



STAFF REPORT – CITY COUNCIL MEETING

April 19, 2017

TO: Honorable Mayor and City Council Members

FROM: Mark Andre, Director of Environmental Services

PREPARER: Mark Andre, Director of Environmental Services

DATE: April 13, 2017

TITLE: **Receive an Update on the Wastewater Treatment Plant Facility Plan and Upgrade Project; Authorize an Upgrade Alternative to Pursue for Development of Additional Detail; Authorize Staff to Seek State Revolving Loan/Grant Funding for Preliminary Design and Engineering; and Initiate CEQA Environmental Review.**

RECOMMENDATION:

It is recommended that the Council:

- 1) Receive an update on the Wastewater Treatment Plant Facility Plan and upgrade project;
- 2) Authorize an alternative to pursue for development of additional detail;
- 3) Authorize staff to seek State Revolving Loan/Grant funds for preliminary design and engineering; and
- 4) Initiate CEQA Environmental Review.

INTRODUCTION:

The Arcata Wastewater Treatment Plant (WWTP) Facility Plan/upgrades are designed to:

- provide reliable service to the community now and in the future;
- meet permit/regulatory requirements that protect public health and the environment; and
- meet the City's goals for sustainability, as much as possible.

The required capital improvements fall into three general categories:

- 1) Facilities beyond their useful life including the WWTP headworks, clarifier and internal and external pumping stations.
- 2) Facilities necessary to accomplish the permit requirements to be chlorine free and move our discharge point to be in compliance with our NPDES permit including pipes, pumps, and valves to re-route wastewater. This will allow the plant to utilize ultra-violet (UV) disinfection process and eliminate chlorine contact basin blending that is not compliant with current standards.
- 3) Identified performance issues to reduce WWTP discharge violations and resolve the narrow compliance safety margins, including the removal of chlorine from the WWTP treatment process which currently contributes significantly to the WWTP's biochemical oxygen demand (BOD) reduction; as well as other pollutants of concern including total and suspended solids removal and anticipated new effluent limits requirements for ammonia discharges to the bay.

Performance enhancements to assure WWTP performance include increased reliability, ease of operation, redundancy and flexibility to accommodate moderate growth and high volume wet weather flows.

Following City Council presentations and focused workshops on this topic, the City Council directed staff and the consultant team to further explore a few items including:

- 1) Meeting with Regional Water Quality Control Board staff to obtain clarity on the future permit requirements.
- 2) Provide detail on the WWTP flow rating and/rainfall inflow for sizing.
- 3) Consideration of oxidation pond improvements.
- 4) Determine if the underlying bay muds would allow for long term use of unlined ponds for treatment and also if the existing bay front levee was stable enough to raise elevation over time for sea level rise adaptation.
- 5) Provide detail on estimated population growth projections.
- 6) Return with revised alternatives for consideration.
- 7) Provide additional detail on costs.

DISCUSSION:

1.) Permit discussions with Regional Water Quality Control Board (RWQCB):

Staff and the consultant team met with the RWQCB in Santa Rosa on June 27, 2016.

That meeting provided important feedback to inform the direction of the plant upgrades including: All flow under 5.9 MGD are to pass through the AMWS enhancement wetlands, which affects hydraulic capacity needs of the total system.

Expect ammonia limits as low as 4 mg/l in permit renewal July 2017. On this matter City staff is requesting a seasonal limit and we are also collecting onsite data so that we can make a case for an appropriate limit rather than an arbitrary one for ammonia.

The RWQCB expects that the City will continually monitor inflow and infiltration (I/I) and work aggressively to reduce it as well as Sanitary Sewer Overflows or SSO's.

2.) Rainfall Influence and flow rating findings

The land based system receives significant additional flow due to rainfall that totals 2 MGD for every one inch of rain that falls directly on the oxidation ponds/wetland system. We decided to use a 3 inch per 24-hour storm event as our design condition. Continued improvements to the wastewater collection system to reduce I/I are ongoing and the City is estimating a reduction of up to 1.2MGD with the currently proposed project which we are currently seeking State Revolving Funds (SRF) to begin construction late this summer. Continued efforts to reduce I/I citywide and specifically working to reduce the I/I emanating from the private side of the system will require continued vigilance and collaborative efforts to successfully reduce it as much as possible. With improved I/I control in the future it may be possible to reduce the size of future long term WWTP capital improvements, improve treatment efficiency as well as significantly reducing sanitary sewer overflows and violations. This is one of the merits of using a phased approach to the facility plan implementation. Currently, storage of I&I in oxidation ponds helps reduce WWTP peak flows while we continue to make I/I reductions in the entire collection system.

