TOWN OF DISCOVERY BAY

A COMMUNITY SERVICES DISTRICT

SDLF Platinum-Level of Governance

PLATINUM LEVEL

NOTICE OF THE REGULAR MEETING
OF THE BOARD OF DIRECTORS
OF THE TOWN OF DISCOVERY BAY
Wednesday July 15, 2020
REGULAR MEETING 7:00 P.M.
Community Center
1601 Discovery Bay Boulevard, Discovery Bay, California
Website address: www.todb.ca.gov

NOTICE
Coronavirus COVID-19

In accordance with the Governor's Executive Order N-33-20, and for the period in which the Order remains in effect, the Town of Discovery Bay Community Services District Board Chambers will be closed to the public.

To accommodate the public during this period of time that the Board's Chambers are closed to the public, the Town of Discovery Bay Community Services District Board of Directors has arranged for members of the public to observe and address the meeting telephonically.

TO ATTEND BY TELECONFERENCE:
Toll-Free Dial-In Number: (877)778-1806
CONFERENCE CODE 891949

Download Agenda Packet and Materials at http://www.todb.ca.gov/

REGULAR MEETING 7:00 P.M.

A. ROLL CALL AND PLEDGE OF ALLEGIANCE

1. Call business meeting to order 7:00 p.m.
2. Pledge of Allegiance.
3. Roll Call.

B. PUBLIC COMMENTS (Individual Public Comments will be limited to a 3-minute time limit)

During Public Comments, the public may address the Board on any issue within the District's jurisdiction which is not on the Agenda. The public may comment on any item on the Agenda at the time the item is before the Board for consideration by filling out a comment form. The public will be called to comment in the order the comment forms are received. Any person wishing to speak must come up and speak from the podium and will have 3 minutes to make their comment. There is a device on the podium with a green, yellow, and red light. The yellow light will come on 30 seconds before the end of the 3 minutes. There will be no dialog between the Board and the commenter as the law strictly limits the ability of Board members to discuss matters not on the agenda. We ask that you refrain from personal attacks during comment, and that you address all comments to the Board only. Any clarifying questions from the Board must go through the President. Comments from the public do not necessarily reflect the viewpoint of the Directors.

C. CONSENT CALENDAR

All matters listed under the CONSENT CALENDAR are considered by the District to be routine and will be enacted by one motion.

1. Approve DRAFT minutes of regular meeting for July 1, 2020.
2. Approve Register of District Invoices.

D. PRESENTATIONS

E. MONTHLY WATER AND WASTEWATER REPORT – VEOLIA

1. Veolia Report – Months of May 2020 and June 2020

F. DISCUSSION AND ACTION ITEMS

1. Discussion and Possible Action Authorizing Increase in The Denitrification and Plant 1 Refurb Capital Project Budget in the amount of $850,000 to install new rotors at all 3 oxidation ditches as part of the project.

G. MANAGER'S REPORT

H. CORRESPONDENCE RECEIVED

I. FUTURE AGENDA ITEMS

J. OPEN SESSION DISCLOSURE OF CLOSED SESSION AGENDA

(Government Code Section 54957.7)

K. CLOSED SESSION:

1. Conference with Real Property Negotiators Pursuant to Government Code Section 54956.8
   Property: 1535 Discovery Bay Boulevard, Discovery Bay, CA 94505 (APN 008-200-010)
   Agency Negotiator: Bill Pease/Mike Davies/Rod Attebery
   Negotiating Parties: East Contra Costa Fire Protection District
   Under Negotiation: Price and Terms

2. Conference with Real Property Negotiators Pursuant to Government Code Section 54956.8
   Property: APN 008-540-028
   Agency Negotiator: Bill Pease/Mike Davies/Rod Attebery
   Negotiating Parties: Lodgepole Investments, LLC
   Under Negotiation: Price and Terms

L. RETURN TO OPEN SESSION; REPORT ON CLOSED SESSION

(Government Code Section 54957.1)

M. ADJOURNMENT

1. Adjourn to the regular meeting on August 5, 2020 beginning at 7:00 p.m. at the Community Center located at 1601 Discovery Bay Boulevard.

"This agenda shall be made available upon request in alternative formats to persons with a disability, as required by the American with Disabilities Act of 1990 (42 U.S.C. § 12132) and the Ralph M. Brown Act (California Government Code § 54954.2). Persons requesting a disability related modification or accommodation in order to participate in the meeting should contact the Town of Discovery Bay, at (925) 634-1131, during regular business hours, at least forty-eight hours prior to the time of the meeting."

"Materials related to an item on the Agenda submitted to the Town of Discovery Bay after distribution of the agenda packet are available for public inspection in the District Office located at 1800 Willow Lake Road during normal business hours."

TOWN OF DISCOVERY BAY

A COMMUNITY SERVICES DISTRICT

SDLF Platinum-Level of Governance

PLATINUM LEVEL

MINUTES OF THE REGULAR MEETING
OF THE BOARD OF DIRECTORS
OF THE TOWN OF DISCOVERY BAY
Wednesday July 1, 2020
REGULAR MEETING 7:00 P.M.

NOTICE
Coronavirus COVID-19

In accordance with the Governor's Executive Order N-33-20, and for the period in which the Order remains in effect, the Town of Discovery Bay Community Services District Board Chambers will be closed to the public.

To accommodate the public during this period of time that the Board's Chambers are closed to the public, the Town of Discovery Bay Community Services District Board of Directors has arranged for members of the public to observe and address the meeting telephonically.

