Luhdorff & Scalmanini
Consulting Engineers

Technical Memorandum

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Lachi Richards, Wild Wings County Service Area Advisory Committee

FROM: Justin Shobe, PE, Supervising Engineer
Bill Gustavson, Principal Project Manager
Aaron King, Project Engineer
Allison Cronk, Staff Engineer

SUBJECT: **WILD WINGS COUNTY SERVICE AREA (CSA) PUBLIC WATER SYSTEM ARSENIC TREATMENT SYSTEM DESIGN**
TASK 3 – PRELIMINARY TREATMENT SYSTEM INFORMATION

1. INTRODUCTION

This technical memorandum (TM) is the third prepared by Luhdorff & Scalmanini Consulting Engineers (LSCE) for the County of Yolo (County) as part of the Task 3 scope of work for design of an arsenic treatment system for the Wild Wings County Service Area (CSA) Public Water System. The first TM (Task 1 TM) provided a summary of the estimated water demand requirements for the Wild Wings CSA from an analysis of available water production records, and the second TM (Task 2 TM) provided a detailed description of the conceptual arsenic treatment system options and operational strategies for the system. Information presented and decisions made during the development of the Task 1 TM and Task 2 TM were included in the development of this Task 3 TM.

In the Task 2 TM, LSCE presented arsenic treatment options (coagulation/filtration and adsorption) and operational strategies for treating arsenic at the Canvas Back well vs. the Pintail well. During the follow-up review with the Wild Wings CSA, system operator (SUSP), and County of Yolo, it was determined that LSCE would solicit information from arsenic treatment vendors in the form of preliminary proposals to advance the comparison of coagulation/filtration and adsorption treatment technologies. This Task 3 TM presents a summary of the information received from vendors, comparison of options, and recommendations for next steps in pilot testing under Task 4.

2. VENDOR INFORMATION

Preliminary treatment system information was provided by three vendors for adsorption systems or coagulation/filtration (C/F) systems. The vendors included:

- Applied Process Equipment (APE) - *Adsorption*
- ATEC Systems Associates (ATEC) – *C/F*
- AdEdge Water Technologies – *Adsorption or C/F*

The cost estimates, process descriptions, footprints, and expected finished water quality provided by these vendors are detailed in this section. Some of this information was gathered from vendor proposal packages while some was gathered from email and phone correspondence with the vendors.

A comparison of the vendor and treatment options based on the key information obtained from vendors is in **Table 1**. The proposal information from vendors is provided in **Attachment 1**.

2.1 APE (Vendor #1) Adsorption System

APE provided a proposal letter with technical brochure information. The APE adsorption media achieves complete removal of arsenic (to 0 ug/L). Blending with raw water can be used to target an effluent concentration of half the MCL (5ug/L) to extend the life of the adsorption media. The APE system requires no pH adjustment with minimal equipment required for backwash.

APE also recommends pre-treatment for manganese removal given the concentration in Canvas Back is near the secondary Maximum Contaminant Level (MCL). They propose pre-treatment of manganese with a Katalox Light Coagulation/Filtration system. The Katalox system can be operated to reduce manganese in the treated water to the target concentration of 20 ug/L, or lower.

APE Adsorption Treatment

The APE adsorption system uses NXT2 media. The NXT2 media adsorbs both oxidative states of arsenic (As-3 and As-5) without pH adjustment and the media has low interference from silica. The adsorption system would consist of a single 10-ft diameter treatment vessel with a site footprint of approximately 12-ft x 12-ft. There would be approximately 210 cubic feet of NXT2 media.

The adsorption system would be backwashed about once per month to fluff the media. Backwash volume is estimated to be 7,500 gallons, and a 10,000-gallon storage tank would be used. Backwash quality would be similar to the treated potable water quality, with minimal solids, and can be metered to the sanitary system to control the flow and timing of discharge to the sewer. No reclaim pumps, controls or piping systems are necessary since the water can be discharged to the sewer from the tank.

APE Pre-Treatment for Manganese (Optional)

The APE adsorption system does not require pH adjustment. Manganese is not expected to have any appreciable effects on the NXT2 media removal. However, the manganese concentration in Canvas Back is near the MCL of 50 ug/L, and APE has recommended pre-treatment for removal of manganese to consistently meet the MCL and improve aesthetic water quality in the system.

The Katalox Light system, recommended by APE as pre-treatment for manganese, uses a granular, manganese oxide (MnO_2)-coated ZEOSORB filter media, which is a C/F class of system. With this approach, the treatment train would consist of a C/F system (Katalox Light) for manganese removal followed by an adsorption system (NXT2 media) for arsenic removal. APE states that Katalox Light will remove 90% of the manganese. Given an influent raw water manganese of 50 ug/L and a total treatment capacity of 500 gpm, the Katalox Light system could be sized to treat 333 gpm and be blended with 167 gpm of raw water to meet the required 500 gpm at 20 ug/L manganese.

The Katalox filters have less than 3 micron of filtration and operate at approximately 8 gpm/ft^2 for service flow and 10 gpm/ft^2 for backwash flow. The module selected for total flow of 333 gpm would consist of either one approximately 7.5-foot diameter vessel, or two approximately 5.5-foot diameter vessels standing approximately 6 feet for either case. The footprint for this filter system is approximately 7-ft x 15-ft for the two-vessel option, or 10-ft x 10-ft for the single vessel option. The benefits of the 2-vessel option are that the backwashes can be run separately for each vessel, allowing for smaller volumes of backwash water to deal with, and simultaneous continued treatment for manganese while running a backwash. The media lasts 8-10 years.

The Katalox Light system requires backwash every 7 days at maximum design flow of 333 gpm. Backwash water would contain manganese solid accumulated in the filter. The total volume would be approximately 5,000 gallons and the recommended storage tank size would be 10,000 gallons. The same tank can be used with the NXT2 adsorption system backwash system. However, since this pre-treatment C/F system will be adding manganese sludge to the tank, the tank will now need to be equipped with a reclaim pumping station include piping and controls and the tank will need to be cleaned of solids for offsite disposal about once per year.

APE Adsorption Post-Treatment

The only post-treatment required for the APE system is chlorination.

APE Adsorption Pilot Test

APE does not require a pilot test for their system. If a pilot test is performed, the cost is $10,000 for the NXT2 arsenic treatment alone plus an additional $10,000 to test the manganese pre-treatment system. The pilot test would take 60 days for the NXT2 arsenic treatment and 7 to 10 days to test the manganese pre-treatment system.

APE Costs

Adsorption by APE was estimated to be $85,000 for the arsenic treatment vessel plus an additional $75,000 for media. With taxes and shipping the capital cost of the NXT2 adsorption system is estimated to be $200,000. Replacement media cost is preliminarily estimated to be approximately $85,000 including removal, replacement, and disposal of old media. The media replacement frequency must be determined through pilot testing. On cursory review, a range of 1 to 3 years for adsorption media replacement can be expected at the annual production of 90 million gallons per year for the Wild Wings CSA (pilot testing will confirm the media life). A 10,000-gallon backwash tank for use in both the NXT and Katalox backwash cycles would cost $20,000.

Pre-treatment using the Katalox Light system by APE was estimated to be $23,000 for a single tank, or $26,000 for the two-tank design. The media cost would be $22,750. The Katalox media replacement is estimated to be $25,000 every 10 years. The ongoing labor and operations and maintenance (O&M) costs increase with the use of this pre-treatment for routine backwash cycles and sludge disposal.

The total cost of the two-tank Katalox system manganese pre-treatment and the NXT arsenic treatment combined would be approximately $260,000 with taxes and shipping.

2.2 AdEdge (Vendor #2) Adsorption System

AdEdge provided an informal proposal for an adsorption arsenic treatment system. The AdEgde adsorption system is expected to result in complete removal of arsenic to 0 ug/L and a slight removal of manganese to approximately 40 ug/L. The reduction in manganese concentration is expected due to physical filtration of the manganese that would be precipitated due to the pH adjustment and chlorination of the feed water.

A target effluent concentration of arsenic can be achieved by blending with raw water from either Canvas Back or Pintail in controlled quantities to help to extend the life of the adsorption media. The AdEdge adsorption system requires pH adjustment to 7.5.

