utilizes efficient oxidation reactions. This energy-efficient design contributes to reduced operational costs and environmental footprint, making EC-AOP a sustainable solution for the treatment of produced water.

Minimal Residuals Generation: EC-AOP produces fewer residuals compared to conventional treatment methods. The electrocoagulation process generates relatively compact sludge, which can be easily separated and dewatered, minimizing the volume of waste generated. The advanced oxidation process converts contaminants into simpler and less toxic byproducts, reducing the overall environmental impact.

This aspect of EC-AOP ensures that the treatment process is not only effective but also environmentally friendly.

Compliance with Regulatory Standards: EC-AOP is designed to meet stringent regulatory standards for water quality and environmental protection. The technology can effectively remove contaminants to levels that meet or exceed regulatory requirements for agricultural irrigation or safe disposal. By employing EC-AOP, operators can ensure compliance with applicable regulations, avoiding potential fines or penalties associated with non-compliance.

OVERVIEW FOR LOTIC'S EC-AOP TECHNOLOGY

- Electro Catalytic Advanced Oxidation Process (EC-AOP) is a Water Treatment System ideal for highly loaded, difficult to treat waste waters.

- The patented technology combines Electro-Coagulation and magnetohydrodynamics, with In-situ Ozone injection in order to create a very powerful Oxidative environment in the reactor tank. The main ingredient created in the reactor tank is the Hydroxyl Radical – one of nature's strongest oxidant.

- Oxidants created are highly capable of destroying organic based molecules. These include carbon-based chains such as hydrocarbons, bacteria cell walls, and other organic pollutants such as pharmaceutical compounds and dyes. Bacteria, pathogens and viruses are 99.9% destroyed through the EC-AOP process.

- The process can help bring various Total Dissolved Solids constituents out of solution.

- The process promotes highly superior flocculation for various Heavy Metals. The flocculation of this material becomes a sludge that can be easily removed from the process stream by mechanical means. Sludge volumes are usually 2-5% per volume, dependent on the fluid.

- The process can reduce fluid hardness, and help bring pH closer to neutral.

- The EC-AOP does not require chemical additions, which means it has a far cheaper OPEX when compared to other water clarification technologies.

- Units are custom designed, engineered and manufactured by Lotic Technologies specifically for each project and its distinct fluid. This means that each particular fluid usually requires testing prior to a reactor design finalization.

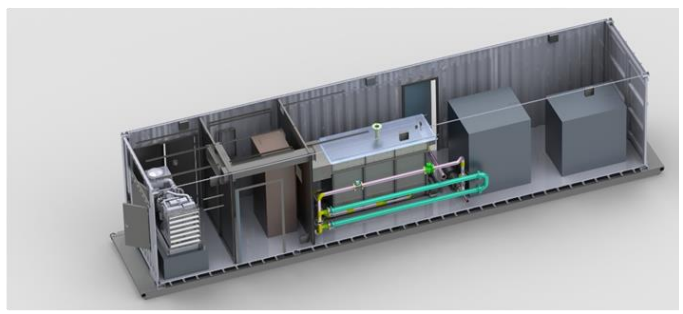
- Units can be custom built for virtually any flow-rate and volume of fluid. Units can be designed to be modular and portable, or permanent fixtures – either stand-alone or integrated into existing infrastructure.

- Depending on what a client is trying to achieve with their fluid, the EC-AOP can be either used as a stand-alone clarification product, or combined with other existing technologies for further clarification, which can also be sourced by Lotic.

- The EC-AOP can be utilized in virtually any industry that utilizes water.

- Each unit is designed and engineered to all pertinent Codes, Regulations, Specifications and Industry-Standards.