3.) Oxidation Pond Improvements Findings

Considerable time and effort was spent on looking at potential upgrades and enhancements to both the treatment marshes and the oxidation ponds in order to determine what appropriate investments to those components would yield cost effective treatment gains. A focused study was prepared by an expert in field, Dr. Joe Middlebrooks, and he provided findings and recommendations including:

Use of oxidation pond 1 for wet weather equalization allowing planned wet weather storage and wastewater metering.

Adding baffles and inlet/outlet controls to prevent short circuiting and approximately 20 (15 HP) aerators to oxidation pond 2 for enhanced treatment of pollutants of concern and specifically ammonia conversion.

Improve removal efficiencies and our ability to meet permit limits likely in low flow months, compromised during wet weather, cold months

Predicted improved ammonia removal, but may not meet permit limit year round requiring other measures.

Remove existing legacy sludge from the 50 year-old ponds to increase depth, volume and reduce internal loading.

4.) Geotechnical Findings

The findings from the LACO Associates geotechnical report and Arcata Marsh Research Institute (AMRI) infiltrometer testing show that the underlying bay muds under the existing ponds and dikes constructed from and within the bay muds are extremely low permeability. The proposed new wetland treatment Marsh 7 to be constructed at the former aquaculture facility and adjacent to the AMRI lab will likely not require lining. The existing bay mud levee that protects and surrounds the oxidation ponds and WWTP were also found to be sound enough to raise the elevation by 2-3 feet over time up to approximately 15' which would be high enough to protect the oxidation ponds from the maximum credible storm surge waves of 14' estimated by FEMA in 2015. This is an important adaptive strategy as well which will allow the City to protect this critical facility as well as adjust to predicted credible storm events and sea level rise. Raising the levees higher will likely require moving material into the oxidation pond in order to allow elevation augmentation. These findings also are supportive of the City's goal to protect the shoreline with living shorelines where possible.

5.) Population Growth Projection Findings

Based upon analysis of past growth rates, future growth rates and the General Plan build out estimates, Arcata's population can be expected to grow at approximately 1% over the next 20 year planning horizon. It is important to stress that the planned WWTP improvements are designed for the Arcata General Plan build-out and growth rate projections and it is not a project that will lead to growth inducing effect.

6.) Expanded Alternatives and staff recommended alternative.

Project alternatives and estimated costs are listed on Attachment (A.) A total of five alternatives were expanded and analyzed since June 2016. All project alternatives include common upgrades to the aging components of the WWTP and the UV disinfection system and re-route of discharge to McDaniel Slough. All alternatives except for Alternative #5 direct significant investments to the land based oxidation pond/treatment/ enhancement wetland systems. All alternatives listed are expected to meet compliance and flow requirements except for Alternative (4.) which is the pond/wetland improvements only alternative without additional secondary components.

Of the expanded alternatives, staff and our consultant team are recommending #4.1. This alternative is a hybrid of the land based wetlands plus the addition of one oxidation ditch and secondary with a design for the addition of another oxidation ditch that would be phased in at some point in the future if needed. This "hybrid" alternative strikes a balance with costs and allows for phasing in improvements. It allows for pond improvements to be made while still maintaining treatment; meets expected compliance objectives; allows an opportunity to obtain information from pond near-term improvements to inform potential additional treatment plant components and sizing needs; allows an

opportunity to ascertain how much reduction the City can obtain from I&I work; provides a level of confidence for future planned growth in the City.

