

# LAKE ARROWHEAD COMMUNITY SERVICES DISTRICT

## MEMORANDUM

**DATE:** MAY 26, 2020

**TO:** BOARD OF DIRECTORS  
Lake Arrowhead Community Services District

**FROM:** MATT BROOKS, Operations Manager  
CATHERINE CERRI, General Manager

**SUBJECT:** CONSIDER APPROVING AN EQUIPMENT LEASE AGREEMENT WITH KADANCE CORPORATION FOR A PILOT-SCALE DEMONSTRATION OF THE NANO2 MICRONIZED OXYGEN INFUSION SYSTEM AT THE WILLOW CREEK WASTEWATER TREATMENT PLANT

### A. RECOMMENDATION

It is recommended that the Board of Directors:

1. Approve an Equipment Lease Agreement with Kadance Corporation to move forward with a pilot-scale demonstration of the NanO2 micronized oxygen infusion system at the Willow Creek Wastewater Treatment Plant (WCWWTP); as outlined in the attached Equipment Lease Agreement and Scope of Work. The equipment lease rate is not to exceed \$15,000 per month and this includes the equipment, transportation, daily oxygen supply, and any special contract lab testing required. The project is anticipated project duration is 90 days.
2. Authorize the General Manager to execute the contract.

### B. REASON FOR RECOMMENDATION

Dudek, an engineering firm currently working with the District, has completed a process evaluation and data gap analysis for the Grass Valley Wastewater Treatment Plant (GVWWTP). This was Phase 1 of a multi-phase wastewater system improvement plan and was completed in July 2018. This phase evaluated individual unit processes at the plant for hydraulic capacity and capacity to perform its intended treatment. The analysis found that the trickling filters at the GVWWTP are a critical bottleneck for BOD removal and nitrification. In November 2019 Dudek completed the second phase of the project, a Consequence of Failure

Analysis for the District's wastewater treatment plants and "top five" most critical wastewater lift stations. This second phase was intended to identify and prioritize risks within these facilities, and to guide strategic O&M and capital investments for the District going forward. Again, one of the top recommendations from this second phase was to "Construct a supplemental treatment process to address BOD removal and nitrification deficiencies with the trickling filters."

Currently the District utilizes trickling filters at the GVWWTP as the lone biological process to achieve nitrification, the process by which ammonia is converted to nitrate. Nitrate is then later removed using denitrification filters. The trickling filters have been identified as a critical bottleneck for BOD and nitrogen removal, which results in ammonia passing through the trickling filters untreated and contributes to high effluent total nitrogen. Activated sludge processes can be modified and/or adjusted to address these nitrification limitations, however, the trickling filters do not have similar capabilities. This has left the District with a lack of options to address the nitrification issue.

Up to this point, the District's options to address the nitrogen removal issues have consisted of: construction of a new nitrifying polishing reactor (i.e. Microvi) to treat the ammonia load that passes through the trickling filters, or conversion of the biological process to activated sludge with biological nutrient removal (BNR) capabilities. While the Microvi technology is still being vetted, both options are known to carry significant capital and operational costs.

Dudek has developed a conceptual design for a system to address the nitrogen removal issues at the GVWWTP with improvements made to the WCWWTP site. Roughly 75% of the District's wastewater flows through the WCWWTP site before going to GVWWTP. Willow Creek WWTP currently consists of preliminary treatment (screenings and grit removal), a primary clarifier, and two storage ponds that can be used for flow equalization and/or emergency storage. The storage ponds are largely under-utilized because of issues with an ineffective mixing system, odor issues, and the need for manual operation.

The current concept before the Board consists of utilizing the storage ponds at the WCWWTP for equalization, aeration, and bio-augmentation to achieve flow and load stabilization, paired with nitrogen treatment ahead of the GVWWTP to reduce influent nitrogen concentrations to the plant and mitigate effluent total nitrogen violations that typically occur during holiday weekends. This concept design is predicated on the use of new technologies that do not yet have years of widespread use and development. Therefore, we recommend that the technologies and equipment are tested and vetted to determine if any performance issues exist, and the practical limitations of the technology. Ultimately, the data captured from the pilot testing are used to determine the requirements for a full-scale system, where the capital and operational costs can be compared to other alternatives for improved nitrogen treatment, such as the Microvi system. Both Dudek and LACSD staff are very excited about this concept, as it has shown very promising results in a similar pilot-scale study in San Luis Obispo recently.