LOTIC
Fluid Treatment Plant
Electro-Catalytic




WT-1
Fluid Treatment Plant
Electro-Catalytic
Advanced Oxidation Process
www.lotictech.ca

2.2 Proposed Pilot Project

Lotic Technologies Inc and it's Partner, Turtle Island Group, will jointly provide the Pilot Project to the customer. This will include providing all technology and equipment, as well as commissioning the equipment on-site. Customer will be responsible for the cost of the Pilot Project, which will be on a monthly rate. There will be a One (1) Month minimum for equipment rentals. Customer will also be responsible for assisting in the safe tie-in to the facility, providing a fluid stream of 25gpm of produced water from the facility, and responsible for providing the Laboratory Analyses that will be required throughout the Pilot Project.

Follow-up polishing equipment will not be required during the Pilot Project, as the conditions and parameters of much of the available technology is widely known and utilized. Equipment will be chosen and sourced based on the results of the EC-AOP Pilot Project.

Ancillary equipment required will include:

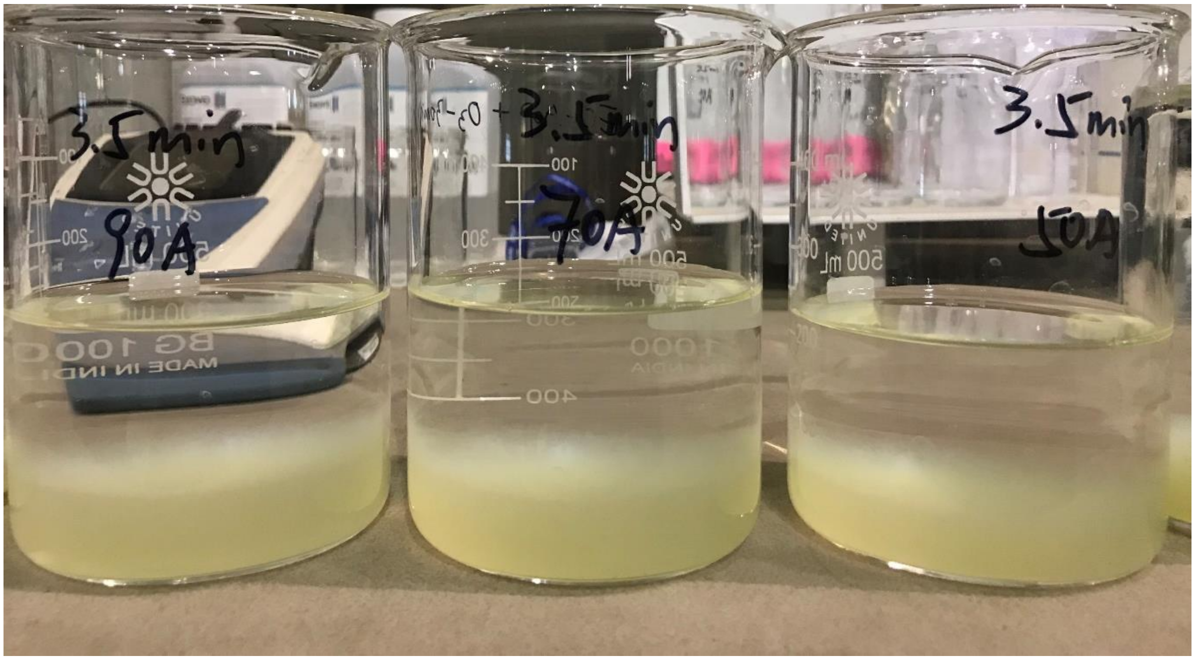
- Tie-in equipment for in-feed and effluent from the EC-AOP plant.
- Power Hook-up.
- Flocculation/Frac Tank

Lotic Technologies will be offering to mobilize its WT-2 Pilot Rental Plant to location as the EC-AOP Pilot Module:

- Portable Skid (Warm-Climate Spec)
- 25gpm EC-AOP Reactor Tanks housed in Skid
- 480V, 3Phase – General Classification Spec
- Air Cooled – DC Rectifier
- *Aqua-Rift* Mag-Tech Pre-Treatment System
- Spray-Bar Foam Suppression System Installed
- ATLAS Ozone Generator, c/w Nano Ozone Injection System – AIRSEP O2 Concentrator
- Ozone Safety Monitoring (Alarm) 0-5000ppb
- Includes Full Electrification/Instrumentation.
- Inc. Air-Conditioned Electrical Room w/ Dehumidification.