TO ATTEND BY TELECONFERENCE:
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REGULAR MEETING 7:00 P.M.

A. ROLL CALL AND PLEDGE OF ALLEGIANCE

1. Call business meeting to order 7:00 p.m.- By President Pease
2. Pledge of Allegiance - Led by Director Bill Mayer
3. Roll Call – All Present.

B. PUBLIC COMMENTS (Individual Public Comments will be limited to a 3-minute time limit)

Public Comment Regarding:

- Concerns of vehicles and motorcycles speeding on Discovery Bay Blvd

C. CONSENT CALENDAR

All matters listed under the CONSENT CALENDAR are considered by the District to be routine and will be enacted by one motion.

1. Approve DRAFT minutes of June 17, 2020 Regular Board of Director's meeting.
2. Approve Register of District Invoices.

Motion made by Director Bill Mayer to approve items on the Consent Calendar as presented.
Second by Director Kevin Graves.

D. AREA AGENCIES REPORTS / PRESENTATION

1. Supervisor Diane Burgis, District III Report.
   None.
2. Sheriff's Office Report.

Lieutenant Mark Johnson reported on criminal activity including traffic violations, increase in crime and increase in auto burglaries. Lieutenant Johnson stated there will be an increase in Sheriff presence with additional staff on patrol for the holiday weekend.

3. CHP Report.
   None.
4. East Contra Costa Fire Protection District Report.

East Contra Costa Fire Department Battalion Chief, Ross Macumber reported on the month's operations for June 2020. Call volume has increased, there will be extra personnel on staff for the holiday weekend. Battalion Chief Macumber issued a reminder that fireworks are illegal in Town of Discovery Bay. Reminded to keep weeds down as indicated in the Weed Ordinance. Public will be fined if they are not being compliant

E. LIAISON REPORTS

F. PRESENTATIONS

G. BUSINESS AND ACTION ITEMS

1. Public Hearing to Consider Town of Discovery Bay CSD Ravenswood Landscape Zone #9, Park, Lighting and Open Space Improvements District Assessment Report for the Fiscal Year 2020-2021; Continue Collection of Assessments on County Tax Roll and Adoption of Resolution No. 2020-17, Allowing for a 1.1% Assessment Increase.

Finance Manager Julie Carter presented information regarding previously approved resolutions. The FY 2020-2021 Assessment Report generated by Herwit Engineering showed 1.1% increase for Ravenswood Improvement District Assessment.

Motion made by Director Kevin Graves to approve Ravenswood Landscape Zone #9, Park, Lighting and Open Space Improvements District Assessment Report for the Fiscal Year 2020-2021; Continue Collection of Assessments on County Tax Roll and Adoption of Resolution No. 2020-17, Allowing for a 1.1% Assessment Increase.

Second by Director Robert Leete.

2. Discussion and Possible Action Authorizing Repairs to the Wastewater Treatment Plant 1 Influent Pump Station, Pump Station W and Installation of Pump Station F Bypass Piping in an Amount Not to Exceed $60,000, Approving Resolution 2020-16 Adopting a CEQA Exemption, Approving the Project and Directing Filing of the Notice of Exemption.

Water Engineer Gregory Harris explained failures at the Influent Pump station and Pump Station W. There is a need to accelerate the project to repair pipes since more pumps are now out of service. There isn't much fiscal change from the previous discussion regarding this repair.

Director Robert Leete asked about the expected timeline to complete this project.

Water Engineer Gregory Harris states he is hoping to get it done by September 2020.

Motion by Director Bill Mayer to accept the Authorization to Repair Wastewater Treatment Plant 1 Influent Pump, Pump Station W and Installation of Pump Station F Bypass Piping in an Amount Not to Exceed $60,000, Approving Resolution 2020-16 Adopting a CEQA Exemption, Approving the Project and Directing Filing of the Notice of Exemption.

Second by Director Kevin Graves.

H. MANAGER'S REPORT

I. **DIRECTORS' REPORTS**

1. Standing Committee Reports.

a. Communications Committee Meeting (Committee Members Bill Pease and Bryon Gutow) July 1, 2020.

Vice President Bryon Gutow provided a summary of how the Town is communicating updates regarding COVID-19 impacts and Community Center has a Facebook page which has also been used to communicate updates to the public.

b. Parks and Recreation Committee Meeting (Committee Members Kevin Graves and Bryon Gutow) July 1, 2020.

Director Kevin Graves states Recreation Program Supervisor Monica Gallo gave update on how the Community Center's Facebook page is helping relay information to the public. Commended staff for being ready to open, however new governor's orders haven't allowed any openings yet. Dog park is doing well. Spoke about landscaping test project on Poe Street. Talked about accepting bids for the pickleball courts, and new wind screens for the tennis courts.

Director Bill Mayer asked about public response regarding the Dog Park.

Director Kevin Graves states that the public has expressed how much they like it.

c. Water and Wastewater Committee Meeting (Committee Members Bill Pease and Bill Mayer) July 1, 2020.

Director Bill Mayer provided update to the Board regarding water and wastewater updates. Influent in Pump Station W was discussed. Update was given regarding Booster pumps at Newport Plant. Well 8 monitoring, and supplemental aeriation were also discussed.

2. Other Reportable Items.

J. GENERAL MANAGER'S REPORT

Introduction of Gerry Limas from Delaware who will be the Veolia Project Manager for the Town.

Director Kevin Graves made an announcement regarding ECCFPD holding a virtual townhall meeting on August 24, 2020. This meeting will discuss the need and ways to fund another fire station.