### **C. BACKGROUND INFORMATION**

GVWWTP has historically struggled to meet its Waste Discharge Requirements (WDRs) during periods of fluctuating hydraulic (storm surges) and organic loadings (Holidays) and during times of extreme temperature fluctuations (seasonal changes). These issues have only worsened over the past 10 years since the expansion of the Plant's capacity at a time when we experienced the worst drought in California history. Rather than flows increasing as was once expected, flows to GVWWTP have rather decreased by approximately 34% (2018 vs 2011). This also means that flows to the wastewater collection system have also dropped by approximately 34%, and the wastewater is sitting much longer in the pipes before it arrives at the GVWWTP. This creates many issues for the treatment plant and treatment plant staff because the wastewater showing up at the doorstep to be treated is of much different strength and nature than that of what the treatment plant is/was designed to effectively handle. Unfortunately, the outcome of this scenario is at times a struggle to meet the WDRs imposed upon the District by the Regional Water Quality Control Board.

The existing biological treatment process at GVWWTP is very limited in control and does not respond well to fluctuating hydraulic and/or organic loadings, along with fluctuating temperatures. As mentioned before, these conditions are routinely seen at GVWWTP. This process is responsible for converting ammonia to nitrate, and later the nitrate is removed in another separate process prior to being discharged. Also, as mentioned before, because of lower collection system flows due to water conservation and the drought, influent ammonia strengths are routinely 25% higher than what they were 10 years ago, and up to 50% higher on Holidays.

Prior to being converted to a flow equalization plant in 2010, the WCWWTP used to have an "activated sludge" treatment process, a biological process, which also converted ammonia to nitrate. Under normal conditions, close to 75% of wastewater flows to WCWWTP prior to GVWWTP, and in the past this portion was pre-treated before it showed up at GVWWTP; thus assisting the GVWWTP biological process in converting ammonia to nitrate. This is no longer happening and as a result, at times of fluctuating loadings or temperatures, LACSD struggles to meet the WDRs.

### **D. FISCAL IMPACT**

This project is a budgeted item and will be funded by Fund 200 (Wastewater Operations) at a monthly lease rate not to exceed \$15,000. The equipment lease rate includes the equipment, transportation, daily oxygen supply, and any special contract lab testing required. The anticipated project duration is 90 days.

### **E. ENVIRONMENTAL IMPACT**

This does not qualify as a project under CEQA.

**F. ATTACHMENTS**

- Kadance/NanO2 Equipment Lease Agreement
- Kadance/NanO2 Scope of Work

## EQUIPMENT LEASE AGREEMENT

This Equipment Lease Agreement ("**Agreement**"), dated as of \_\_\_\_\_, 20\_\_\_\_, is by and between Kadance Corporation, a Minnesota corporation, with a mailing address of P.O. Box 4245, Hopkins, MN 55343 ("**Provider**"), and, a city in the State of California at a location described as \_\_\_\_\_ and a mailing address of \_\_\_\_\_ ("**User**," and together with Provider, the "**Parties**," and each, a "**Party**").

**WHEREAS**, Provider is in the business of selling water treatment equipment and related technology; and

**WHEREAS**, User desires to lease from Provider, and Provider desires to lease to User the equipment more specifically described in this Agreement.

**NOW, THEREFORE**, in consideration of the mutual covenants, terms, and conditions set forth herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Lease. Provider agrees to lease to User, and User agrees lease from Provider, the equipment described more fully in attached Schedule A (the "**Equipment**").

2. Transportation, Installation and Operation. User shall not remove the Equipment from User's address specified above without prior written approval of Provider. User shall allow Provider to enter User's premises at all reasonable times to locate and inspect the state and condition of the Equipment. User shall at its expense keep and maintain the Equipment in a good state of repair, normal wear and tear excepted, and shall use the Equipment only for its intended purpose and follow Provider's instructions regarding the use and maintenance of the Equipment.

User shall be responsible for all costs for installation, operation, de-installation and scheduled return of the Equipment. These costs include, but are not limited to installation, and removal costs of the Equipment during the Term. In addition, User, at its sole cost and expense, shall provide all utility services necessary for operation of the Equipment including water, electricity.

3. Rent. In consideration of User' right to possess and use the Equipment during the Term (as defined in Section 11), User shall pay the rent at the monthly rate specified in attached Schedule B ("Rent") in advance, on the first day of each calendar month during the Term (with the first month's rent, prorated, if necessary, due on the date of this Agreement first above written), without any set-off, offset, abatement, or deduction whatsoever in US dollars. User shall pay interest on all late payments at the lesser of the rate of 1.5%/ per month and the highest rate permissible under applicable law, calculated daily and compounded monthly. User shall reimburse Provider for all costs incurred in collecting any late payments, including, without limitation, attorneys' fees. Payment of any late charge does not excuse User of any default under this Agreement.

If by the expiration of the Term, User does not return the Equipment to Provider in the condition and on the terms and conditions of Section 7, User shall continue to comply with all the terms and conditions of this Agreement, including the obligation to pay 200% the prorated daily Rent for each day from the expiration of the Term until the date on which User returns such Equipment to Provider in the

manner required under Section 7 ("Holdover Rent"). User shall not construe anything contained in this Section, including User's payment of Holdover Rent, as Provider's (a) waiver of User's failure to perform any obligation under this Agreement; or (b) assent to any renewal of this Agreement..