AdEdge Adsorption Treatment

The AdEdge adsorption system is a skid-mounted, 2-vessel system using BayOxide E-33 media. Each vessel is made of carbon steel and has a 7-ft diameter with a 5-ft tall shell. The vessels are on a skid that is delivered pre-piped, pre-wired, and with manual valves for backwashing the system. The skid footprint would be approximately 10-ft x 20-ft. There would be approximately 200 cubic feet of BayOxide E-33 media.

The backwash for an adsorption system is primarily to reduce bed packing (e.g. media fluffing), but in the case of the AdEdge system as proposed, it will serve the additional purpose of removing manganese precipitate expected to develop during filtration. The system will require backwashing approximately every 30 to 45 days. Backwashes are manually controlled and can be alternated between vessels. Each vessel will require approximately 2,700 gallons of backwash water from the distribution system. A storage tank of 7,000 gallons would be used. Backwash quality would be similar to the treated potable water quality, with minimal solids, and can be metered to the sanitary system to control the flow and timing of discharge to the sewer. No reclaim pumps, controls or piping systems are necessary since the water can be discharged to the sewer from the tank.

AdEdge Adsorption Pre-Treatment

AdEdge requires pre-treatment pH adjustment to about 7.5 to increase solubility of silica and phosphate to reduce their interference with arsenic adsorption. Pre-treatment chlorination is also required to force the transformation of arsenic oxidative state from As-3 to As-5.

AdEdge Adsorption Post-Treatment

Post-treatment readjustment of pH is an option, though not required or recommended by the vendor. This can be done with through the addition of sodium hydroxide (NaOH).

AdEdge Adsorption Pilot Test

The pilot test for the AdEdge adsorption system would last 60 days and cost around $15,000. It is not required by the manufacturer.

AdEdge Adsorption Cost

The capital cost for the AdEdge adsorption system is approximately $250,000 including taxes and shipping. Replacement media cost is preliminarily estimated to be approximately $60,000 including

removal, replacement, and disposal of old media. The media replacement frequency must be determined through pilot testing. On cursory review, a range of 1 to 3 years for adsorptive media replacement can be expected at the annual production of 90 million gallons per year for the Wild Wings CSA (pilot testing will confirm media life).

2.3 AdEdge (Vendor #2) Coagulation/Filtration System

AdEdge submitted a preliminary proposal for a coagulation/filtration (C/F) system that utilizes a greensand media for arsenic reduction. The effluent water quality for this system is expected to be approximately 5 ug/L arsenic and less than 20 ug/L manganese. This system would require pH adjustment and backwashing, as well addition of ferric chloride for pre-treatment.

AdEdge Coagulation/Filtration Treatment

The AdEdge C/F system is a skid-mounted, 2-vessel system using ADGS+ (greensand) black filter media. The 2 vessels are made of carbon steel and are 8-ft diameter with 60-inch side shells. The site footprint of the filter system is about 11-ft x 20-ft. At an effluent arsenic concentration of 5 ug/L, the treatment would be full flow (no blending) to achieve desired water quality. Furthermore, the manganese concentration of 20 ug/L would meet the target effluent and improve the aesthetic water quality.

The system will require a backwash cycle approximately every 3 to 4 days. Backwashing is automatically controlled and conducted consecutively from one vessel to the next. Approximately 4,500 gallons of treated water is required to backwash each vessel, resulting in a total 9,000 gallons used for backwashing both vessels. During backwash, treated water would be taken from the distribution system at a flow of 500 gpm for a duration of 20 minutes. The water could be taken directly from the onsite storage tank. Coagulation/filtration backwash will contain manganese, iron, and arsenic at relatively high concentrations. This waste will be stored in a 20,000-gallon storage tank. A reclaim water system would be used to recycle the backwash waste, and the solids in the tank will be removed and discarded approximately once per year. AdEdge offers an optional H2Zero backwash recycle and sludge management system to reduce waste and provide options for disposal.

AdEdge Coagulation/Filtration Pre-Treatment

Pre-treatment pH adjustment to about 7.3 and pre-chlorination are required. Addition of ferric chloride to between 2 and 2.5 mg/L is required.

AdEdge Coagulation/Filtration Post-Treatment

The pH can be readjusted by the addition of sodium hydroxide. However, at a pH of 7.3, post-treatment may not be needed (pilot testing will confirm if post-treatment is necessary).

AdEdge Coagulation/Filtration Pilot Test

The pilot test for the AdEdge coagulation/filtration system would last 7 days and cost $15,000.

AdEdge Coagulation/Filtration Cost

The capital cost for this system is approximately $300,000 including taxes and shipping. Replacement media cost is preliminarily estimated to be approximately $70,000 including removal, replacement, and disposal of old media. The media replacement frequency is every 10 years.

2.4 ATEC (Vendor #3) Coagulation/Filtration System

ATEC provided a preliminary proposal for a coagulation/filtration system. This system would treat both arsenic and manganese to around 5 ug/L. The ATEC system would require pH adjustment and backwashing, with additional chemical feed possible. Of the C/F systems available on the market, ATEC tends to be the simpler to operate.

ATEC Coagulation/Filtration Treatment

The ATEC C/F system is a skid-mounted system with multiple vertical vessels. The vessels are 48-inch diameter and approximately 10 feet tall and come pre-piped and pre-wired. Piping and valves on the top of the vessels control the flow for service and backwash using 3-way valves on each vessel. Each vessel would hold approximately 43 cubic feet of pyrolusite media that would be replaced at 10-year intervals or longer. ATEC uses pyrolusite media which is a pure form of manganese dioxide. The loading rate of this media is typically higher than competing oxidative media, 8-12 gpm/ft^2 can be expected (pilot testing would confirm the actual loading rate and thus filter size and cost). On a preliminary review, a 6-vessel system could be used with a site footprint of 11-ft x 20-ft, however a smaller size might be possible depending the outcome of pilot testing.

The system will require backwashing every day. Backwashing is automatically controlled, and approximately 13,500 gallons of treated water will be required. Coagulation/filtration backwash will contain manganese, iron, and arsenic at relatively high concentrations. A benefit of ATEC vessels is that they can use raw water from the well to produce treated water for backwashing using the multiple vessel arrangement and the 3-way valves. In this way, the distribution system does not need to provide backwash water. This waste will be stored in a 20,000-gallon storage tank. A reclaim water system would also be used to recycle the backwash waste, and the solids in the tank will be removed and discarded approximately once per year.

ATEC Coagulation/Filtration Pre-Treatment

Pre-treatment pH adjustment to about 7.3 and pre-chlorination are required. Addition of potassium permanganate may be required to mitigate the effect of silica on the filtration media.

ATEC Coagulation/Filtration Post-Treatment

The pH can be readjusted by the addition of sodium hydroxide. However, at a pH of 7.3, post-treatment may not be needed (pilot testing will confirm if post-treatment is necessary).

ATEC Coagulation/Filtration Pilot Test

A pilot test is required by ATEC and it will finalize any unknown design parameters. The pilot test for the ATEC coagulation/filtration system would last 5 days and cost approximately $7,000-$10,000.

ATEC Coagulation/Filtration Cost

The capital cost of the system is approximately $200,000 if a 6-vessel system is required, including taxes and shipping.

2.5 Comparison of Preliminary Manufacture Proposals

Table 1 compares the information provided by each of the treatment manufacturers.