K. CORRESPONDENCE RECEIVED (Information Only)

L. FUTURE AGENDA ITEMS

M. ADJOURNMENT

1. Adjourned at 7:28 p.m. to the next regular meeting of July 15, 2020 beginning at 7:00 p.m. at the Community Center located at 1601 Discovery Bay Boulevard.

"This agenda shall be made available upon request in alternative formats to persons with a disability, as required by the American with Disabilities Act of 1990 (42 U.S.C. § 12132) and the Ralph M. Brown Act (California Government Code § 54954.2). Persons requesting a disability related modification or accommodation in order to participate in the meeting should contact the Town of Discovery Bay, at (925) 634-1131, during regular business hours, at least forty-eight hours prior to the time of the meeting."

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Town of Discovery Bay

"A Community Services District"

STAFF REPORT

Meeting Date

July 15, 2020

Prepared By: Julie Carter, Finance Manager & Lesley Marable, Accountant
Submitted By: Michael R. Davies, General Manager

Agenda Title

Approve Register of District Invoices.

Recommended Action

Staff recommends that the Board approve the listed invoices for payment.

Executive Summary

District invoices are paid on a regular basis, and must obtain Board authorization prior to payment. Staff recommends Board authorization in order that the District can continue to pay warrants in a timely manner.

Fiscal Impact:

Amount Requested $ 317,520.88
Sufficient Budgeted Funds Available?: Yes **(If no, see attached fiscal analysis)**
Prog/Fund # See listing of invoices. **Category:** Operating Expenses and Capital Improvements

Previous Relevant Board Actions for This Item

Attachments

Request For Authorization to Pay Invoices for the Town of Discovery Bay CSD 2020/2021

AGENDA ITEM: C-2

For The Meeting On July 15, 2020

Town of Discovery Bay CSD

Fiscal Year 7/20 - 6/21

Veolia Water North America	$156,584.12
Herwit Engineering	$56,434.60
Town of Discovery Bay CSD	$32,648.36
Neumiller & Beardslee	$18,821.54
CaliforniaChoice Benefit Admin	$18,313.87
Badger Meter	$5,629.25
Precision IT Consulting	$5,340.78
Krauss Appraisal, LLC	$4,400.00
Matrix Trust	$2,448.83
Watersavers Irrigation Inc.	$2,342.08
J.W. Backhoe & Construction, Inc.	$2,310.15
TASC	$2,146.60
Univar Solutions USA Inc.	$1,696.20
Upper Case Printing, Inc.	$1,259.25
Verizon Wireless	$894.13
Mt. Diablo Resource Recovery	$789.56
Ricoh USA, Inc	$727.17
Office Depot	$593.87
Brentwood Ace Hardware	$493.07
Stantec Consulting Services Inc	$485.00
Robert Leete	$460.00
William Mayer	$460.00
City of Antioch	$375.00
Bill Pease	$345.00
Kevin Graves	$345.00
ReliaStar Life Insurance Company	$325.00
Bryon Gutow	$230.00
Geotab USA, Inc.	$177.75
UniFirst Corporation	$120.00
Denalect Alarm Company	$118.50
Bay Area News Group	$106.20
Community Center Refund Customer	$50.00
County Clerk - CCC	$50.00
	$317,520.88

Town of Discovery Bay

"A Community Services District"

STAFF REPORT

Meeting Date

July 15, 2020

Prepared By: Gregory Harris, District Wastewater Engineer
Submitted By: Michael R. Davies, General Manager

Agenda Title

Discussion and Possible Action Authorizing Increase in The Denitrification and Plant 1 Refurb Capital Project Budget in the amount of $850,000 to install new rotors at all 3 oxidation ditches as part of the project.

Recommended Action

It is recommended that the Board take the following Action:

a. Authorizing Staff to Increase the budget for the Denitrification and Plant 1 Refurb Project in the amount of $850,00 to install new rotors at all 3 oxidation ditches as part of the project.

Executive Summary

Intermittently the wastewater treatment plant has been unable to keep up with biological load flowing into the plant, causing oxygen levels to fall below treatment levels throughout the day for hours at a time. This information was discovered in the fall of 2019 and happens to be consistent with the Wastewater Master Plan (the Plan) projections.

The Master Plan anticipated the existing rotors were not putting enough oxygen in the ditch and estimated the oxygen deficit. The Plan also provided a cost to supplement the rotors with oxygen to all three oxidation ditches. It was recommended to perform an oxygen transfer test to verify the actual oxygen deficit for the oxidation ditches as part of the final design.

The Town conducted oxygen testing at Plant No. 1. The test noted that the existing rotors only put out about half the amount of oxygen required under the Master Plan.

It has been observed that the oxygen deficit is greater than was anticipated in the Master Plan before the oxygen testing took place. HERWIT Engineering has been investigating alternatives to provide the additional oxygen and has narrowed the selection down to the following two feasible alternatives.

The Alternatives are:

1) Add diffusers and aeration blowers to each oxidation ditch and keep the existing rotors.
2) Replace the existing rotors with newer more efficient and higher horsepower rotors from Evoqua.

HERWIT Engineering has completed an Aeration Alternatives Analysis outlining the costs and the pros and cons of each alternative. The results show a significant difference in the operations and maintenance between the two options, however there is a minimal cost differences for operations and maintenance between the two options.

The below cost break down details the two alternative options.