4. Limited Warranty. At Provider's sole and exclusive option, Provider may replace the Equipment with identical or similar Equipment if the Equipment fails to operate in accordance with the manufacturer's specifications and operation instructions. Such replacement shall be made as soon as practicable after User returns the non-conforming Equipment. User shall return all non-conforming Equipment at its expense and risk of loss to Provider to the destination specified by Provider. Products manufactured by a third party ("**Third-Party Product**") may constitute, contain, be contained in, incorporated into, attached to, or packaged together with, the Equipment. Third-Party Products are not covered by the above limited warranty.

The limited warranty above does not apply where the Equipment has been subjected to abuse, misuse, neglect, negligence, accident, improper testing, improper installation, improper storage, improper handling, abnormal physical stress, abnormal environmental conditions, or use contrary to any instructions issued by Provider, or used with any Third-Party Product, hardware, software, or product that has not been previously approved in writing by Provider.

OTHER THAN AS SET FORTH ABOVE, PROVIDER MAKES NO WARRANTY WHATSOEVER, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY AGAINST INTERFERENCE; OR (d) WARRANTY AGAINST INFRINGEMENT OF ANY PATENT, COPYRIGHT, TRADEMARK, TRADE SECRET, OR OTHER PROPRIETARY RIGHTS OF A THIRD PARTY; WHETHER ARISING BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE, OR OTHERWISE. THE REMEDIES SET FORTH IN THIS SECTION 4 ARE USER'S SOLE AND EXCLUSIVE REMEDIES AND PROVIDER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH HEREIN.

5. Title and Risk of Loss. Title to the Equipment remains with Provider throughout the Term, and User shall acquire no right, title, or interest in the Equipment. User shall not pledge or encumber the Equipment in any way. User shall bear all risk of loss, damage, destruction, theft, and condemnation to or of the Equipment from any cause whatsoever ("**Loss**") until the Equipment has been returned to Provider to the destination specified in Section 7.1. User shall notify Provider in writing within three (3) days of any such Loss.

6. Precautionary UCC-1 Financing Statement. User authorizes Provider to file precautionary Uniform Commercial Code ("UCC") financing statements and other similar filings and recordings with respect to the Equipment. User agrees not to file any corrective or termination statements or partial releases with respect to any UCCs or other similar filings or recordings filed by Provider in connection with the Equipment except (i) if Provider fails to file a corrective or termination statement or release on request from User after the expiration or earlier termination of this Agreement or (ii) with Provider's consent.

7. Return of Equipment.

7.1 Obligation to Return Equipment. User shall, at its risk and expense, no later than the expiration of the Term (a) de-install, inspect, and properly pack the Equipment; and (b) return the Equipment, freight prepaid, to Provider's facility set out on the first page of this Agreement, or to such other location as Provider might designate, by delivering the Equipment on board such carrier as Provider may specify.

7.2 Condition of Equipment Upon Return. User shall cause the Equipment returned for any reason under this Agreement to (a) be free and clear of all liens (other than liens of Provider) and rights of third parties; (b) be in the same condition as when delivered to User, ordinary wear and tear excepted; (c) have all User's insignia or markings removed or painted over and the areas where such markings were removed or painted over refurbished as necessary to blend with adjacent areas; and (d) be in compliance with applicable law.

8. Compliance with Law. User shall (a) comply with all applicable laws, regulations, and ordinances and (b) maintain in effect all the licenses, permissions, authorizations, consents, and permits that it needs to carry out its obligations under this Agreement.

9. Indemnification. User shall indemnify, defend, and hold harmless Provider and its officers, directors, employees, agents, affiliates, successors, and permitted assigns (collectively, "**Indemnified Party**") against any and all losses, damages, liabilities, deficiencies, claims, actions, judgments, settlements, interest, awards, penalties, fines, costs, or expenses of whatever kind, including reasonable attorneys' fees, fees and the costs of enforcing any right to indemnification under this Agreement, and the cost of pursuing any insurance providers, incurred by Indemnified Party/awarded against Indemnified Party, relating to/arising out of or resulting from any claim of a third party or Provider arising out of or occurring in connection with the Equipment or User's negligence, willful misconduct, or breach of this Agreement. User shall not enter into any settlement without Provider's or Indemnified Party's prior written consent.