Table 1: Comparison of Vendor Information

	APE (Adsorption)	AdEdge (Adsorption)	AdEdge (C/F)	ATEC (C/F)
Water Quality				
Arsenic Removal	100%	100%	To 5 ug/L	5 ug/L
Manganese Removal	To 20 ug/L (Katalox blended)	20%	To Less than 20 ug/L	5 ug/L
Competing chemicals concern	None	Silica	None	None
Footprint				
Vessel Size **	10' Dia (1 vessel)	7' Dia (2 vessel)	8' Dia (2 vessel)	4' Dia (6 vessel)
Footprint **	12'x12' (NXT) 7'x15' (Katalox)	10'x20'	11'x20'	11'x20'
Pre-Treatment **	Mn Pre-Treatment (Katalox)	Acid to drop pH to 7.5 for Silica	Acid to drop pH to 7.2-7.4 Ferric Chloride (FeCl)	Acid to drop pH to 7.2-7.4 Potential Potassium Permanganate
Post Treatment **	None	Readjust pH	Readjust pH	Readjust pH
Media				
Type	NXT2	BayOxide E33	Greensand+	MnO2
Volume **	210 cf	200 cf	300 cf	260 cf
Media Life	1-3 years **	1-3 Years **	10+ years	10+ Years
Backwash				
Source	Distribution System	Distribution System	Distribution System	Well
Volume **	7,500 gallons	7,000 gallons	9,000 gallons	13,500 gallons
Frequency **	Every 30 days	Every 30-45 days	Every 3-4 days	Every Day
Duration and Flow	10 minutes @ 750 gpm	20 minutes @ 270 gpm	20 minutes @ 500 gpm	30 minutes @ 600 gpm (from well)
Effluent WQ	Same as Distribution System	Same as Distribution System	Mn/As solids sludge	Mn/As solids sludge
Backwash Tank	10,000 gallons	10,000 gallons	20,000 gallons	25,000 gallons
Pilot Test				
Required	No	No	No	Yes
Cost	$20,000	$15,000	$15,000	$10,000
Duration	60 days for NXT 5 days for Katalox	60 days	7 days	5 days
Costs				
Capital Cost	$260,000	$250,000	$300,000	$200,000
Replacement Media	$85,000 (NXT – 1-3 years) $25,000 (Katalox – 10 years)	$60,000 (1-3 years)	$70,000 (10 years)	$70,000 (10 years)

*** Pilot Testing is required to finalize these values*

Pilot testing would be used to determine final system sizing, formal cost estimates from the vendors, pre- and post-treatment benefits, and the estimated media life (for adsorption). Below are preliminary cost estimates based on a cursory review of the complete upgrade requirements using the preliminary information obtained from vendors and previous evaluations of other site upgrades.

Table 2 provides a preliminary estimate of the total capital costs of both adsorption and C/F systems considering the upgrades required on each site pertaining to installation, backwash recovery, pre-treatment, contractor site work, and upgrades for a VFD and SCADA systems.

Table 2: Capital Cost (Preliminary Estimate)

Type	Adsorption		C/F	
Treatment System	$250,000	Example: AdEdge	$300,000	Example: AdEdge
Treatment Install	$50,000	Cost for assembly	$50,000	Cost for assembly
Backwash Tank	$30,000	10Kgal tank and appurt.	$70,000	25Kgal tank and appurt.
Reclaim System	$0	(not needed)	$50,000	50 gpm pump station
Filter Face Piping	$20,000	Connections to skid	$20,000	Connections to skid
Pre-Treatment Systems	$25,000	Enclosure and equip.	$50,000	Enclosure and equip.
Site Work	$250,000	Pads, utilities, site mods	$250,000	Pads, utilities, site mods
Control Upgrades	$200,000	100 HP VFD and SCADA	$200,000	100 HP VFD and SCADA
Contractor Markup & Mob.	$200,000	Approx. 20% of above	$200,000	Approx. 20% of above
Upsizing Contingency	$200,000	Approx. 20% of above	$200,000	Approx. 20% of above
Total **	**$1,225,000**		**$1,390,000**	

*** Pilot Testing is needed to confirm sizing and system requirements for actual cost estimate*

Table 3 provides an approximate comparison of the life-cycle costs of the adsorption versus C/F systems. These costs consider only the media replacement cost, providing a total cost after 50 years of operation (which is the assumed useful life).

Table 3: Preliminary Life Cycle Cost

Type	Capital	Media	Media Life	50-year Total Cost
Adsorption	$1,225,000	$85,000	2 years **	$3,350,000
C/F [1]	$1,390,000	$70,000	10 years	$1,740,000
Combined (APE)	$1,500,000	$85,000 ($25,000 C/F)	2 years ** (10 years C/F)	$3,750,000

*** Pilot Testing needed to confirm media life.*
(1) The C/F cost does not include the added cost of O&M and labor for backwash, reclaim and solids disposal.

3. PRELIMINARY CONCLUSIONS

It can be concluded that either technology is feasible to remove arsenic to meet that primary MCL requirement and the target arsenic concentration of half the MCL (5 ug/L). Pilot testing is required for the vendors to confirm treatment sizing, pre-treatment requirements, media life, and total system cost. At this point, no final conclusions can be reached in terms of which technology would provide the lowest capital cost and life cycle cost; however this preliminary review indicates C/F would have a higher capital

cost and a lower life-cycle cost due to frequent media exchanges of adsorption media. Pilot testing both systems is needed to confirm preliminary findings.

The advantages and disadvantages of either technology remain as described in TM 2. Namely, the adsorption systems will be easier to operate as a filter that has very little automation and in frequent backwashing that can be discarded to the sewer. In contrast the C/F will be backwashed daily through automation, the tank will accumulate sludge that need to be discarded annually, and the system will include a reclaim pumping system adding to the programming and automation.

In terms of delivered water quality for customers, assuming current influent water quality, the C/F systems reduce both arsenic and manganese concentrations to meet the targets (5 and 20 ug/L, respectively) set out in TM 2. Excepted delivered concentrations of both constituents are approximately 5 ug/L with the C/F systems. Adsorption alone can achieve the target for arsenic, but does not reach the desired removal of manganese to 20 ug/L. While the system is not out of compliance for manganese, an adsorption would not remove manganese nor improve the aesthetic problems.

The APE combined system, by using both pre-treatment of C/F to target manganese, and a main treatment using adsorption to target arsenic, neither of which require pH adjustment, reduces both target constituents to at or below the target levels. The combined system delivered concentrations of arsenic and manganese are expected to be 0 ug/L and 20 ug/L respectively and the capital cost is in the same magnitude as the other options. A concern with the combined APE system would be whether the sites have the space to fit the system, which can be determined through pilot testing and final system sizing.

An important consideration should be future conditions. If arsenic concentrations in the treated well rise significantly above current levels, a C/F system alone will likely not be able to meet the target concentration of 5 ug/L for arsenic, although it will still meet the MCL of 10 ug/L. Similarly, if the concentration of manganese increases in the treated well, an adsorption system alone will, in addition to not meeting the target concentration of 20 ug/L for manganese, begin to approach the MCL of 50 ug/L. The combined system will continue to meet both target concentrations, even if influent concentrations rise above current conditions.

4. NEXT STEPS FOR PILOT TESTING

Per discussions with the Wild Wings CSA representative, system operator, and Yolo County, pilot testing of both types of treatment systems (adsorption and coagulation/filtration) is desired. Based on the vendors costs above, to pilot test all vendors and all systems would be approximately $60,000 of vendor fees, plus the scope and budget for LSCE to oversee the process. In the next task, LSCE will develop a pilot program to obtain final costs from the selected list of vendors.

LSCE recommends, at minimum, pilot testing the APE combined system (adsorption and C/F) and the ATEC system (C/F). The ATEC system appears to be the best capital price, meets the target water quality for arsenic and manganese, and is the best option for C/F given unique advantages with backwash supply and simple operation. The APE combined system would provide the best effluent quality and pilot testing should be done to confirm if the combined system can fit on either site. If desired, the AdEdge adsorption system can also be pilot tested for a comparison of adsorption options.

Following a review and follow-up meeting with the County, System Operator, and CSA Advisory Committee, and as outlined in LSCE's scope of work, LSCE will commence on the next task (Task 4) which will be to perform pilot testing on the system. Vendors selected for pilot testing will be based on the decisions made from this Task 3 TM. As described in LSCE's scope of work, LSCE will coordinate with the vendors and SUSP to commence these pilot testing efforts.

Attachment 1

Vendor Information:

Applied Process Equipment

APPLIED PROCESS EQUIPMENT

Water Treatment Division

To: *Aaron King with Luhdorff & Scalmanini, Consulting Engineers*
From: *Applied Process Equipment, Inc.*
Subject: *Arsenic Treatment System*
Date: *October 14, 2020*

This report summarizes a preliminary proposal for treatment of arsenic and manganese in the water supply detailed by LSCE. It covers a review of the provided water analysis, proposed process system details, and additional product information.