Alternative Option 1 Total Costs $1,207,000
This plan would add diffusers and aeration blowers to each oxidations ditch and keep the existing rotors

Current Budget $728,000
$640,000 Plant 1 and Plant 2 Supplemental Aeration for the Rotors,

$ 88,000 Plant 1 Launder Covers

Leaving a Net Project Deficit of $479,000

Alternative Option 2 Total Costs $2,052,000
This plan replaces the existing rother with new, efficient, higher horsepower rotors

Current Budget $1,208,000
$640,000 Plant 1 and Plant 2 Supplemental Aeration for the Rotors,
$ 88,000 Plant 1 Launder Covers
$480,000 Plant Frame Electrical & Structure Rehab

Leaving a Net Project Deficit of $844,000

Aeration Alternative 1 & 2 Financing Plan

Alt. 1		**Cost**	**1,207,000.00**		**Alt. 2**		**Cost**	**2,052,000.00**
Description: Add diffusers and aeration blowers to each oxidation ditch and keep the existing rotors.					Description: Replace the existing rotors with newer more efficient and higher horsepower rotors from Evoqua.			
Plant	Project #	Description	Budgeted		Plant	Project #	Description	Budgeted
1 & 2	7005/7018	Supplemental Aeration in Oxidation Ditches	640,000.00		1 & 2	7005/7018	Supplemental Aeration in Oxidation Ditches	640,000.00
1	7005	Clarifier Launder Covers	88,000.00		1	7005	Clarifier Launder Covers	88,000.00
					1	7018	Frame Elect. and Struct. Rehab.	480,000.00
		Total	**728,000.00**				**Total**	**1,208,000.00**
		Net Project Deficit	**(479,000.00)**				**Net Project Deficit**	**(844,000.00)**
							Net Increase in Cost of Alternative No. 1	**(365,000.00)**

Several meetings have been organized to review the pros and cons of each alternative with Veolia, Town Staff, and HERWIT Engineering. Based on these discussions, it is proposed that Alternative No. 2 provides the best long-term value to the District, is less complex, and easier to operate as well as elevates potential noise concerns with operation at Plant No .1.

Staff's recommendation is to proceed with Alternative Option 2 in the amount of $2,052,000 installing new rotors at all three oxidation ditches. There are sufficient reserves to cover the cost of the Net Project Deficit of $844,000.

Previous Relevant Board Actions for This Item

Approved Capital Improvement Budget for the Plant 1 Refurbishment and Denitrification project in the amount $13.8 million.

Fiscal Impact: The new rotors will increase the cost of the Denitrification Project.
Amount Requested: $850,000 in additional costs to install rotors at all 3 oxidation ditches.
Sufficient Budgeted Funds Available: Yes
Prog/Fund # Category:

Attachment
1. Discovery Bay Aeration Alternatives Analysis
2. Plant No. 1 Oxygen Test Report

AGENDA ITEM: F-1

Discovery Bay Aeration Alternative Analysis	Alt 1 Existing Rotors + Diffusers	Alt 2 Evoqua Rotors
Capital Cost (Including Contractor Markups, Overhead, Profit)		
Remove Existing Rotors	0	60,000
New Rotors, Installed	0	1,542,000
Blowers, Installed	450,000	0
Air Diffusion Systems, Installed	207,000	0
Piping	150,000	150,000
Electrical	400,000	300,000
Total Capital Cost	1,207,000	2,052,000
Annual Average Actual Oxygen Requirement Breakdown, lb/d		
Rotors (d)	2,300	6,400
Diffusers/Blowers	4,100	0
Total	6,400	6,400
Annual Average Field Aeration Efficiency, lb/hp.hr (a)		
Rotors	1.52	1.46
Diffusers/Blowers	2.73	---
Weighted Average	2.30	1.46
Power Cost, $ (b)		
Annual Average	114,000	180,000
Present Worth (c)	1,696,000	2,678,000
Operation and Maintenance Cost Differential (Net Alt 1 - Alt 2)		
Annual Average	30,000	0
Present Worth (c)	446,000	0
Total Present Worth Cost	3,349,000	4,730,000

(a) From performance calculations.

(b) Based on average cost input here, $/kWH 0.15

(c) 20 years, 3% discount rate, Present Worth Factor = 14.8775

(d) For existing rotors, presume one inside and one outside per ditch at 75% of maximum power draw.

Alt 1, Existing Rotors + Diffusers		Alt 2, Evoqua Rotors	
Pro	**Con**	**Pro**	**Con**
Lowest capital cost			Highest capital cost
Diffusers have high aeration efficiency and can be used as primary aeration method, resulting in lowest annual power cost.	More complex operation, load allocation between rotors and diffusers at varying loads	Aeration efficiency substantially higher than existing rotors.	High efficiency operation requires reversing flow direction in ditches and additional piping modifications for mixed liquor recirculation.
	Rotor output still dependent on ditch water level, unless add vfds to rotors. In practice water level not adjusted.	Simple operation, DO control by automated rotor selection and rotor speed with VFDs.	
	Annual diffuser maintenance required, resulting in need to take ditches out of service.	New rotors easy to maintain, without taking ditches out of service.	
	Existing low efficiency rotors remain in service. Rotors at Plant 1 are 40 years old, remaining useful life not determined.	Eliminate existing less efficient rotors, some of which are very old.	
	More congested site, blowers on ditch islands, exposed aeration piping.		
	Rags and stringy materials escaping screens will accumulate on diffusers/piping, resulting in possible damage and added maintenance.		
	More difficult to drain and clean ditches with diffusers in the way.		
	protect diffusers even when ditch is out of service. Algae and mosquito mitigation required.		
	Unless we add a building around the blowers, the aeration blowers will make noise that likely can be heard by residences around Plant No. 1 . The cost of a building is not included in the cost breakdown.		
	Blower Filters will have to be replaced often possibly weekly given the amount of dust experienced at both Plant No. 1 and No.2		