The hybrid system and phased approach as outlined in Alternative #4.1 utilizes an adaptive management strategy. Adaptive management (learning by doing) is a structured, iterative process of decision making in the face of uncertainty, with a goal for reducing uncertainty over time using system monitoring. Because adaptive management is based on information feedback, it improves outcomes in the long-run. For the City's WWTP, the challenge of the adaptive approach is in finding a solid balance between acquiring knowledge to improve operations in the future and achieving the best short-term outcomes based on current knowledge and information.

Other considerations:

Sea level rise will impact the levees at the WWTP and any anticipated new structures. All recommended plant upgrades will be viable for the next 30-40-year design life cycle. Future plant upgrades on a smaller footprint (corporation yard) will extend the viability of the core WWTP at least another 30-40 years. All project alternatives will incorporate sea level rise adaptive measures including:

Phased raising of the levee around the oxidation ponds, treatment marshes and WWTP/Corporation Yard.

Establishment of "living shorelines" on the outboard side of the levee to minimize wave energy; reduce armoring costs and to provide habitats.

Design of replacement facilities on a higher base elevation within the corporation yard and design of outfall pipes and pumps to be able to work under higher future sea levels.

Provide flexibility for flow paths.

*Note: the facility plan and alternatives do not detail costs for sea level rise adaptation measures at this time. These additional costs are not listed a near term but must be planned and programmed in the CIP. Staff will be looking at possible special funding opportunities for both sea level rise adaptation measures and energy upgrades. For long-term planning (beyond 30-40 years), protection of the core corporation yard (approx. nine acres) and WWTP involves approximately 3,700 linear feet of levee. An additional mile of levee protection would be required to if we were to try to protect the oxidation ponds and treatment marshes beyond the current planning horizon of 30-40 years.

All project alternatives have a substantial increase in energy consumption. Components such as UV, aerators, oxidation ditch aerators and pumps have an impact on energy consumption and costs. While the project includes a modest 60kW photovoltaic system to provide some energy offset, it is less than 10% of the total net energy increase. The 60 kW systems are near term placeholder for now for systems that can be accommodated on anticipated building roofs within the corp. yard. A much larger system may be able to site at the WWTP after a more detailed design is completed. Additionally, staff will recommend that in the near future a separate project to analyze the sludge digester and provide information on the potential to generate energy from biogas (methane). Additionally, staff is interesting in exploring the total lifecycle costs in terms of carbon footprint. From a literature review, it is apparent that the lifecycle aspects of UV compared to chlorine may be favorable. This will be further explored as well as the current carbon footprint of the City's current chemical disinfection system in order to provide net energy and carbon impact comparison.

Next Steps:

Move forward with improvements

(not all decisions on process need to be made yet)

Start CEQA and environmental review

Apply for Disadvantaged Community status state revolving loan/grant
 Confirm design criteria based on tentative NPDES permit (June 2017)
 Pre-design to finalize proposed improvements

The City's existing National Pollution Discharge Elimination System (NPDES) Permit required work such as reconfiguring the plant and switching to UV disinfection be completed by December 2016. Preliminary design must begin as soon as possible due to an impending Time Schedule Order applied to resolve the missed December 2016 permit requirements. The missed permit conditions are to relocate the wastewater treatment plant outfall, switch to UV disinfection, and eliminate the circular blending pattern known as Combined Basin Mode.

Other critical work such as replacing old equipment should begin as soon as possible to reduce the danger of costly and dangerous equipment failure and to fulfill the permit requirement that equipment be maintained adequately. Due to widespread replacement needs covering most of the primary equipment preliminary design and engineering should begin as soon as possible. The project elements already identified as CIP priorities such as: influent pumps, bar screens, grit removal system, primary clarifiers, and pump stations within the plant will collectively require a substantial amount of planning/engineering dollars in the immediate future and are required regardless of approach used to resolve the performance deficiency.

There is a clear need to secure a substantial amount of funding for planning/engineering as soon as possible. Securing planning/engineering funding will allow portions of the total project to move forward.

BUDGET/FISCAL IMPACT:

The complete project costs for replacement and/or refurbishing WWTP components plus adding the permit required UV disinfection and piping to new outfall total \$21.9 million (M), this is the minimum level of work required immediately to maintain the aged system and comply with the goal to be chlorine free.