10. Insurance. During the term of this Agreement, User shall, at its own expense, maintain and carry insurance in full force and effect which includes, but is not limited to, commercial general liability insurance in a sum no less than \$1,000,000.00 with financially sound and reputable insurers. Such insurance shall provide all risks coverage for the Equipment as well as full coverage protecting Provider from any loss or damage to its employees, contractors, or agents suffer upon Provider's premises. Upon Provider's request, User shall provide Provider with a certificate of insurance from User's insurer evidencing the insurance coverage specified in this Agreement. The insurance policy endorsement shall name Provider as an additional insured and be signed by an authorized representative of the insurer. User shall provide Provider with ten (10) days' advance written notice in the event of a cancellation or material change in User's insurance policy. Except where prohibited by law, User shall require its insurer to waive all rights of subrogation against Provider's insurers and Provider.

11. Term and Termination. The term of this Agreement commences on the date of this Agreement and continues for a period of 60 days unless and until earlier terminated as provided under this Agreement (the "**Term**"). Either party may terminate this Agreement for any reason prior to the end of the Term upon thirty (30) day written notice to the other as provided in this Agreement. In addition to any remedies that may be provided in this Agreement, either Party may terminate this Agreement with

immediate effect upon notice to the other Party, if the other Party: (i) fails to pay any amount when due under this Agreement; (ii) has not otherwise performed or complied with any of the terms of this Agreement, in whole or in part; or (iii) becomes insolvent, files a petition for bankruptcy, or commences or has commenced against it proceedings relating to bankruptcy, receivership, reorganization, or assignment for the benefit of creditors. If User is in default of any of the terms and conditions of this Agreement, Provider, and its agents, at User's risk, cost, and expense may at any time/during normal business hours enter User's premises where the Equipment is stored or used and recover the Equipment.

12. Confidential Information. All non-public, confidential, or proprietary information of Provider, including, but not limited to, specifications, samples, patterns, designs, plans, drawings, documents, data, business operations, customer lists, pricing, discounts, or rebates, disclosed by Provider to User, whether disclosed orally or disclosed or accessed in written, electronic, or other form or media, and whether or not marked, designated, or otherwise identified as "confidential," in connection with this Agreement is confidential, solely for the use of performing this Agreement and may not be disclosed or copied unless authorized by Provider in writing. Upon Provider's request, User shall promptly return all documents and other materials received from Provider. Provider shall be entitled to injunctive relief for any violation of this Section. This Section shall not apply to information that is: (a) in the public domain; (b) known to User at the time of disclosure; or (c) rightfully obtained by User on a non-confidential basis from a third party.

13. Entire Agreement. This Agreement, including and together with any related exhibits, schedules, attachments, and appendices, constitutes the sole and entire agreement of the Parties with respect to the subject matter contained herein, and supersedes all prior and contemporaneous understandings, agreements, representations, and warranties, both written and oral, regarding such subject matter.

14. Survival. Subject to the limitations and other provisions of this Agreement: (a) the representations and warranties of the Parties contained herein shall survive the expiration or earlier termination of this Agreement; and (b) Sections 9, 10 and 12 of this Agreement, as well as any other provision that, in order to give proper effect to its intent, should survive such expiration or termination, shall survive the expiration or earlier termination of this Agreement.

15. Notices. All notices, requests, consents, claims, demands, waivers, summons, and other legal process, and other similar types of communications hereunder must be in writing and addressed to the relevant Party at the address set forth on the first page of this Agreement (or to such other address that may be designated by the receiving Party from time to time in accordance with this Section 15). All notices must be delivered by personal delivery, nationally recognized overnight courier (with all fees pre-paid), or certified or registered mail (in each case, return receipt requested, postage prepaid). A notice is effective only (i) upon receipt by the receiving Party and (ii) if the Party giving the notice has complied with the requirements of this Section 15.

16. Severability. If any term or provision of this Agreement is invalid, illegal, or unenforceable in any jurisdiction, such invalidity, illegality, or unenforceability shall not affect any other term or provision of this Agreement or invalidate or render unenforceable such term or provision in any other jurisdiction.

17. Amendments. No amendment to or modification of this Agreement is effective unless it is in writing and signed by an authorized representative of each Party.

18. Waiver. No waiver by any party of any of the provisions of this Agreement shall be effective unless explicitly set forth in writing and signed by the party so waiving. Except as otherwise set forth in this Agreement, no failure to exercise, or delay in exercising, any rights, remedy, power, or privilege arising from this Agreement shall operate or be construed as a waiver thereof, nor shall any single or partial exercise of any right, remedy, power, or privilege hereunder preclude any other or further exercise thereof or the exercise of any other right, remedy, power, or privilege.

19. Cumulative Remedies. All rights and remedies provided in this Agreement are cumulative and not exclusive, and the exercise by either Party of any right or remedy does not preclude the exercise of any other rights or remedies that may now or subsequently be available at law, in equity, by statute, in any other agreement between the Parties, or otherwise. Notwithstanding the previous sentence, the Parties intend that User's rights under Section 4 are User's exclusive remedies for the events specified therein.