REDMON ENGINEERING COMPANY

Consulting Engineers

PO Box 044258

Racine, Wisconsin 53404-7005

(414) 467-8993

e-mail: redmonengineering@gmail.com

T May 27, 2020

Town of Discovery Bay CSD
Attn.: General Manager
Gregory Harris – HERWIT Engineering
1800 Willow Lake Road
Discovery Bay, CA 94505

Re: Town of Discovery Bay WWTP - Report of the Clean Water Test Results of the Brush Aeration System

Dear Gregory,

As you know Redmon Engineering Company conducted a series of non-steady state oxygen transfer tests on the Brush Aeration System at Plant #1 for the Town of Discovery Bay, located in Contra Costa County, California. The oxidation ditch tested is approximately 70 feet wide by 350 feet long and was operating at a side water depth of 5.97 feet. The clean water testing took place from February 18 to 20, 2020. The attached report identifies the results of the testing program.

Following your review, should you have any comments or questions, please let me know.

Best regards,

REDMON ENGINEERING COMPANY

David T. Redmon, P.E.

REDMON
ENGINEERING COMPANY

CLEAN WATER OXYGEN TRANSFER TEST
OF THE
BRUSH AERATION SYSTEM
AT THE
TOWN OF DISCOVERY BAY WWTP IN CONTRA COSTA COUNTY, CA

February 2020

INTRODUCTION

Redmon Engineering Company was engaged by the Town of Discovery Bay to conduct a series of full-scale non-steady state clean water oxygen transfer tests on the brush aeration system installed at Plant 1, to document oxygen transfer performance characteristics of the system.

This document includes all the information regarding the tests conducted, the testing equipment and procedures followed, and the final results for the conditions tested.

The tests were conducted by David Redmon, of Redmon Engineering Company on February 18 to 20, 2020 under the direction of Gregory Harris of HERWIT Engineering. Assistance was provided by plant staff and Veolia.

DESCRIPTION OF TESTING PROCEDURES AND EQUIPMENT

The Clean Water Oxygen Transfer Tests presented in this document have been carried out by Redmon Engineering Company following the procedures described in the ASCE Standard “A Standard for the Measurement of Oxygen Transfer in Clean Water,”

(ASCE/EWRI 2-06).

Summary of Method

The test method is based upon removal of dissolved oxygen from the water volume by sodium sulfite followed by reaeration to near the saturation level. The dissolved oxygen inventory of the water volume is monitored during the reaeration period by measuring dissolved oxygen concentrations at several sampling points selected to best represent the tank contents.

The data obtained at each determination point are then analyzed by a simplified mass transfer model to estimate the apparent mass transfer coefficient, K_La, and the steady state dissolved oxygen saturation concentration, C^*_∞. The basic model is given by:

$$C = C^*_\infty - (C^*_\infty - C_0) \exp(-K_La_t)$$

Where:

C = dissolved oxygen concentration, mg/l

C^*_∞ = determination point value of the steady DO concentration at time approaches infinity, mg/l,

C_0 = DO concentration at time zero, mg/l, and

K_La = determination point value of the apparent volumetric mass transfer coefficient, 1/hr.

The differentiated form of the above equation, known as the Log Deficit Method, was used to determine the overall value of K_La for each test.

$$\mathbf{K_La = Ln ((C^* - C_1)/(C^* - C_2))/(t_2 - t_1)}$$

Where:

Ln = is the natural log

C* =. is the saturation value measured at the end of the test

C_1 & C_2 = the dissolved oxygen concentration at times 1 and 2

t_1 & t_2 = times 1 and 2.

The above equation yields a linear regression of the natural log of the DO deficit versus time. In this test, the average DO data representing approximately 20% to 90% of the DO saturation value was employed to fit the above equation during reaeration period. In this way, an overall estimate of K_La is obtained. This estimate is adjusted to standard conditions (20°C water temperature, zero DO concentration and one atmosphere – 29.92 inches mercury) and the standard oxygen transfer rate (SOTR) is obtained as the product of the overall K_La value, corresponding adjusted determination point C^*_∞ value, and the tank volume.

$$\mathbf{SOTR = K_La_{20} (C^*_{\infty 20}) V}$$

Where:

K_La_{20} = determination point value of KLa corrected to 20°C;

$C^*_{\infty 20}$ = determination point value of steady-state DO concentration corrected to 20°C and a standard barometric pressure of 1.00 atmospheres;

V = liquid volume of test water in the test tank when the aerator(s) is turned off.

The standard aeration efficiency (SAE), or rated of oxygen transfer per unit of power input, is often of interest and is computed by the following expression:

SAE = SOTR / Power Input.

Description of the Aeration System and Test Basin

The activated sludge portion of the Town of Discovery Bay Wastewater Treatment Facility (Plant 1) consists of a single looped reactor. The basin is approximately 350 feet in length and has a total width (in plan view) of about 110 feet. The channel width is about 44.5 feet at the top and has a flat bottom that is 29.0 feet wide. The side slopes on either side of the channel have a one-to-one slope. For the non-steady state clean water tests in question, the aeration basin was operated at a side water depth of 5.97 feet. The aeration system is a Lakeside Brush surface aeration system (4 - 30 horsepower brush rotors) and is installed in the test basin according to the design drawings. The test basin was filled with potable water. A plan view of the

basin with is shown in Figure 1 along with the DO probe locations. Also, shown in Figure 1 are the four brush rotors. The two inside rotors are referred to as Rotors #1 and #3, while the two outside rotors are referred to as Rotors #2 and #4. The total volume of water in the basin has been computed to be 1,050,000 gallons.