The staff recommended project is Alternative 4.1 (see Attachment A.) which additionally includes the improvements to the existing oxidation ponds as described above, rehabilitation of existing wetlands and construction of an additional Marsh 7, (\$8.0 M), construction of a 1.8 MGD oxidation ditch, digester improvements and sludge handling (\$12.4M). This would result in an estimated total project cost of \$42.3 million dollars.

Life cycle costs for the alternatives analyzed are included in Attachment B.

Staff will be developing additional detail on the necessary rate structure to support capital costs and debt services for the project once those costs are better determined. It is unknown at this time how much loan or grant funding may be available for this project.

ATTACHMENTS:

- A. Alternatives and Cost Estimates (PDF)
- B. Alternatives Lifecycle Costs and Energy Usage (PDF)
- C. Estimated Power Usage by process (PDF)

City of Arcata Wastewater Treatment Facility Improvements Project - Estimated Alternatives Project and Construction Costs

Prepared by LACO/Carollo. LACO Project No. 8226.00

Updated April 5, 2017

CIP ELEMENTS	DESCRIPTION / BASIS	Common Elements		ALTERNATIVE 4 PHASED SECONDARY TREATMENT								ALTERNATIVE 5	
		Plant Rehabilitation and Modernization plus UV Disinfection plus 60 kW Photovoltaic System		Alt 4 Common Elements plus Pond Improvements (Oxidation Ponds, Treatment Wetlands, and Enhancement Wetlands)	Alt 4-1 Common Elements plus Pond Improvements plus One Oxidation Ditch and Secondary Clarifier	Alt 4-2 Common Elements plus Pond Improvements plus Two Oxidation Ditches and Two Secondary Clarifiers	Alt 4-3 Common Elements plus Pond Improvements plus Three Oxidation Ditches and Three Secondary Clarifiers					Treatment Three Oxidation Ditches and Clarifiers Modified Common Elements No Pond Improvements No Phasing	
Headworks Capacity ⁽¹⁾		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD	
Total Secondary Process Capacity ⁽¹⁾		None added		2.3 MGD		4.1 MGD		5.9 MGD		> 5.9 MGD		5.9 MGD	
UV/Outfall Capacity ⁽¹⁾		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD	
		Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost
Flow Reconfiguration		\$ 3,200,000	\$ 4,240,000	\$ 3,200,000	\$ 4,240,000	\$ 3,200,000	\$ 4,240,000	\$ 3,200,000	\$ 4,240,000	\$ 3,200,000	\$ 4,240,000	\$ 2,910,000	\$ 3,780,000
AWTF Reconfiguration/New Outfall 003	4200 ft of 24-inch pipe and new outfall, takeoff	\$ 1,810,000	\$ 2,350,000	\$ 1,810,000	\$ 2,350,000	\$ 1,810,000	\$ 2,350,000	\$ 1,810,000	\$ 2,350,000	\$ 1,810,000	\$ 2,350,000	\$ 1,810,000	\$ 2,350,000
Treatment Wetlands 4 Influent Pump Replacement	Pump and structure	\$ 60,000	\$ 160,000	\$ 60,000	\$ 160,000	\$ 60,000	\$ 160,000	\$ 60,000	\$ 160,000	\$ 60,000	\$ 160,000	\$ -	\$ -