We appreciate you submitting the water analysis for our review as this information greatly assists us in determining the best system to treat your arsenic and to provide an accurate estimation for media life. To review the water supply, we first input the specific water chemistry into our ISOLUX performance and estimation worksheet. The result of this estimation is included for your review.

The water supply has a few components to be addressed for arsenic treatment. The water has an average arsenic level of 10 ppb and a high reading of 15 ppb with a need for treatment to consistently remove arsenic to a level below 10 ppb. We assessed the capability of the ISOLUX arsenic treatment system and determined:

- The manganese level is at 50 ppb and is at EPA MCL. This secondary limit is enforceable in California and pretreatment to remove this contaminate is advised. Also, due to ISOLUX fine particle size, the manganese significantly reduces the free space between the particles available for water flow. This results in increased pressure drop and reduced flow rate. In severe cases, the flow rate can be reduced to the point where effective operation can no longer be maintained and the media must be replaced before arsenic removal capacity is reached.
- Silica is at 42 ppm. The silica concentration is relatively high and a common cause of media bed fouling. Silica forms a gelatinous mass that coats the media bed preventing the adsorption of arsenic.
- The pH level is at 8.32. Lowering pH is necessary for optimum performance and media life.

Due to these water conditions that negatively impact the ISOLUX performance and the higher flow rate of 500 GPM, we recommend pretreatment for the removal of manganese followed by NXT media for arsenic removal. The NXT product allows for the higher flow rate compared to ISOLUX, is least susceptible to competing ions such as silica and can operate without the adjustment to pH. Our firm is unique in our ability to utilize six of the seven most widely used arsenic removal media. As an OEM we are an authorized distributor of all the listed products in the attached comparison sheet. This position allows us to solve problems and work to find the exact set of treatment products and delivery systems to efficiently address your specific application requirements.

There are two options we have available for the removal of manganese in the water supply. One option is the use of a filter media called Katalox Light. There are several benefits to using Katalox light as a filtration media:

- The media will removal enough manganese to keep the concentration below MCL.
- The media also has the ability to remove some arsenic, further extending the media life of NXT arsenic removal media.
- The media life is long and would need to be replaced between 8-10 years.

This media does however require a rigorous backwash cycle to remove oxidized manganese and as a complete system will include one large vessel containing Katalox Light media and a separate tank and pump to provide the backwash water.

The second option is the use of a system consisting of an ozone generator, a multimedia filter, and a cone bottom sedimentation tank. This option has the benefit of removing the manganese to near non-detect and having a lower capital cost. The process includes:

- The **ozone generator** to convert the dissolved manganese metal into a manganese oxide precipitate. This will allow for the particulates to settle out of the water and be easily removed.
- A **multimedia filter system** will be installed to capture particulate manganese oxide. The unfiltered water flows downward through a tank of filter media where suspended particles are trapped down to a 0.5-micron level. When the trapped particles cause a pressure differential across the media bed, an automatic control valve will backwash the system. The frequency of the backwash cycle will be determined with operation.
- The backwash cycle will release trapped particles within the media and for this reason the backwash water will flow into a **cone bottom tank** to allow for the particles to settle out of the backwash water. A timer on the cone bottom tank will release the settled particles into a bag filter for disposal and the bag can be replaced once full. The water from the cone bottom tank will be released to current drain system or can be reintroduced into the treatment system.

The NXT system was reviewed by the chief chemist at Treibacher and they provided a recommended size for the treatment system and estimate for media life. This estimation is based on a single water analysis and variation must be considered based on seasonal changes and other environmental factors that can change a water chemistry. The required media is estimated to be 5150 kg and will have a media life of one year. There are a few options for tank sizing depending on space restriction and preference:

- a tank diameter of 10 ft to keep the surface loading rate low enough and height of 5 ft.
- use a number of 48 inch diameter vessels. Three vessels for full flow.
- a lead-lag pair of 10 ft diameter tanks. By setting up a lead lag system, the lead vessel can quickly be converted to the lag position when the concentration tests near maximum arsenic level. This will allow the system to continue running with little downtime. It also allows the media to be used to the fullest and ensures that you do not have to be waiting for the replacement of media to continue operating. The use of a lag vessel will increase the capital cost but will not increase the operation costs for the system.

You will need to hire a licensed mechanical contractor to do the installation. We will provide final drawings and installation instructions after a purchase order is submitted. There is an option for an APE technician to be onsite to provide guidance and startup training. Pricing information for this option is detailed in the following budget quote. Once all modifications to the design are complete and a purchase order is received, we estimate complete system delivery to be 8-10 weeks.

After reviewing this information, please contact us with any questions. We will gladly work with you on any changes and modifications that you desire. We look forward to hearing from you and taking the next step to a solution.

Submitted By:

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Competitive Comparison Chart - February 2020

	Zirconium Hydroxide	Lanthanum Oxide	Aluminum Hydroxide	Ferric (Iron) Oxide	Ferric (Iron) Hydroxide	Impregnated Iron Resin	Titanium Dioxide
Manufacturers	ISOLUX	EP Minerals NXT2	AXENS	Adedge - E33 LanXESS - E33 **(GFO)**	EVOQUA GFH	Purolite - A33E FerrylX	Graver MetSorb DOW - As500
Description	Powder in cartridges	Granular in pressure vessels	Iron impregnated activated alumina	Granular in pressure vessels	Granular in pressure vessels	Round bead resin	Granular in pressure vessels
AsIII & AsV removal	Yes, Both simultaneously	Yes To pH 10.0	Yes, better for AsV, oxidation recommended	Yes, but must be oxidized.	Yes, but more effective for Arsenic (As) V	Yes	Yes, less effective for AsIII
Periodic Backwashing required	No	Yes	No	Yes	Yes	No	Yes
Reaction time *(empty bed contact time)*	27 seconds	1.5 to 3 minutes	5 minutes minimum	Typically 3 - 5 minutes	3.5 minutes minimum	2.5 to 5.0	3 minutes
Potential to Dump Arsenic	None	Yes, above pH 12.0	Yes, under extreme pH ranges – > 11 or < 3	Yes, under certain circumstances	Yes, under certain circumstances	Yes	None.
Wastewater generation	None	Yes backwash	Yes backwash	Yes backwash	Yes backwash	None	Yes backwash
pH Zero point-of-charge **	11.0	12.0		9.0	9.0	9.0	9.0
pH range ***	4 – 11.0	5.5 – 10.5	5.0 – 8.0	5.5 – 8.3	5.5 – 8.5	4.5 - 8.5	6.5 – 8.5
Cost per Gallon Treated	High	Low	Low	Average	Average/High	High	Low

WATCH GmbH
A Water Company

MADE IN GERMANY

KATALOX LIGHT

ADVANCED FILTRATION MEDIA

Filtration of

- Less than 3 micron
- Suspended solids
- Sediments
- Turbidity
- Organics
- Color
- Odor

Removal of

- Iron
- Manganese
- Hydrogen Sulfide
- Arsenic
- Radium
- Heavy Metals
- Radionuclides






Water Quality. NSF. Green Technology

www.watchwater.de

Product Information

WATCH GmbH
A Water Company

What is Katalox Light®?

Katalox Light® is a new brand of revolutionary advanced filtration media completely developed in Germany. It's composition simply makes it outstanding against the contemporary filter media available in water treatment industries, like sand, BIRM, Greensand Plus, Manganese Greensand etc. **Katalox Light®** is manufactured in Germany.

Katalox Light® is engineered with unique MnO_2 coating technique on ZEOSORB®, providing it light weight, higher filtration surface, more service life and more reliable performance (filtration down to 3µm) than any other existing granular filter media.