TEST PROCEDURE

The tests have been conducted following the procedures described in the ASCE Standard ASCE/EWRI 2-06, "A Standard for the Measurement of Oxygen Transfer in Clean Water."

Deoxygenation

Deoxygenation of the test water was achieved by the addition of anhydrous sodium sulfite (Na_2SO_3) in excess of the stoichiometric amount required for the removal of all dissolved oxygen present in the test water, using cobalt sulfate heptahydrate ($CoSO_4$-$7H_20$) as a catalyst. In order to assure uniform distribution of the cobalt catalyst, it was dissolved in water and added to the test basin with the aeration system running for several hours before the first addition of sodium sulfite. A total of 4.6 kilograms (10.1 pounds) of the cobalt sulfate heptahydrate was added to the test basin to yield a cobalt ion concentration of approximately 0.20 mg/l. The ASCE Standard requires that the cobalt ion concentration be in the range of 0.10 to 0.50 mg/l.

As a matter of convenience the sodium sulfite was added as a dry powder at the

two locations (at the inlet side of the brush rotors). Enough sodium sulfite was added to increase the total dissolved solids by about 150 mg/l per test (approximately 1,000 lbs per test). Care was taken to add the sulfite slowly by moving the bags back and forth. The sulfite was dry and there were no lumps present. The sulfite was added with the brush aerators operating at the specified condition and at the desired side water depth. For all eight test runs the bags of sodium sulfite were added on about 30 second intervals. In all cases, a dissolved oxygen concentration of less than 0.50 mg/l was achieved in all areas of the test volume for at least five minutes.

Measurement of Oxygen Transfer

Determination of dissolved oxygen concentration in the different areas of the test tank was done using five Yellow Springs Instruments (YSI) Model 52 Dissolved Oxygen Meters and membrane probes. All DO probes were fitted with 1.0 mil membranes. Location of the DO probes in the test basin is shown in Figure 1. With the meters and probes in place in the test basin, they were calibrated to the appropriate surface saturation value (correcting for water temperature and local barometric pressure) after the aerators had been operating for several hours.

The DO versus time data for each non-steady state test run was logged on 30 second intervals. All four of the dissolved oxygen meters were automatically logged to an Excel spreadsheet.

TEST PROGRAM

The testing program was designed by Gregory Harris of HERWIT Engineering. A total of eight (8) test runs were conducted. Two sets of runs were made with all four rotors in operation. Two sets of runs were also made with both Aerators 1, 3, and 4, and Aerators 2, 3, and 4 running. Single runs were made with Aerators 1 and 3, and 2 and 4 in operation.

Power Measurements

Readings of frequency (hertz), current, voltage, and power factor were taken manually from the electrical panels in the motor control center. These readings were obtained by the plant staff electrician, and in several cases with the assistance of Gregory Harris, while the individual oxygen transfer test runs were being conducted. In some cases, measurements were also made at a later time under the same operating conditions.

Test Conditions and Results

Table 1 summarizes the non-steady state results for each of the test runs.

This table includes the test run number, the aerators running, the side water depth, the liquid volume, the water temperature, Kla_{20}, C^*_{20}, the standard oxygen transfer rate (SOTR), the total power input, and the standard aeration efficiency (SAE). These values all pertain to the oxygen transfer performance in potable water.

Table 2 contains a summary of the power data as assembled by Gregory Harris. For each test run the average voltage and amperage values are presented for each rotor that was in operation. At the bottom of Table 2 is the total power value for each test run, in both kilowatts and horsepower. These values were used to compute the Standard Aeration Efficiency (SAE – pounds of oxygen transferred per horsepower). In each case the Standard Oxygen Transfer Rate (pounds of oxygen transferred per hour in potable water) was divided by the total power input to compute the SAE value for each test run.

Discussion

The data presented in Table 1 indicate that the SOTR of the aeration system is directly proportional to the power input. This is not surprising. Of interest is the difference of power draw for the two inside rotors and compared to the two outside rotors. The two inside rotors on average had a power draw of 21.5 horsepower for all eight test runs, while the two outside rotors had an average power draw of 16.1 horsepower. Thus the inside rotors power draw was approximately 1.33 times that of

the outside rotors. The difference in power draw appears to be related to the liquid velocity approaching each rotor. It is apparent that the liquid velocity on the outside of the channel is faster than it is on the inside of the channel. Also, as the flow rounds the corner of the mid-wall, there is an eddy current on the inside of the channel just ahead of the inside rotor. One can see that the approach velocity is significant slower than at the same location on the outside of the channel.

The impact of the above discussion is plainly seen when comparing the results of Test Run #6 (with only the two inside rotors running) with that of Test Run #8 (with only the two outside rotors running). When the two inside rotors were running the total Standard Oxygen Transfer Rate was 90.5 pounds of oxygen per hour and when the two outside rotors were running the transfer rate was only 67.6 pounds per hour. The SOTR with the two inside rotors running is 1.33 times that when only the two outside rotors were running.

As would be expected, the highest total oxygen transfer rate was obtained when all four rotors were running. As was indicated earlier, the total mass of oxygen transferred in each test is directly proportional to the total power input. The average Standard Aeration Efficiency (SAE) for all eight test runs is 2.49 pounds of oxygen per horsepower-hour. The standard deviation of these runs is 0.0811, and the standard deviation divided by the mean is 0.0326. This data indicates very little variation in the SAE for all eight test runs, regardless of which rotors were operating.