Municipal Wastewater

Parameter	Control	Treated sample	Removal
COD (mg/L)	149	35	76.5%
BOD (mg/L)	13	6	53.8%
TSS (mg/L)	41	9	78.0%
Ammonia (mg/L)	12.8	12.4	3.1%
TKN (mg/L)	17.3	13.5	22.0%
Phosphorus (mg/L)	2.37	<0.05	>97.9%
Calcium (mg/L)	77.2	34.5	55.3%
Magnesium (mg/L)	44.2	21.7	50.9%
Hardness (mg/L)	375	176	53.1%
Alkalinity (mg/L)	300	178	40.7%
Total Coliform (CFU/100mL)	20	1	95.0%
E.Coli (CFU/100mL)	10	1	90.0%



Oilfield Produced Water

Parameter	Control	Treated sample	Removal
Hardness (mg/L)	351	87	75%
Alkalinity (mg/L)	634	350	45%
Calcium (mg/L)	307	80	74%
Magnesium (mg/L)	48	5	89%
Silica (mg/L)	142	1	99%
Tannin (mg/L)	158	0	100%

Sample Description			Trucked Out Water 14-17-070-08W6M	Produced Water 1st Run 14-17-070-08W6M	Produced Water 2nd Run 14-17-070-08W6M
Date Sampled			07/28/2021	07/29/2021	07/29/2021
Parameter	**Unit**	**RDL**	**2794370**	**2799602**	**2799603**
Benzene	mg/L	0.0005	3.15	0.132	0.0021
Toluene	mg/L	0.0003	9.29	0.437	0.0066
Ethylbenzene	mg/L	0.0005	0.680	0.0135	<0.0005
Xylenes	mg/L	0.0005	9.01	0.225	0.0036
C6 - C10 (F1)	mg/L	0.1	119	1.0	0.1
C6 - C10 (F1 minus BTEX)	mg/L	0.1	97.1	0.1	0.1
C10 - C16 (F2)	mg/L	0.1	334	0.4	0.3
Toluene-d8 (BTEX)	%		125	126	119
o-Terphenyl (F2)	%		129	101	102
Sediment			Not Present	Trace	Not Present
Parameter	**Unit**	**RDL**	**2794370**	**2799602**	**2799603**
Total Aluminum	mg/L	0.004	0.4	0.6	3.5
Total Antimony	mg/L	0.001	0.058	0.004	0.055
Total Arsenic	mg/L	0.001	2.25	0.04	0.09
Total Barium	mg/L	0.05	4.46	5.18	5.10
Total Beryllium	mg/L	0.0005	<0.0040	<0.0040	<0.0040
Total Boron	mg/L	0.01	170	156	144
Total Cadmium	mg/L	0.000016	0.137	0.00064	0.00449
Total Chromium	mg/L	0.0005	<0.020	<0.020	<0.020
Total Cobalt	mg/L	0.0009	<0.0060	<0.0060	<0.0060
Total Copper	mg/L	0.0008	<0.020	<0.020	0.026
Total Iron	mg/L	0.1	0.7	<0.5	<0.5
Total Lead	mg/L	0.0001	<0.0001	<0.01	<0.01
Total Manganese	mg/L	0.005	2.80	1.95	1.26
Total Molybdenum	mg/L	0.001	<0.004	0.011	<0.004
Total Nickel	mg/L	0.003	<0.020	<0.020	<0.020
Total Phosphorus	mg/L	0.08	<0.50	<0.50	<0.50
Total Selenium	mg/L	0.0005	0.429	1.48	1.54
Total Silver	mg/L	0.00005	<0.0020	<0.0020	<0.0020
Total Sodium	mg/L	0.6	42100	42100	42200
Total Thallium	mg/L	0.0005	<0.0020	<0.0020	<0.0020
Total Titanium	mg/L	0.001	<0.1	<0.1	<0.1
Total Uranium	mg/L	0.001	<0.002	<0.002	<0.002
Total Zinc	mg/L	0.01	<0.4	0.5	<0.4