20. Assignment; Successors and Assigns. User shall not assign, transfer, delegate, or subcontract any of its rights or obligations under this Agreement without the prior written consent of Provider. Any purported assignment or delegation in violation of this Section shall be null and void. No assignment or delegation shall relieve User of any of its obligations hereunder. Provider may at any time assign, transfer, or subcontract any or all of its rights or obligations under this Agreement [to any affiliate or to any person acquiring all or substantially all of Provider's assets] without User's prior written consent. This Agreement is binding on and inures to the benefit of the Parties to this Agreement and their respective permitted successors and permitted assigns.

21. No Third-Party Beneficiaries. This Agreement benefits solely the Parties to this Agreement and their respective permitted successors and assigns and nothing in this Agreement, express or implied, confers on any other Person any legal or equitable right, benefit or remedy of any nature whatsoever under or by reason of this Agreement.

22. Choice of Law and Choice of Forum. This Agreement and all matters arising out of or relating to this Agreement are governed by, and construed in accordance with, the laws of the State of Minnesota, without regard to the conflict of laws provisions of such State. Any legal suit, action, or proceeding arising out of or relating to this Agreement must be instituted in the federal courts of the United States of America or the courts of the State of Minnesota, in each case located in the City of Minneapolis and County of Hennepin, and each Party irrevocably submits to the exclusive jurisdiction of such courts in any such suit, action, or proceeding.

23. Waiver of Jury Trial. EACH PARTY ACKNOWLEDGES AND AGREES THAT ANY CONTROVERSY THAT MAY ARISE UNDER THIS AGREEMENT, INCLUDING EXHIBITS, SCHEDULES, ATTACHMENTS, AND APPENDICES ATTACHED TO THIS AGREEMENT, IS LIKELY TO INVOLVE COMPLICATED AND DIFFICULT ISSUES AND, THEREFORE, EACH SUCH PARTY IRREVOCABLY AND UNCONDITIONALLY WAIVES ANY RIGHT IT MAY HAVE TO A TRIAL BY JURY IN RESPECT OF ANY LEGAL ACTION ARISING OUT OF OR RELATING TO THIS AGREEMENT, INCLUDING ANY EXHIBITS, SCHEDULES, ATTACHMENTS, OR APPENDICES ATTACHED TO THIS AGREEMENT, OR THE TRANSACTIONS CONTEMPLATED HEREBY.

24. Limitation of Liability. **IN NO EVENT SHALL PROVIDER BE RESPONSIBLE OR LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, PUNITIVE, OR ENHANCED DAMAGES, LOST PROFITS OR REVENUES, OR DIMINUTION IN VALUE, ARISING OUT OF OR RELATING TO ANY BREACH OF ANY PROVISION OF THIS AGREEMENT, REGARDLESS OF (A) WHETHER SUCH DAMAGES WERE FORESEEABLE, (B) WHETHER OR NOT PROVIDER WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND (C) THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT, OR OTHERWISE) UPON WHICH THE CLAIM IS BASED, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE. IN NO EVENT SHALL PROVIDER’S AGGREGATE LIABILITY UNDER THIS AGREEMENT EXCEED \$1,000.00.**

25. Force Majeure. Provider shall not be liable or responsible to User, nor be deemed to have defaulted or breached this Agreement, for any failure or delay in fulfilling or performing any term of this Agreement when and to the extent such failure or delay is caused by or results from acts or circumstances beyond the reasonable control of Provider including, without limitation, acts of God, flood, fire, earthquake, explosion, governmental actions, war, invasion or hostilities (whether war is declared or not), terrorist threats or acts, riot, or other civil unrest, national emergency, revolution, insurrection, epidemic, lockouts, strikes or other labor disputes (whether or not relating to either party’s workforce), or restraints or delays affecting carriers or inability or delay in obtaining supplies of adequate or suitable materials, materials or telecommunication breakdown, or power outage.

26. Counterparts. This Agreement may be executed in counterparts, each of which is deemed an original, but all of which together are deemed to be one and the same agreement.