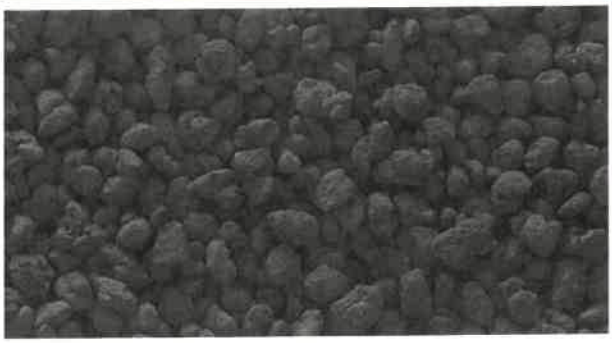
Katalox Light® is being used in numerous system for residential, commercial, industrial and municipal applications worldwide, for High level filtration, color and odor removal, Iron, Manganese, Hydrogen sulfide removal, efficient reduction of Arsenic, Zinc, Copper, Lead, Radium, Uranium and other radionuclides and heavy metals.

Katalox Light® is ANSI/NSF 61 Certified for drinking water applications and has met the ANSI/NSF 372 Lead free compliance.

Advanced use

High concentration coating of MnO_2 on the **Katalox Light®** surface (10%) is the biggest advantage compared to any similar product available in the market. This makes the oxidation and co-precipitation of contaminants much more effective. For removal of very high concentration of contaminant it's recommended to use H_2O_2 as an oxidizer, which provides accelerated catalytic oxidation on the surface of the media. Conventional oxidizing agents like chlorine or potassium permanganate also could be used if required.

Katalox Light® can be used for Arsenic, Radium, Uranium removal but in these cases there is requirement of Iron in the water. **Katalox Light®** system is designed with special iron dosing technology which has many advantages over Adsorbent media used for Heavy Metal removal.



ADVANTAGES:

- High content MnO_2 coating (10%)
- Very High Surface Area
- Contains NO Crystalline Silica
- Light Weight - providing significant savings on backwash water
- Higher Filtration rates
- Filtration of sand, sediment and suspended solids, down to 3 micron
- High efficiency removal capacity of Iron, Manganese and Hydrogen sulfide
- Effective reduction of Arsenic, Zinc, Copper, Lead, Radium, Uranium, radionuclides and other heavy metals
- Media replacement every 7 - 10 years
- No disinfection by-product
- No mandatory $KMnO_4$, chlorine or chlorine dioxide dosing
- Low operational costs
- Unique product, unmatched by our competitors

The Future

The future of water treatment, as we see it, is going to give us more difficult challenges and we all need more advanced and robust products.

In **Watch®**'s vision, **Katalox Light®** can be addressed for advanced concepts like Water Reuse, Controlled Adsorption of Arsenic and Heavy Metals, advanced Membrane pre-treatment, Zero-Discharge Cooling tower etc.

Contact us for information.

Standard Packaging:
1 ft³ bags (28 Liters); Mass: 30 kg (66 lb)
40 bags on a Pallet
16 Pallets in a container

KL Systems

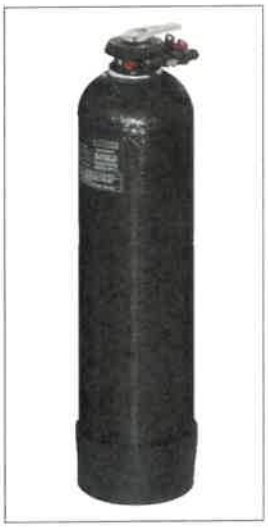
WATCH GmbH
A Water Company

Watch® **Katalox Light®** systems offer a new technology with advanced catalytic filtration available in water treatment industry. All systems have been engineered keeping both professionals and consumers in mind. Systems are available with different models and customized for manual backwash without using electricity or it can be made fully-automatic. System can be used in a variety of applications including residential, commercial and any process water applications for food and beverage industry.

Standard systems are designed with a filtration velocity of 20 m/h (8.2 gpm/ft^2) to provide a good filtration. This value may differ for advanced application like Arsenic, Radium, Uranium and other Heavy Metal removal where co-precipitation process requires higher contact time thus lower filtration velocity. Running the system at higher velocity may compromise the filtration performance.

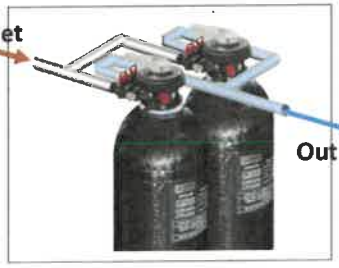
Virtually there is no flow rate limitations for KL systems as KL units can be configured in parallel to address industrial high flow requirements.

KL System with simple Manual Control



KL System with fully Automatic Control

Parallel configuration for Higher Flow rates



Example:
2 parallel KL 1465-Mn would have a total flow of 2 x 3000 lph = 6000 lph (26.2 gpm)

Standard Pressure Vessel Listing for KL Systems (Manual/Automatic)

Pressure Vessel			KL media amount			Service flow rate				Backwash	
			volume		Bed Height	Standard		Maximum			
Vessel Model	Area	Freeboard				flow-rate		flow-rate		flow-rate	
	m^2	%	liters	ft^3	mm	m^3/h	gpm	m^3/h	gpm	m^3/h	gpm
08x44	0.03	30	24	0.8	725.3	0.6	2.9	1.0	4.3	0.8	3.6
10x54	0.05	30	42	1.5	838.6	1.0	4.5	1.5	6.7	1.3	5.6
12x52	0.07	30	56	2.0	767.5	1.5	6.4	2.2	9.6	1.8	8.0
14x65	0.10	30	98	3.5	986.8	2.0	8.7	3.0	13.1	2.5	10.9
16x65	0.13	30	126	4.5	971.3	2.5	11.4	3.9	17.1	3.2	14.3
18x65	0.16	30	170	6.0	1035.5	3.5	15.5	4.9	21.7	4.1	18.1
21x60	0.22	30	224	8.0	1002.4	4.5	19.7	6.7	29.5	5.6	24.6
24x69	0.29	30	308	11.0	1055.3	6.0	26.3	8.8	38.6	7.3	32.1
30x72	0.46	30	510	18.0	1118.3	10.0	44.2	13.7	60.2	11.4	50.2
36x72	0.66	30	764	27.0	1163.4	15.0	66.0	19.7	86.7	16.4	72.3
42x78	0.89	30	935	33.0	1046.1	20.0	86.6	26.8	118.1	22.3	98.4
48x82	1.17	30	1300	46.0	1113.5	25.0	110.0	35.0	154.2	29.2	128.5

Technical Data

WATCH GmbH
A Water Company

Composition of KATALOX LIGHT®:

Compounds	Typical value	Specifications
ZEOSORB (Naturally Mined)	85%	>85%
Manganese dioxide	10%	>9.5%
Hydrated Lime	5%	<5%

Physical Properties:

Appearance		Granular black beads
Odor		none
Mesh size	US	14 x 30
	SI	0.6 - 1.4 mm
Uniformity Coefficient		≤ 1.75
Bulk density	US	66 lb/ft^3
	SI	1060 kg/m^3
Moisture Content		<0.5% as shipped
Filtration		< 3 micron
Removal Capacity	for Fe^{2+} alone	3000 mg/l 85000 mg/ft^3 (aprx)
	for Mn^{2+} alone	1500 mg/l 42500 mg/ft^3 (aprx)
	for H_2S alone	500 mg/l 14000 mg/ft^3 (aprx)

Recommended System Operating Conditions:

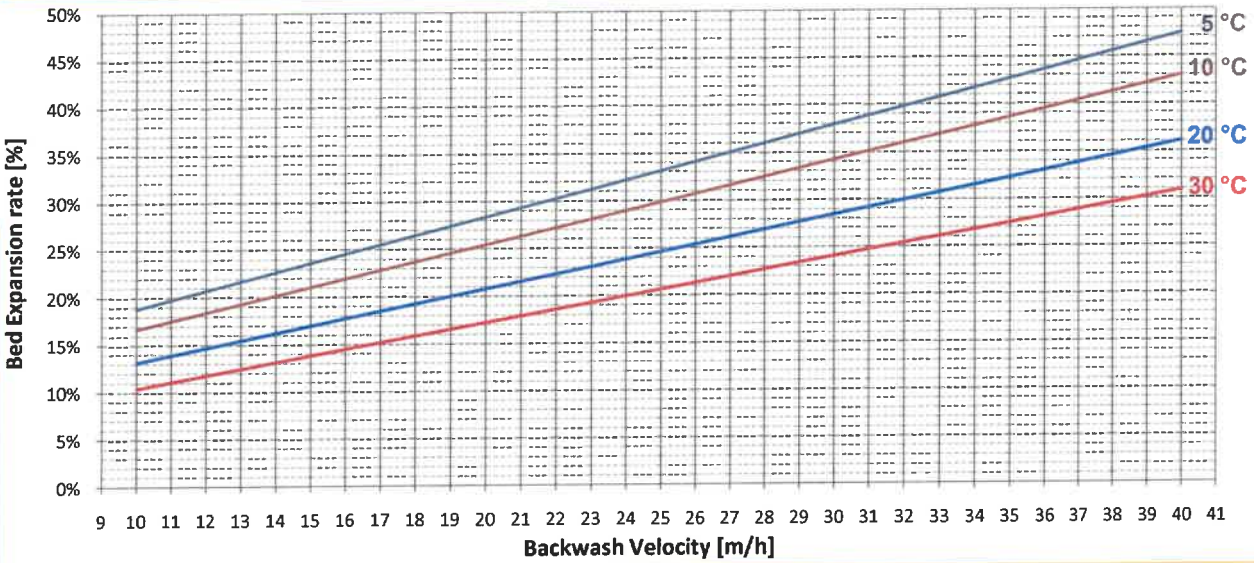
Inlet water pH		5.8 - 10.5
Freeboard		25 - 35%
Min. Bed Depth	US	29.5 inches
	SI	75 cm
Optimal Bed. Depth	US	47 inches
	SI	120 cm
Service flow	US	6 - 12 gpm/ ft^2
	SI	15 - 30 m/h
Backwash velocity	US	8 - 10 gpm/ ft^2
	SI	20 - 25 m/h
Backwash time		5 -10 minutes
Rinse time		1 - 2 minutes

Regeneration/Dosing (optional*)

*Only if the water doesn't have sufficient oxygen to oxidize the contaminants. It also helps to clean the media surface better if used at the backwash

H_2O_2	for 1.0 mg/l of	Fe^{2+}	0.9 mg/l
	for 1.0 mg/l of	Mn^{2+}	1.8 mg/l
	for 1.0 mg/l of	H_2S	4.5 mg/l
$KMnO_4$/Cl	for 1.0 mg/l of	Fe^{2+}	1.0 mg/l
	for 1.0 mg/l of	Mn^{2+}	2.0 mg/l
	for 1.0 mg/l of	H_2S	5.0 mg/l

Backwash Velocity [m/h] vs. Bed Expansion [%]:



Distributed by:

Address:

Tel:
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Manufactured by:

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A Water Company

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Tel: +49 621 87951-0
Fax: +49 621 87951-99
Email: info@watchwater.de

Arsenic Removal

NXT®-3C

NXT Adsorptive Media

Benefits:

Cost Effective:

- High capacity for As adsorption - Provides the lowest adsorptive treatment cost per 1000 gallons
- Rapid kinetics
- Dry media - Easy to use, free flowing
- Removes other contaminants - phosphate, chromium, selenium, fluoride, antimony, lead and more
- No chemicals required for regeneration
- Removes both As (III) and As (V) to less than 5 µg/l (ppb) without the need for an oxidation step
- Removes As up to 10 pH without the need for chemical pretreatment

Safe:

- Will not release bound Arsenic in the event of pH upset
- Non-hazardous waste - Meets TCLP Requirements

NXT®-3C Typical Properties:

- Description: Patented Mixed-Metal Adsorptive Media
- Surface Area: 250 m^2/g
- Zeta Point pH: 12.0
- Bulk Density: 49lb/ft^3
- Particle Size: 10 x 65 mesh
- Color: Reddish Brown
- Minimum EBCT: 2.5 Minutes
- Surface Loading Rate: 7-9 gpm/ft^2

Certified by:

NSF®

EP Minerals®

Phone: 775.824.7600
Fax: 775.824.7601
Email: incredible_minerals@epminerals.com
www.epminerals.com

Arsenic Removal

NXT®-3C is a patented iron and lanthanum-based media which provides users with the lowest treatment costs per thousand gallons for adsorption technology. This is due to the high surface area of the media, which is greater than 250 m^2/gram. High surface area increases the medias capacity for arsenic adsorption and extends bed volumes.

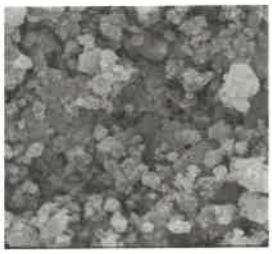
In addition to the high surface area, NXT-3C is stable. Once the arsenic is bound to the media, NXT-3C will not release the bound arsenic in the event of pH upset. Release or "spiking" occurs when the pH of the water exceeds the zeta point pH of the media. NXT-3C has a high zeta point pH of 12.0 while many iron based medias have a zeta point of 7.8 pH. This stability reduces the potential to distribute water which has high arsenic concentrations in excess of the EPA standard, due to loss of pH control.

NXT-3C Pilot Unit

NXT®-3C

ARSENIC REMOVAL SYSTEMS

NXT® is a patented iron and Lanthanum based adsorption media uniquely formulated to remove Arsenic from drinking water.



PROPERTIES

Zero Point of Charge (ZETA point): 12.0 pH

Surface Area: Greater than 200 m2/g

Weight: One cubic ft. = 48 lbs.

Particle Size: 10 x 65 mesh

Color: Reddish brown

Minimum EBCT (empty bed contact time): 2.5-5.0 minutes

Surface Loading Rate: 7-9 gpm/ft²

Total Adsorptive Capacity:
Greater than 50 g/kg As Anions (+3 &+5)

Pressure Drop: Less than10 psi

NSF
Certified to NSF/ANSI/CAN 61

OTIMUM WORKING CONDITIONS

	Ideal Range:	Units:
pH	5.5 – 9.5	mg/L
Total Arsenic	0.010 – 0.100	mg/L
Iron	Less than 0.3	mg/L
Manganese	Less than 0.05	mg/L
Phosphate	Less than 0.55	mg/L
Silica	Less than 35	mg/L
Sulfate	Less than 100	mg/L
Sulfides	Less than detect	mg/L
Total Suspended Solids	Less than 5	mg/L
Vanadium	Less than 0.05	mg/L
Fluoride	Less than 1	mg/L
Turbidity	5 NTU	NTU
Hardness	Less than 300	mg/L

** USEPA TCLP tested as non-hazardous waste safe for landfill, but due to variances in influent water quality, users are urged to perform independent verification of the non-hazardous character of spent media cartridges. Additionally, some states may have disposal criteria different from Federal guidelines (TCLP).*

NOTE THE FOLLOWING:
Water with pH greater than 9 may still require pH adjustment for optimum performance.
Economical treatment can still be achieved if ideal range is exceeded parameters are exceeded, particularly for increased levels of Silica and phosphate compared to other adsorptive medias.

9332 North 95th Street, Suite B106, Scottsdale, AZ 85258 *Phone: 480-998-4097* sales@isolux-arsenicremoval.com

ARSENIC REMOVAL SYSTEMS

Unmatched Performance & Lowest Treatment Cost

NXT® is a patented iron and Lanthanum-based adsorption media uniquely formulated to remove Arsenic from drinking water. A mixed metal, (La-FeO), with large, solid, high surface area granules, NXT has demonstrated twice the arsenic loading capacity, longer life and shorter reaction time (EBT) than other iron-based medias.

Ideal for medium to high flow rate applications to 2,000 gpm, NXT media is NSF 61 certified and delivers unmatched performance compared to other arsenic adsorption medias:

- Lowest cost per gallon treated.
- Simultaneous AsIII and AsV removal without pretreatment.
- Handles high levels of silica, phosphorous and vanadium that quickly plug other medias.
- Functions at pH 10 eliminating need/cost of pH adjustment.
- Strong arsenic bond that won't release in backwash or pH spikes.