Treatment Wetlands: Pump Station 1 R&R Project	Three new pumps & VFDs	\$ 170,000	\$ 220,000	\$ 170,000	\$ 220,000	\$ 170,000	\$ 220,000	\$ 170,000	\$ 220,000	\$ 170,000	\$ 220,000	\$ -	\$ -
Treatment Wetlands: Pump Station 2 R&R Project	Two new pumps & VFDs (if needed)	\$ 60,000	\$ 80,000	\$ 60,000	\$ 80,000	\$ 60,000	\$ 80,000	\$ 60,000	\$ 80,000	\$ 60,000	\$ 80,000	\$ -	\$ -
Enhancement Wetlands: Pump Station Project	New 5.9 mgd pump station based on cost curve	\$ 1,100,000	\$ 1,430,000	\$ 1,100,000	\$ 1,430,000	\$ 1,100,000	\$ 1,430,000	\$ 1,100,000	\$ 1,430,000	\$ 1,100,000	\$ 1,430,000	\$ 1,100,000	\$ 1,430,000
Headworks/Primary		\$ 8,650,000	\$ 11,240,000	\$ 8,650,000	\$ 11,240,000	\$ 8,650,000	\$ 11,240,000	\$ 8,650,000	\$ 11,240,000	\$ 8,650,000	\$ 11,240,000	\$ 6,600,000	\$ 8,580,000
Headworks: Influent Screw Pump, Bar Screen, Flume and Grit Chamber Replacement	New 5.9 MGD headworks based on cost curve	\$ 6,600,000	\$ 8,580,000	\$ 6,600,000	\$ 8,580,000	\$ 6,600,000	\$ 8,580,000	\$ 6,600,000	\$ 8,580,000	\$ 6,600,000	\$ 8,580,000	\$ 6,600,000	\$ 8,580,000
Primary Clarifier Replacement	New 2.3 mgd Primary Clarifier based on cost curve	\$ 1,910,000	\$ 2,480,000	\$ 1,910,000	\$ 2,480,000	\$ 1,910,000	\$ 2,480,000	\$ 1,910,000	\$ 2,480,000	\$ 1,910,000	\$ 2,480,000	\$ -	\$ -
Primary Clarifier: Sludge Pump Replacement	Four sludge/scum pumps	\$ 140,000	\$ 180,000	\$ 140,000	\$ 180,000	\$ 140,000	\$ 180,000	\$ 140,000	\$ 180,000	\$ 140,000	\$ 180,000	\$ -	\$ -
Ponds/Wetlands				\$ 5,860,000	\$ 7,980,000	\$ 5,860,000	\$ 7,980,000	\$ 5,860,000	\$ 7,980,000	\$ 5,860,000	\$ 7,980,000	\$ 200,000	\$ 260,000
Treatment Marsh #7	2.3 acres @ \$100,000 per acre			\$ 230,000	\$ 500,000	\$ 230,000	\$ 500,000	\$ 230,000	\$ 500,000	\$ 230,000	\$ 500,000	\$ -	\$ -
Oxidation Ponds: Pond Pump Station R&R Project	Three new pumps			\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ -	\$ -
Oxidation Ponds: Transfer Structure Reconfiguration	Placeholder from Erik Lust			\$ 275,000	\$ 360,000	\$ 275,000	\$ 360,000	\$ 275,000	\$ 360,000	\$ 275,000	\$ 360,000	\$ -	\$ -
Oxidation Ponds: Aerator Replacement	Aerator additions based on a ratio from Petaluma aerator addition 2005 bid (escalated)			\$ 1,470,000	\$ 1,910,000	\$ 1,470,000	\$ 1,910,000	\$ 1,470,000	\$ 1,910,000	\$ 1,470,000	\$ 1,910,000	\$ -	\$ -
Oxidation Ponds: Baffle Wall	Takeoff based on diagonal and SF cost for sheet pile, maybe a high unit cost			\$ 810,000	\$ 1,060,000	\$ 810,000	\$ 1,060,000	\$ 810,000	\$ 1,060,000	\$ 810,000	\$ 1,060,000	\$ -	\$ -
Treatment Wetlands Re-Vegetation Project	TW 1 to 4: total acres x \$100,000			\$ 580,000	\$ 750,000	\$ 580,000	\$ 750,000	\$ 580,000	\$ 750,000	\$ 580,000	\$ 750,000	\$ -	\$ -
Enhancement Wetlands Re-Vegetation Project	EW (3) total acres x \$50,000			\$ 870,000	\$ 1,280,000	\$ 870,000	\$ 1,280,000	\$ 870,000	\$ 1,280,000	\$ 870,000	\$ 1,280,000	\$ -	\$ -