Appendix I contains the dissolved oxygen versus time data that was logged for each test run. Also presented are plots of the individual probe values versus time and the average DO value from all four probes versus time. At the very bottom, for each test run, the log deficit plot and the trend line for each data set is presented.

CLEAN WATER OXYGEN TRANSFER TESTS
OF THE
BRUSH AERATION SYSTEM
AT THE
DISCOVERY BAY WWTF

PERFORMED ON BEHALF OF:

THE TOWN OF DISCOVERY BAY
DISCOVERY BAY, CALIFORNIA

CONDUCTED

February 18-20, 2020

PERFORMED BY:

REDMON ENGINEERING COMPANY

PO Box 044258
Racine, Wisconsin 53404

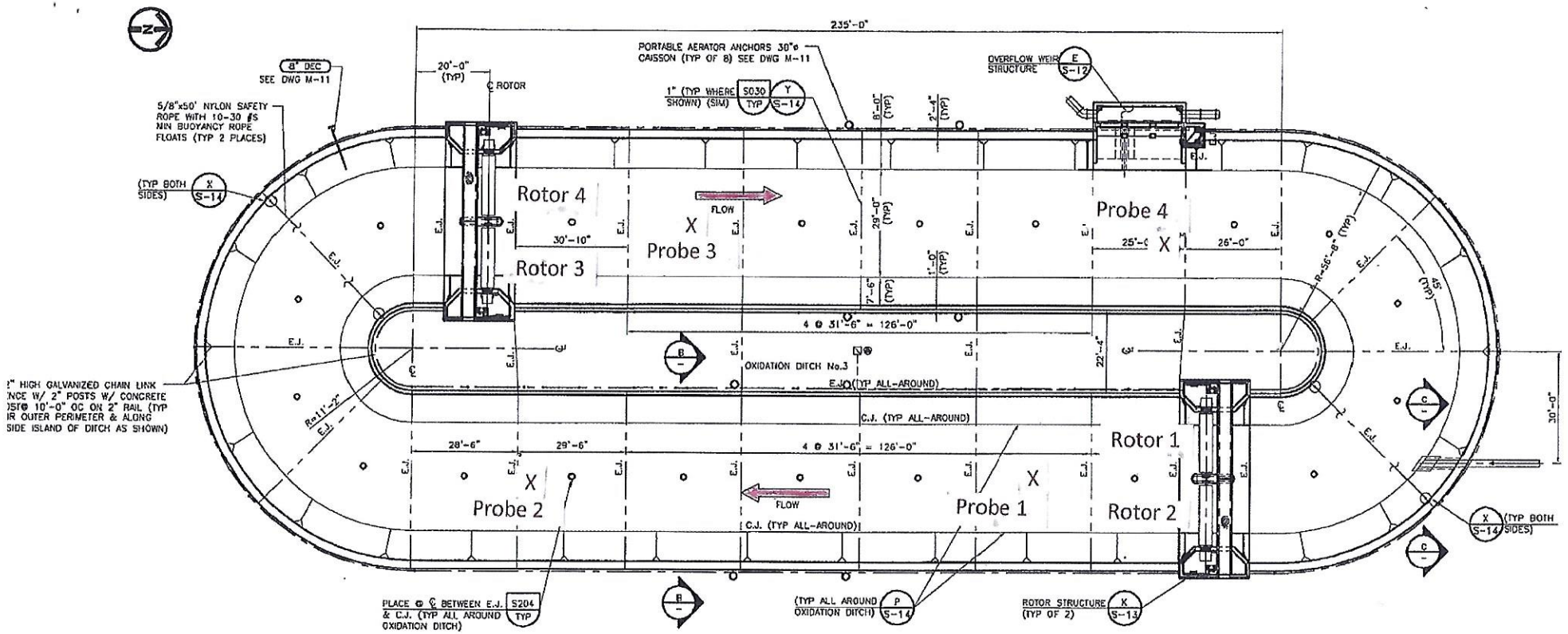
(414) 467-8993

A P P E N D I X I

NON-STEADY STATE TEST DATA
AND
DATA ANALYSIS

FIGURE 1 - TOWN OF DISCOVERY BAY AERATION BASIN PLAN VIEW

PROBE LOCATIONS FOR CLEAN WATER TESTS CONDUCTED FEBRUARY 2020



Power Input	SOTR
26.96	67.6
38.12	90.5
44.65	108.9
45.6	112.9
50.47	122.9
53.1	132.8
60.31	153.7
59.76	157.5