NXT Lanthanum granules

Specifications

System Type:	Granular media in pressure vessels
Media Type:	Patented Lanthanum adsorption media
Surface Area:	Greater than 200 m^2/g
Bulk Density (weight):	48 lbs./Cubic ft.
Minimum Empty bed contact time (EBCT):	2.5 to 5 minutes
Surface Loading Rate:	7-9 gpm/ft^2
Particle Size:	10 x 65 mesh
Contaminant removal:	Arsenic III & V, plus phosphate, chromium, selenium, fluoride
Backwashing:	Monthly
pH range:	5.5 – 10.5
pH Zero point-of-charge *(ZETA point)*:	12.0
Media Disposal:	Landfill*
Water Treatment Vessel:	steel pressure vessels in ten standard sizes
Vessel Construction:	100 psig, mild carbon steel, with NSF 61 lining
Pressure Drop:	Less than 10 psi
Cost per Gallon Treated:	Low

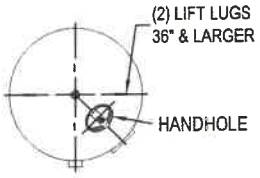
** USEPA TCLP tested as non-hazardous waste safe for landfill, but due to variances in influent water quality, users are urged to perform independent verification of the non-hazardous character of spent media cartridges. Additionally, some states may have disposal criteria different from Federal guidelines (TCLP).*

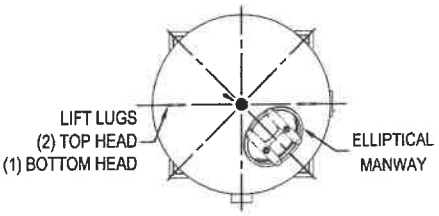
NSF

Steel Water Treatment Vessels

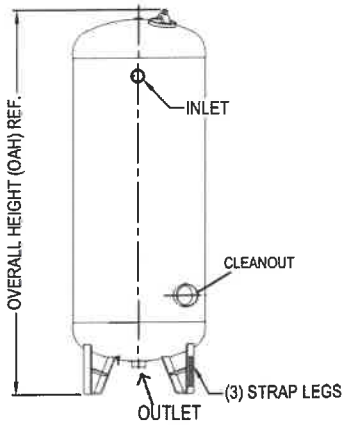
Ten Standard Sizes from 20"–72" for a Wide Range of Applications

- Versatile vessels designed for NXT Lanthanum adsorption media
- Carbon steel construction
- 100 PSIG working pressures (150 PSIG available)
- Seismically rated supports optional
- NSF/ANSI 61 certified epoxy lining for excellent corrosion protection & long life
- Finish coated in "Safety Blue" epoxy
- ASME Code available on request
- Custom sizes available if required

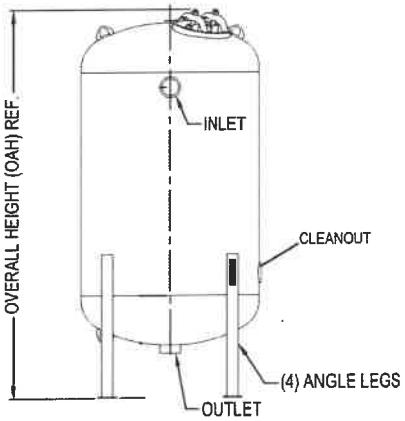




Internal steel distributors installed in all tanks.



Regular Capacity Tanks



High Capacity Tanks

Model #	DIA.	Height (overall)	Volume (gal)	Media (cu ft)	Inlet / Outlet
Regular Capacity Tanks:					
NXT-2060LC	20"	76"	85	6	2" NPS*
NXT-2460LC	24"	78"	124	9	2" NPS
NXT-3060LC-3	30"	85"	205	14	3" NPT*
NXT-3672LC	36"	101"	350	20	3" NPT
NXT-4272LC	42"	103"	484	28	3" NPT
High Capacity Tanks:					
NXT-4872LC	48"	111"	660	36	4" NPT
NXT-5472LC	54"	113"	848	46	4" NPT
NXT-6072LC	60"	115"	1060	58	4" NPT
NXT-6672LC	66"	115"	1276	70	4" NPT
NXT-7272LC	72"	119"	1568	84	4" NPT

**NPS = National Pipe Straight, NPT = National Pipe Threaded*

NSF
Certified to NSF/ANSI/CAN 61

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NXT®
ARSENIC REMOVAL SYSTEMS

May 2020

Attachment 1

Vendor Information:

AdEdge

AdEdge Water Treatment Package Options

Selected Skid Mounted and Modular Systems

Intelligent thinking.....clean water

Option A
Triplex, Skid Mounted PLC Controlled, Carbon Steel Vessel

Features
- *Skid mounted, pre-piped, packaged*
- *Fully automated, PLC control panel*
- *Color HMI touch screen for operator interface*
- *Electric or air actuated control valves*
- *Hydraulic panel, gauges, sample ports for operator*
- ***Flow range: 75-2,000 gpm typical***

Option B
Duplex, Skid Mounted PLC Controlled, Carbon Steel Vessel

Features
- *Skid mounted, pre-piped, packaged*
- *Fully automated, PLC control panel*
- *Color HMI touch screen for operator interface*
- *Electric or air actuated control valves*
- *Hydraulic panel, gauges, sample ports for operator*
- ***Flow range: 75-2,000 gpm typical***

Option C
Skid Mounted, Manually Controlled, Carbon Steel Vessel

Features
- *Skid mounted, pre-piped, packaged*
- *Manual valve Harness, Manual controls*
- *Simple, lower cost alternative to automated systems*
- *Hydraulic panel, gauges, sample ports for operator*
- *Panel mounted Flow sensors/transmitters*
- ***Flow range: 75-2,000 gpm typical***

Option D
Skid Mounted, PLC Controlled, High pressure Stainless

Features
- *Skid mounted, pre-piped, packaged, 150 psi rated SS*
- *Fully automated, PLC control panel*
- *Color HMI touch screen for operator interface*
- *Electric or air actuated control valves*
- *Hydraulic panel, gauges, sample ports for operator*
- ***Flow range: 75-2,000 gpm typical***

Option E
Modular, Side Mount Valve, Copper Face Piping

Features
- *Modular design, packaged, field installation by others*
- *Composite Vessel, Automated Side Mount Valves*
- *Copper face piping for valve mounting*
- *Digital programmable valves*
- *Flow meters, flow control valves, instruments (loose)*
- *Interconnecting piping by others*
- ***Flow range: 50-120 gpm typical***

Option F
Skid Mounted, Automated Top Valve, Composite Vessel

Features
- *Stainless steel skid mounted, pre-piped, packaged*
- *Composite Vessel, Automated Top Mount Valves*
- *Panel mounted Flow sensors/transmitters*
- *Hydraulic panel, gauges, sample ports*
- *Top inlet/outlet configuration*
- *Hydraulic panel, gauges, sample ports for operator*
- ***Flow range: 50-120 gpm typical***

Option G
Skid Mounted PLC Controlled, Composite Vessel

Features
- *Skid mounted, pre-piped, packaged*
- *Composite Vessel, Top Mount Valves with PLC*
- *Fully automated, PLC control panel*
- *Color HMI touch screen for operator interface*
- *Electric control valves*
- *Hydraulic panel, gauges, sample ports for operator*
- ***Flow range: 5-75 gpm typical***

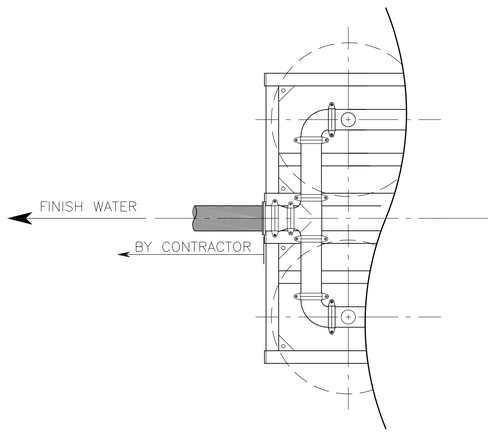
Option H
Modular, Automated Top Mount Valve Configuration

Features
- *Modular design, packaged for field installation by others*
- *Composite Vessel, Automated Top Mount Valves*
- *Digital programmable valves*
- *Flow meters, flow control valves, instruments (loose)*
- *Interconnecting piping by others*
- ***Flow range: 5-80 gpm typical***