Parameter	Unit	RDL	2794370	2799602	2799603
Acid Producing Bacteria	cfU/mL		82000	2	1
Iron Reducng Bacteria	cfU/mL		9000	2200	8
Sulphur Reducing Bacteria	cfU/mL		2200000	2200000	1
COMPLETE WATER					
Parameter	**Unit**	**RDL**	**2794370**	**2799602**	**2799603**
TDS_CALC	mg/L		137326	139018	139082
TDS_180	mg/L		150200	147900	145900
pH			7.49	7.80	5.91
H2S	mg/L		1185.69	155.58	n/d
Relative Density (25C)	C		1.095	1.095	1.096
Refractive Index (25C)	C		1.3580	13580.0	1.3575
Resistivity (25C)	OHM.m		0.083	0.066	0.065
Salinity	%		13.53	13.96	13.97
Total Alkalinity (as CaCO3)	mg/L		1433.33	465.00	21.67
Chloride	mg/L / mmol/L		82100.0 / 2315.8	84700.0 / 2389.1	84800.0 / 2391.9
Bromine	mg/L / mmol/L		125.0 / 1.6	106.0 / 1.3	111.0 / 1.4
Iodine	mg/L / mmol/L		14.7 / 0.1	46.1 / 0.4	10.0 / 0.1
HCO3	mg/L / mmol/L		1748.7 / 28.7	567.3 / 9.3	26.4 / 0.4
SO4	mg/L / mmol/L		721.0 / 7.5	796.0 / 8.3	1230.0 / 12.8
CO3	mg/L / mmol/L		nil / nil	nil / nil	nil/ nil
OH	mg/L / mmol/L		nil / nil	nil / nil	nil/ nil
Sodium	mg/L / mmol/L		42200.0 / 1835.6	41900.0 / 1822.5	42400.0 / 1844.3
Potassium	mg/L / mmol/L		2190.0 / 56.0	2240.0 / 57.3	2250.0 / 57.5
Calcium	mg/L / mmol/L		8470.0 / 211.3	8340.0 / 208.1	7650.0 / 190.9
Magnesium	mg/L / mmol/L		786.0 / 32.3	763.0 / 31.4	739.0 / 30.4
Barium	mg/L / mmol/L		2.8 / Trace	2.8 / Trace	2.8 / Trace
Strontium	mg/L / mmol/L		471.0 / 5.4	452.0 / 5.2	457.0 / 5.2
Iron	mg/L / mmol/L		Trace / Trace	Trace / Trace	Trace / Trace
Cation/Anion Ratio			1.01	0.98	0.97

3. Project Cost

3.1 Phase 1a – Bench Testing (Option)

If possible, Lotic would request a 1bbl volume delivery of each sample to Lotic's facility in Leduc, Alberta, in order to perform fluid-specific Bench Testing through the EC-AOP. A standard oil barrel would be a sufficient minimum for the Project.

Lotic's EC-AOP Bench-Test unit is a directly scaled unit. Fluid processed through our Bench-Test unit can be directly correlated to a commercial sized unit.

Bench-Testing would consist of running 2 to 4 samples through the EC-AOP at specific reactor parameters. Lab analysis of the processed samples vs a control sample will greatly assist in determining feasibility of the technology. Lotic would utilize a 3rd party laboratory to perform analysis on both a Control and samples of EC-AOP treated fluid through various parameters. Laboratory data would then be shared with Shell to assist in determining EC-AOP feasibility.

Secondarily, this bench-testing phase will assist in the subsequent commercial design phase, and would also cut down on time/cost involved with commercial unit commissioning.