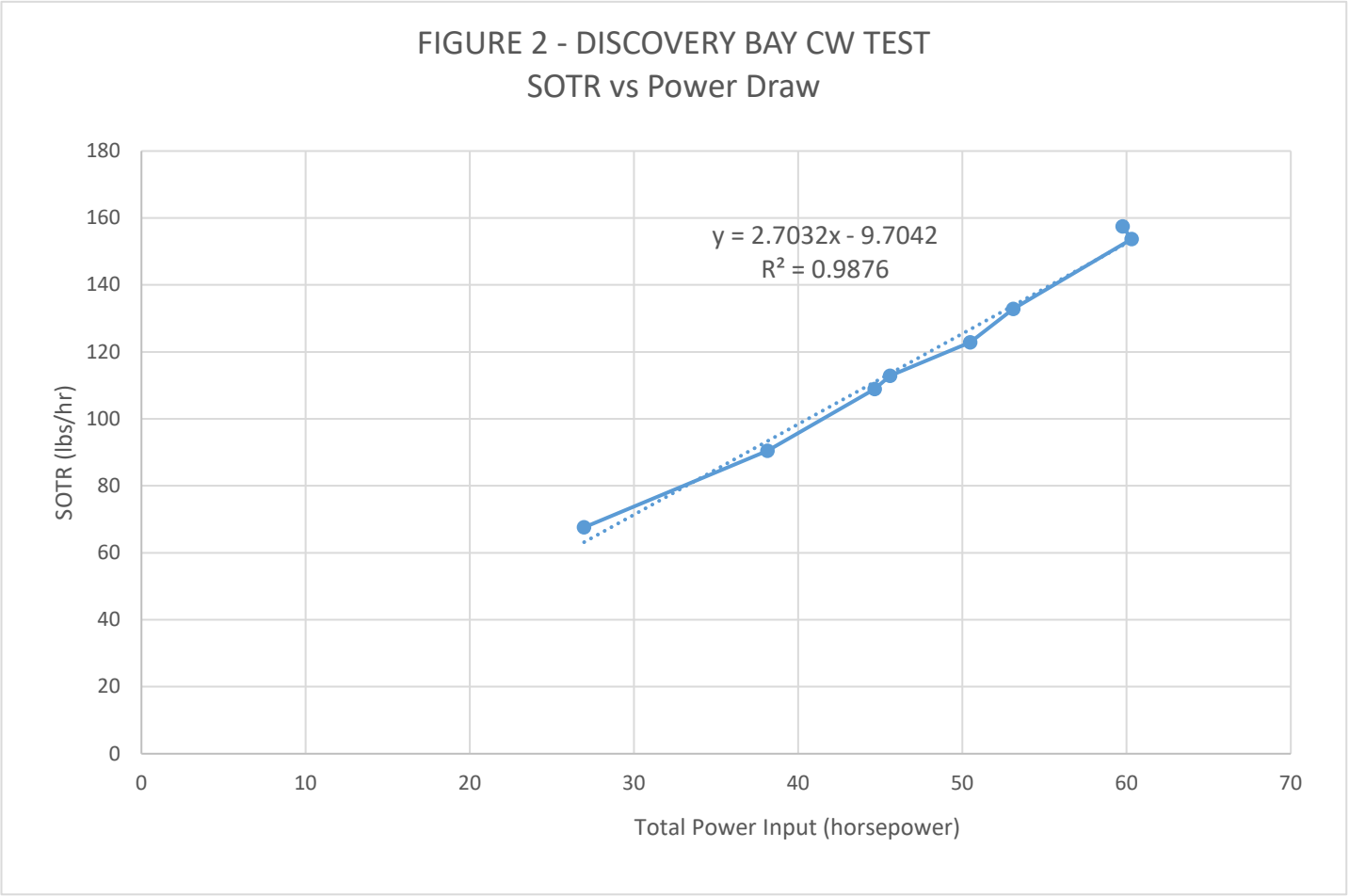


TABLE 1 - SUMMARY OF CLEAN WATER TEST RESULTS FOR DISCOVERY BAY

Test #	**Aerators Running**	**Side Water Depth** (feet)	**Basin Volume** (gallons)	**Water Temp.** (degrees Celcius)	**Kla 20** (1/hr)	**C*20** (mg/l)	**SOTR** (lbs/hr)	**Power Input - Total** (hp)	**SAE** (lbs/HP-hr)
1	1, 3, & 4	5.92	1,050,000	12.9	1.669	9.09	132.8	53.10	2.50
2	2, 3, & 4	5.92	1,050,000	13.6	1.369	9.09	108.9	44.65	2.44
3	1, 2, 3, & 4	5.92	1,050,000	12.1	1.976	9.09	157.5	59.76	2.64
4	2, 3, & 4	5.92	1,050,000	12.5	1.419	9.09	112.9	45.60	2.48
5	1, 3, & 4	5.92	1,050,000	13.0	1.544	9.09	122.9	50.47	2.44
6	1 & 3	5.92	1,050,000	13.4	1.137	9.09	90.5	38.12	2.37
7	1, 2, 3, & 4	5.92	1,050,000	12.1	1.932	9.09	153.7	60.31	2.55
8	2 & 4	5.92	1,050,000	13.0	0.85	9.09	67.6	26.96	2.51

TABLE 2 - POWER DRAW DATA FOR CLEAN WATER TESTING - DISCOVERY BAY

	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8
Rotor #1- Ave Volts	478.7	--	478.0	--	478.3	479.3	478.0	--
Rotor #1- Ave amps	20.4	--	21.5	--	20.8	21.0	20.6	--
Rotor #2- Ave Volts	--	475.7	477.7	477.3	--	--	477.7	477.0
Rotor #2- Ave amps	--	16.0	15.4	15.9	--	--	17.8	16.2
Rotor #3- Ave Volts	478.7	475.3	477.7	478.0	478.3	479.7	477.7	--
Rotor #3- Ave amps	24.5	22.8	20.9	22.9	22.4	22.8	20.3	--
Rotor #4- Ave Volts	476.3	475.7	477.7	477.3	478.0	--	478.0	477.0
Rotor #4- Ave amps	17.4	15.6	15.2	16.1	16.6	--	14.6	16.7
Total Power -kW	39.61	33.31	44.58	34.02	37.65	28.44	44.99	20.11
Total Power -hp	53.09	44.65	59.76	45.6	50.47	38.12	60.31	26.96