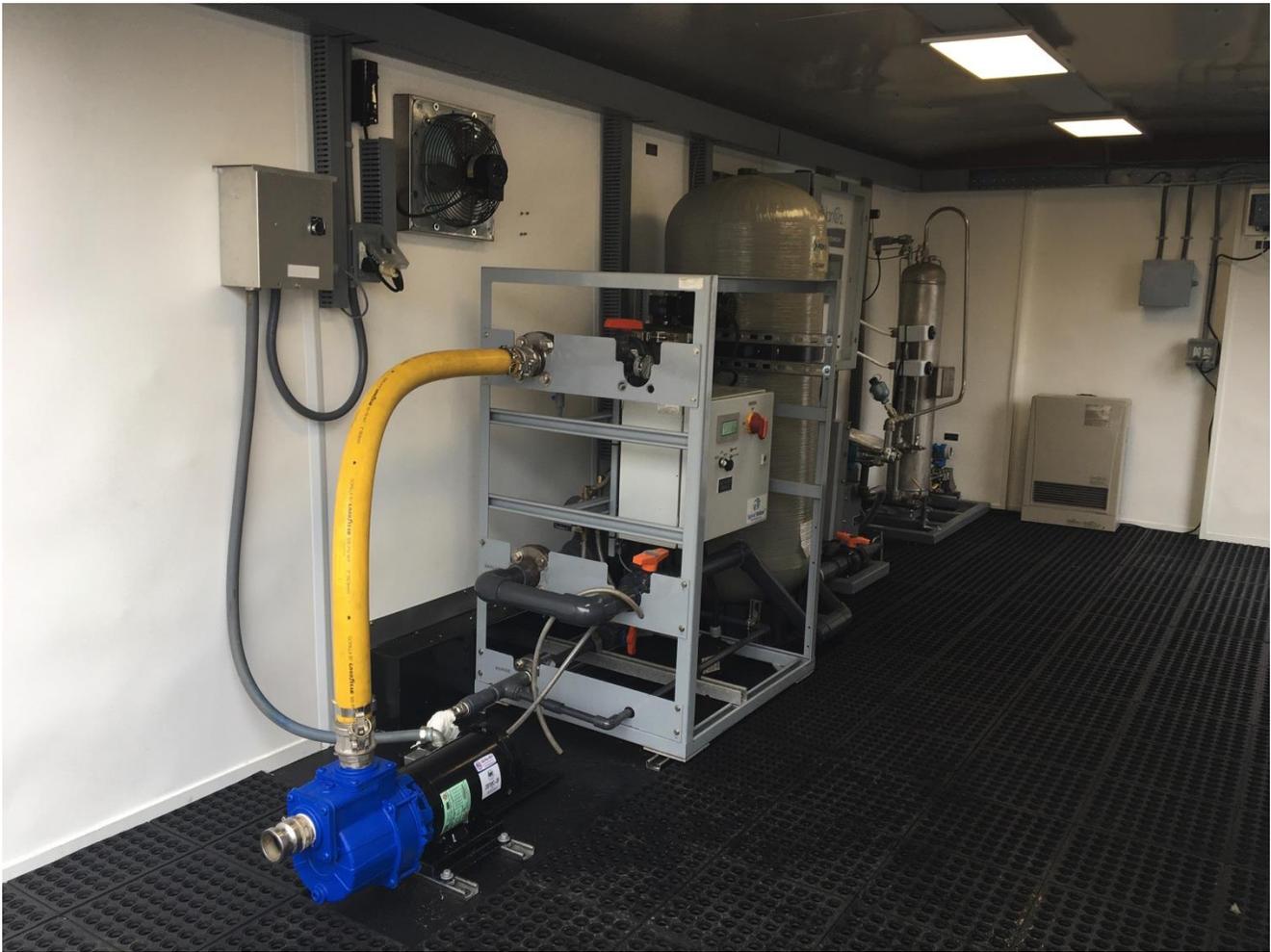
27. Headings. Headings in this Agreement are for convenience of reference only, and are not to be used in any interpretation of the agreement between the parties.

**IN WITNESS WHEREOF**, the Parties hereto have executed this Agreement as of the date first above written.

<b>LAKE ARROWHEAD CSD</b>	<b>KADANCE CORPORATION</b>
By _____ Name: Title:	By _____ Name: Greg Patterson Title: President

## SCHEDULE A DESCRIPTION OF EQUIPMENT





## **SCHEDULE B RENT**

User shall pay as Rent for the use of the Equipment, Transportation, Daily Oxygen Supply, and any special Contract Lab Testing a monthly the sum not to exceed \$15,000.00 payable on or before the first day of every month. If any Rent payment shall be unpaid for more than five (5) days after the due date thereof, User will pay on demand, as an additional later service and/or overhead charge, but not as interest, on amounts not paid when due, the greater of \$25.00 or an amount equal to 5% of any such unpaid amount but in no event to exceed maximum lawful charges. Upon the expiration of the term of this Agreement, and until return to Provider of all equipment leased hereunder, this Agreement shall remain effective and shall become a month-to-month Agreement between the parties on the terms and conditions, including Holdover Rent, as provided in the Agreement.

# **Kadance NanO<sub>2</sub> Demonstration Project**

## **Lake Arrowhead CSD – Willow Creek WWTP Site**

### **Scope of Work:**

Kadance Resources, Inc. proposes to perform a demonstration pilot test of the Kadance/NanO<sub>2</sub> micronized oxygen infusion system to significantly reduce process loading and related energy demand in the District's wastewater infrastructure between Willow Creek and Grass Valley Treatment Plants.