Upon receipt of initial lab analysis, subsequent bench-testing could be completed to further "fine-tune" the process parameters, and could yield further successful data.

Produced Fluid BENCH-TESTING – Basic Suite + Metals/BTEX: <u>$2,385.00 for Minimum Runs</u>
<u>$2,935.00 for Recommended</u>

- Bench Test Setup Charge - $1,400.00
- $275.00 per Test Batch
  - EC-AOP Bench Test Unit at Lotic Leduc Shop.
  - Includes Setup, Testing Technicians
  - Includes 3rd-Party Laboratory Testing
  - Minimum 3 Test Batches
  - Recommended 5 Test Batches
  - (1) Test Batch is CONTROL, Remainder Test Batches are different Parameter Runs.
- Environmental Disposal Surcharge - $160.00

	($USD)
Recommended Per Sample:	**$2,935.00**
Total Project (x3 Locations):	**$8,805.00**

** Pricing does not include Sample Delivery, VAT, Import/Export Fees or Taxes, and these costs are to be assumed by the customer.*

3.2 Phase 1b - Pilot Project

Lotic & Turtle Island will propose to offer this proposed Pilot Project to customer with the following Price Schedule.

EC-AOP Clarification Pilot Project:

	($USD)
Per Month Charge – EC-AOP Pilot Unit:	**$36,000.00**
Project Labour (Estimate, 1 Month):	**$39,600.00**

Price is mostly Turn-Key per month, and will include EC-AOP Pilot Unit and applicable Labour, including (2x) EC-AOP technicians.

Mobilization, inter-location moves, and demobilization of Pilot Unit is not included, and will be billed back to customer at Cost+15%.

Deposit equal to One-Half Month (USD $18,000.00) will be required and due at the time of Purchase Order in order to secure scheduling of EC-AOP unit. Deposit will be credited back to Customer at the finalization of the Pilot, less any pertinent damage costs to the Pilot Unit outside of expected normal wear and tear.

Any and all costs incurred that are not outlined in above, will be billed back at Cost+15%.

3.3 Phase 2 – Front End Engineering & Design

Following successful Pilot Project, Lotic will move into Phase 2 of the Project which includes the Front End Engineering & Design (FEED) for commercial facilities.

Facilities will be designed and engineered for the total commercial requirements of:

FEED Phase will also provide a final determination on ancillary equipment / options that are available and optimum for the proposed facility. Ancillary equipment would include determination on RO vs Deionization or other desalination if required, and determination on final Zero-Liquid Discharge, Sludge Dewatering etc.

Facility Engineering and Design – EC-AOP Clarification Facilities:

	($USD)
ESTIMATE:	**$550,000.00**

Price is inclusive for full Facility Design and Engineering to applicable Industry Standards.

Terms are 50% non-refundable deposit upon Service Order, 25% upon Issued for Approval (IFA) Package, and 25% upon approved Issued for Construction (IFC) Package.

3.4 Phase 3 – Commercial Facilities ESTIMATE

Costs herein are considered preliminary, and are based on discussions to date and preliminary designs.

All costs are subject to change as the project develops further.

BASE COST – PRELIMINARY DESIGN

	($USD)
ESTIMATE:	**$13,200,000.00**

Terms are 50% non-refundable deposit upon Service Order, 25% upon Completion and Ready for Delivery, and 25% upon Delivery and Facility Commissioning.

This cost estimate is inclusive of:

- EC-AOP Equipment
- Mechanical Sludge Separation – Lamella Clarifiers / Filtration
- Electrical, Instrumentation & Automation
- Piping, Valves, Pumps
- Master Control Room
- Installation, Construction & Commissioning Labour
- Execution Engineering Support & Project Management

This cost estimate does not include:

- Sludge Mitigation (Dewatering)
- Biochar or Activated Carbon Final Polishing
- Groundworks, Site Preparation or Building
- Facility Tie-In
- Mobilization of Equipment
- GST, VAT, Import/Export Duties, Taxes etc.