Oxidation Ponds: Emergency Pond Pump Replacement Project	Added pump and piping			\$ 200,000	\$ 260,000	\$ 200,000	\$ 260,000	\$ 200,000	\$ 260,000	\$ 200,000	\$ 260,000	\$ 200,000	\$ 260,000
Oxidation Ponds: Sludge Removal R&R Project	Takeoff based on \$600/ dry ton (Synagro) and compared to McKinleyville - Pond 2 Prioritized			\$ 1,275,000	\$ 1,660,000	\$ 1,275,000	\$ 1,660,000	\$ 1,275,000	\$ 1,660,000	\$ 1,275,000	\$ 1,660,000	\$ -	\$ -
New Parallel/Sidestream Treatment⁽²⁾						\$ 7,380,000	\$ 9,600,000	\$ 14,760,000	\$ 19,200,000	\$ 23,410,000	\$ 30,460,000	\$ 23,350,000	\$ 30,370,000
New Secondary Treatment Project: Oxidation Ditches and Secondary Clarifiers Project	Scaled from Modesto 2.3 MGD OD bid (2008?) and added secondary clarifier from cost curve					\$ 7,380,000	\$ 9,600,000	\$ 14,760,000	\$ 19,200,000	\$ 23,410,000	\$ 30,460,000	\$ 23,350,000	\$ 30,370,000
UV Disinfection/Other		\$ 4,510,000	\$ 5,870,000	\$ 4,510,000	\$ 5,870,000	\$ 4,510,000	\$ 5,870,000	\$ 4,510,000	\$ 5,870,000	\$ 4,510,000	\$ 5,870,000	\$ 3,292,000	\$ 4,280,000
UV Disinfection System	Based on facility plan const cost (based on Trojan budget proposal)	\$ 4,360,000	\$ 5,670,000	\$ 4,360,000	\$ 5,670,000	\$ 4,360,000	\$ 5,670,000	\$ 4,360,000	\$ 5,670,000	\$ 4,360,000	\$ 5,670,000	\$ 3,142,000	\$ 4,080,000
Disinfection: Chlorine/SO2 Project	Placeholder from Erik Lust	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000	\$ 150,000	\$ 200,000
Digester⁽²⁾						\$ 1,200,000	\$ 1,560,000	\$ 1,200,000	\$ 1,560,000	\$ 1,200,000	\$ 1,560,000	\$ 1,200,000	\$ 1,560,000
Digester R&R Project - Phase 1	Based on placeholder for cover rehab from Erik Lust and replacement boiler (larger capacity)					\$ 1,200,000	\$ 1,560,000	\$ 1,200,000	\$ 1,560,000	\$ 1,200,000	\$ 1,560,000	\$ 1,200,000	\$ 1,560,000
Thickening⁽²⁾						\$ 940,000	\$ 1,220,000	\$ 1,410,000	\$ 1,830,000	\$ 1,970,000	\$ 2,560,000	\$ 1,910,000	\$ 2,480,000
New Secondary Sludge Thickening Project	Based on Rotary drum thickener, Marin SD#5 2012 bid					\$ 940,000	\$ 1,220,000	\$ 1,410,000	\$ 1,830,000	\$ 1,970,000	\$ 2,560,000	\$ 1,910,000	\$ 2,480,000
Relocation/Modernization		\$ 400,000	\$ 520,000	\$ 400,000	\$ 520,000	\$ 400,000	\$ 520,000	\$ 400,000	\$ 520,000	\$ 400,000	\$ 520,000	\$ 400,000	\$ 520,000
60 kW PV System	Based on budget quote	\$ 300,000	\$ 390,000	\$ 300,000	\$ 390,000	\$ 300,000	\$ 390,000	\$ 300,000	\$ 390,000	\$ 300,000	\$ 390,000	\$ 300,000	\$ 390,000
Corporation Yard Modifications & Building Replacement	Placeholder	\$ 100,000	\$ 130,000	\$ 100,000	\$ 130,000	\$ 100,000	\$ 130,000	\$ 100,000	\$ 130,000	\$ 100,000	\$ 130,000	\$ 100,000	\$ 130,000
TOTAL COSTS		\$ 16,760,000	\$ 21,870,000	\$ 22,620,000	\$ 29,850,000	\$ 32,140,000	\$ 42,230,000	\$ 39,990,000	\$ 52,440,000	\$ 49,200,000	\$ 64,430,000	\$ 39,862,000	\$ 51,830,000