The demonstration project utilizes a mobile demonstration unit with auxiliary pressurized pure oxygen to inject a pure oxygen emulsion into sewage and treatment systems. Non-buoyant, emulsified oxygen will be infused into primary effluent at the Willow Cr. WWTP plant site.

This will be done to demonstrate efficacy of oxygenation and electro-chemical treatment of contaminants during the first two weeks after installation, then, assuming preliminary efficacy is demonstrated, extend to a full 60-90-day period under a rental/user agreement to measure additional benefits in the system for odor and algae control at Willow Creek, as well as measurable load reductions to the Grass Valley treatment plant.

The goals of the project are:

- 1) Reduce Ammonia-N and BOD loading at Willow Creek to reduce the overall loading through the intertie to Grass Valley WRF via innovative and cost-effective load reduction
- 2) Reduce historical odor and algae nuisance in the emergency storage and equalization ponds at Willow Creek,
- 3) Possibly demonstrate in-pipe treatment and load reduction of Ammonia-N and BOD in the intertie main between Willow Creek and Grass Valley

The outcome of the project is expected to demonstrate improvement in process cost control at Grass Valley via reductions in energy and chemicals, recovered capacity to minimize future capital improvements, and improve process stability and discharge compliance. By reducing expenditures for non-renewable resources and major capital improvements, the District will realize improved financial flexibility to meet changing demands, economic variables and related pressures on user rates and debt burden.

The District is in the on-going process of planning and implementing Capital Improvement Program (CIP) projects that address issues of treatment process efficiency and capacity upgrades, including in the secondary and tertiary processes at Grass Valley. Along with other upgrades, these processes command a significant demand on the electrical supply for recirculation pumping and UV disinfection and other

associated costs, such as maintenance and denitrification chemical addition. The District is interested in investigating additional technologies to enhance energy efficiency in the current and upgraded processes, more easily and economically meet stringent nitrogen discharge standards and recover lost treatment capacity associated with increased sewage strength. The NanO<sub>2</sub> oxygenation technology is expected to enhance the energy performance of the trickling filter system and overall loading to the secondary and tertiary treatment systems.

This proposal describes a short duration field test hosted by the District, using a NanO<sub>2</sub> demonstration rig to assess the application efficacy and demonstrate reliability and economic benefits for purposes of gaining approval of a new, alternative treatment technology. A framework for a pilot test is presented here to address those issues, and to demonstrate proof of concept, control and economy. The initial pilot field test will provide valuable insight and data to facilitate sizing and design of full-scale systems to achieve the future performance and capacity goals and will demonstrate potential energy savings achievable through the technology.

Kadance will coordinate with the District, Dudek and Alternative Energy Systems Consulting, Inc. (AESC) to participate in measuring and validating the efficacy and economy of the process. A similar successful project has been underway in San Luis Obispo for the past three months. The opportunities in Lake Arrowhead provide a new perspective and measurable benefit of a unique method treatment of contaminants that may reduce energy demands for secondary/tertiary treatment by over 30% and increase the rated capacity and reliability of the existing system without major capital expansion.

### **The Concept of Micro-Nanobubble Emulsion Infusion**

The Kadance/NanO<sub>2</sub> oxygen infusion technology brings a new level of oxidation technology to wastewater treatment. With the Kadance/NanO<sub>2</sub> Infusion Technology, oxygen can be delivered as a super-saturated solution (>800 mg/L) via simple, low-pressure piping. This avoids the capital expense normally associated with high-pressure/high-volume blowers and a complex, expensive array of pneumatic piping, pressure control valves and diffuser systems. The availability of pure oxygen emulsion reduces tank volumes, increases oxygen transfer in both trickling filters and activated sludge processes, reducing capacity demands and tankage requirements.

### **Goals**

The goals of the project are as follows:

#### **1) Phase I: Efficacy and Performance Test:**

- a) Demonstrate efficacy for 2 weeks of infusing pure oxygen into primary effluent at Willow Creek
- b) Extend the pond treatment strategy for 60-90 days to measure Ammonia and BOD removal while concurrently controlling odors and algae growth in one pond;
- c) Mitigate nuisance impacts related to algal growth and the release of hydrogen sulfide (H<sub>2</sub>S) from stored sewage in the Willow Creek ponds

- d) Electro-chemically reduce ammonia and volatile organics produced in the primary effluent and mitigate transfer of energy demand at the Grass Valley plant related to dissolved sulfide, ammonia and volatile fatty acids;

## **2) *Optional Phase II: In-Pipe Intertie Treatment Test***

- a) Provide in-pipe treatment of the raw sewage or primary effluent conveyed through the Willow Creek site, but discharged directly to Grass Valley
- b) Mitigate the toxicity and high Ammonia-N loading to and capacity loss in the trickling filter at the Grass Valley process related to ammonia and soluble organic acids.
- c) Reduce denitrification chemical demand (methanol) by eliminating up to 50% of the ammonia which is otherwise converted to nitrate
- d) Improve UV performance by oxidizing complex molecules that otherwise absorb UV energy during disinfection
- e) Reduce trickling filter recirculation energy by enabling ammonia reduction without the need for high dilution rates

## **Tasks**

The following tasks summarize the proposed scope of work and anticipated general activities related to each scope task.