Notes:
 1. Based on influent flow.
 2. Includes 20 % growth factor applied to secondary treatment and solids handling facilities.
 3. Costs are in today's dollars.

Table X Estimated Lifecycle Cost and Energy Usage Comparison of Treatment Alternatives Wastewater Treatment Plant Improvement Project City of Arcata, California							
							Updated April 5, 2017
Alternative	Description	Secondary Treatment Capacity (MGD)	Estimated Total Project Cost ⁽¹⁾	O&M			Lifecycle Cost ⁽³⁾
				Annual Power Usage (kWh)	Annual Cost ⁽²⁾	Present Worth ⁽³⁾	
4	Common Elements + Pond Improvements Only	2.3	\$29,850,000	1,860,000	\$474,000	\$8,330,000	\$38,180,000
4-1	Common Elements + Pond Improvements + 1 Ox Ditch	4.1	\$42,230,000	2,650,000	\$625,000	\$10,990,000	\$53,220,000
4-2	Common Elements + Pond Improvements + 2 Ox Ditches	5.9	\$52,440,000	3,430,000	\$776,000	\$13,650,000	\$66,090,000
4-3	Common Elements + Pond Improvements + 3 Ox Ditches (Ponds Offline)	5.9	\$64,430,000	3,160,000	\$747,000	\$13,140,000	\$77,570,000
5	Modified Common Elements + 3 Ox Ditches No Pond Improvements and No Phasing	5.9	\$51,830,000	3,160,000	\$747,000	\$13,140,000	\$64,970,000

Notes:

(1) Costs are in today's dollars.

(2) Annual O&M power usage and costs include only differential O&M costs, and does not include the cost of common O&M costs such as influent pumping which are common to all alternatives..

(3) Lifecycle cost is total project cost plus present worth value of annual O&M costs. Annual O&M costs were converted to present worth value based on 3 percent inflation rate, 6 percent discount rate, and 25-year analysis period.

Table Y Estimated Power Usage by Process Wastewater Treatment Improvement Project City of Arcata, California			
			Updated April 5, 2017
Alternative	Description	Estimated Annual Power Usage	
		kWh	Percent
4	Pond Improvements	1,859,000	
	Primary Clarifier	46,000	2.5%
	Oxidation Ponds	1,051,000	56.5%
	UV Disinfection	484,000	26.0%
	Chlorine Disinfection	7,000	0.4%
	Effluent Pumping	271,000	14.6%
4-1	Pond Improvements + 1 Ox Ditch	2,645,000	
	Primary Clarifier	46,000	1.7%
	Oxidation Ponds	1,051,000	39.7%
	Oxidation Ditch	654,000	24.7%
	Secondary Clarifier	89,000	3.4%
	Thickening	44,000	1.7%
	UV Disinfection	484,000	18.3%
	Chlorine Disinfection	7,000	0.3%
	Effluent Pumping	271,000	10.2%
4-2	Pond Improvements + 2 Ox Ditches	3,432,000	
	Primary Clarifier	46,000	1.3%
	Oxidation Ponds	1,051,000	30.6%
	Oxidation Ditch	1,307,000	38.1%
	Secondary Clarifier	178,000	5.2%
	Thickening	88,000	2.6%
	UV Disinfection	484,000	14.1%
	Chlorine Disinfection	7,000	0.2%
	Effluent Pumping	271,000	7.9%
4-3	Pond Improvements + 3 Ox Ditches (Ponds Offline)	3,165,000	
	Primary Clarifier	-	
	Oxidation Ponds	-	
	Oxidation Ditch	2,143,000	67.7%
	Secondary Clarifier	292,000	9.2%
	Thickening	145,000	4.6%
	UV Disinfection	308,000	9.7%
	Chlorine Disinfection	7,000	0.2%
	Effluent Pumping	271,000	8.6%
5	Conventional Treatment 3 Ox Ditches	3,165,000	
	Oxidation Ditch	2,143,000	67.7%
	Secondary Clarifier	292,000	9.2%
	Thickening	145,000	4.6%
	UV Disinfection	308,000	9.7%
	Chlorine Disinfection	7,000	0.2%
	Effluent Pumping	271,000	8.6%

Attachment: C. Estimated Power Usage by process (1452 : WWTP Reconfiguration Progress Report and Recommendation)