### **Task 1 – Define process objectives and installation configuration**

- Coordinate with the District and peer partners to define the project charter, scope, schedule, and budget;
- Develop accurate baseline conditions in terms of energy and wastewater characteristics;
- Develop a robust sampling and monitoring plan;
- Establish a peer-review study group roster and circulate sampling and monitoring plan for approval and to solicit feedback and input (optional);
- Gather additional site data to prepare for delivery of trailer demonstration unit;
- Create a calendar for project implementation and completion;
- Define final report outline and structure for District review.

### **Task 2 – Deployment, installation, and commissioning**

- Install power data loggers on NanO2 Demonstration System, potentially affected electro-mechanical equipment at Willow Creek and Grass Valley treatment plants;
- Support installation and commissioning of the NanO2 system at the Willow Creek headworks and operate for 14 days to demonstrate initial efficacy in providing oxygen emulsion to the pond (elevated, sustainable DO), initial chemical oxidation of Ammonia-n and elimination of dissolved sulfides in the primary effluent.
- Extend the performance period under a rental use agreement to the pond for up to 30-60 days, then relocate to the intertie for an additional 15-45days;
- Verify sampling procedures to analyze impacts of oxygen infusion;
- Conduct site visit to observe, discuss, and troubleshoot installation and project performance with staff;

### **Task 3 – Measurement and Analysis**

- Coordinate sampling collection and analysis by the plant laboratory for timely and consistent measurement of impact;
- Evaluate sampling and energy data to determine effectiveness and efficacy;
- Perform process calculations to model conditions in the wastewater treatment plant;
- Evaluate post-intervention energy savings and normalize to nutrient loading for full scale implementation;
- Draft Emerging Technologies study report development for consideration by SCE for partial funding of permanent installations, including recommended additional application characteristics for future evaluation.

### **Task 4 – Improvement and Refinements, and Final Report**

- Adjustment in treatment processes and energy usage at Grass Valley
- Other as-needed operations support services;
- Estimate costs of full-scale implementation;
- Estimate benefits of additional site installations;
- Produce final report for District and SCE, including recommendations for additional site installations for future efficacy and efficiency testing.

### **Task Deliverables**

- Task 1: Baseline conditions memorandum; project schedule; draft Final Report outline
- Task 2: Documentation of sampling and monitoring plan
- Task 3: Draft report to document energy and process implications of pilot study
- Task 4: Final report

### **Responsibilities**

#### **1. NanO<sub>2</sub> Demonstration Facility operation, monitoring and servicing by Kadance/NanO<sub>2</sub> with labor assistance via District**

1. System monitoring and control
  1. Hydraulic feed rate and source selection
    1. Potable service water
      1. Hydraulic limitations?
  2. Inlet strainer/filter/PRV maintenance
  3. Pressurized oxygen feed rate
  4. NanO<sub>2</sub> production
  5. Programmer control and remote signal (Hotspot or Wi-Fi)
2. Process coordination with District
  1. Regulate flow & processing rate re: pumping rates and/or times

2. Provide resources, labor, recommendations and guidance for preparation of bio-augmentation products
3. Provide weekly status report and 1-week look-ahead
- 2. Install Primary Bypass and Holding Tank for NanO<sub>2</sub> Demonstration Unit - District**
  1. Install a baffle and submersible feed pump in the primary effluent launder
  2. Install a black, polypropylene tank (probably 2,000gallons) near the primary clarifier for oxygen infusion and return to the primary launder
  3. Provide electrical and feedwater supply to the NanO<sub>2</sub> unit
  4. Provide as-needed support and site inspection labor for monitoring and observation
- 3. Energy monitoring and related metrics - AESC & District**
  1. Manage data logger download and NanO<sub>2</sub> and in-plant energy monitoring
  2. Data analysis by AESC; monthly download
  3. Energy demand report
- 4. Project administration and reporting - Dudek & AESC**
  1. Project coordination and scheduling
  2. Coordinate weekly project call and updates
  3. Weekly status report to stakeholders and peer review group
    1. Achievements
    2. Interruptions and obstacles
    3. Change management
  4. Draft performance report