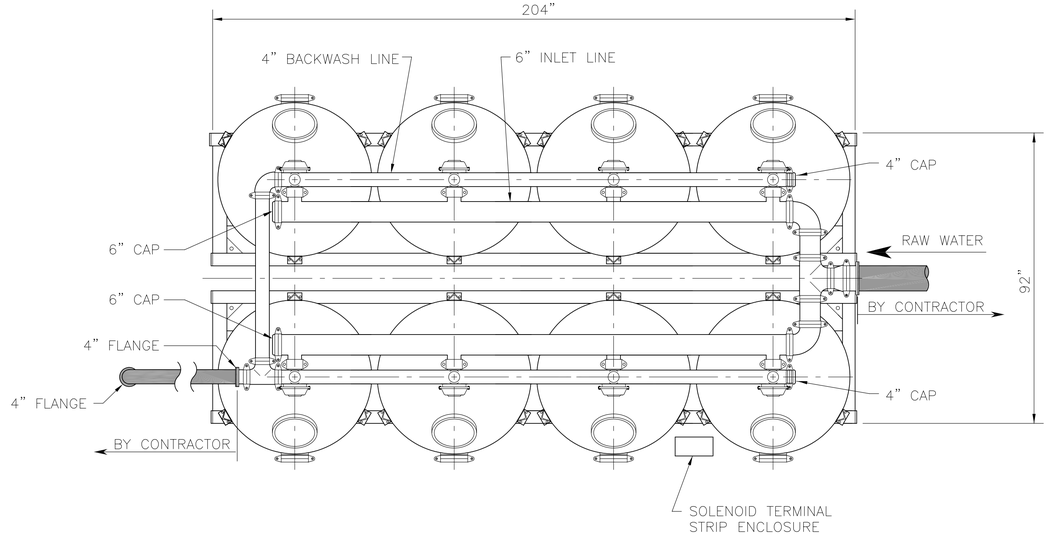
Attachment 1

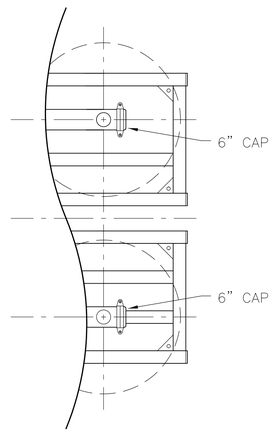
Vendor Information:

ATEC

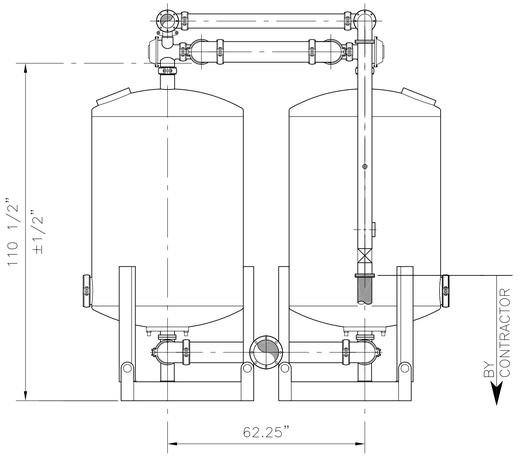


LEFT SIDE, FILTERS REMOVED

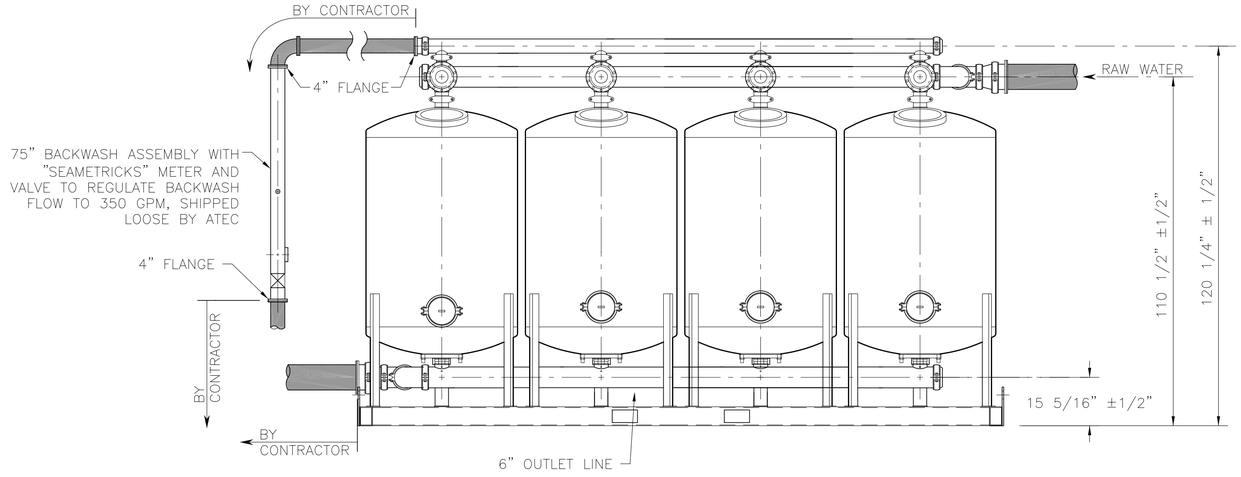


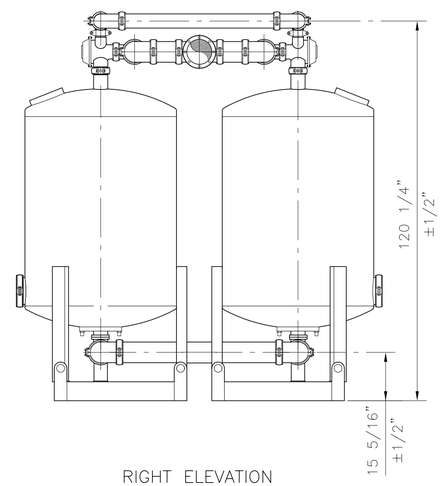


RIGHT SIDE, FILTERS REMOVED



LEFT ELEVATION





RIGHT ELEVATION

NOTES:

[A] THE FOUR (6) FILTER SYSTEM IS DELIVERED ON (2) 4 FILTER SKIDS.

[B] AIR RELIEF/VACUUM RELIEF VALVE WILL BE SUPPLIED FOR INSTALL ON 2" COUPLING ON INLET LINE.

[C] SHADED PIPING BY CONTRACTOR.

[D] FILTER PIPING CONNECTIONS WILL BE PROVIDED TO SUIT FIELD CONDITIONS.

ATEC SYSTEMS ASSOCIATES
P.O. BOX 10239
BAINBRIDGE ISLAND, WASHINGTON 98110-0329
PHONE: (360) 414-9223 FAX: (360) 397-0375

DESIGN BY:	.
DRAWN BY:	.
CHECKED BY:	.
APR'D BY:	.

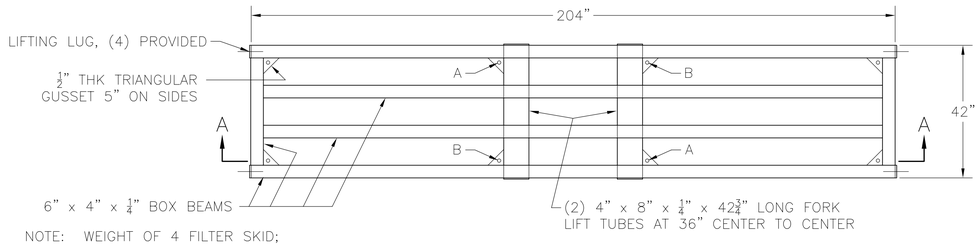
NO.	DATE		BY	APVD

0 2 4
SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 1/2" = 1'-0"
SCALEABLE IN 11x17 - 1/4" = 1'-0"

STANDARD EIGHT FILTER
48 - INCH SYSTEM
ATEC TREATMENT SYSTEM

FILTER DETAILS

SHEET NO.	1 of 2
DWG. NO.	
DATE:	11-7-2011
FILE:	Standard 8 - Filter 48



NOTE: WEIGHT OF 4 FILTER SKID;
EMPTY 15,200#
WITH MEDIA AND WATER 48,000#

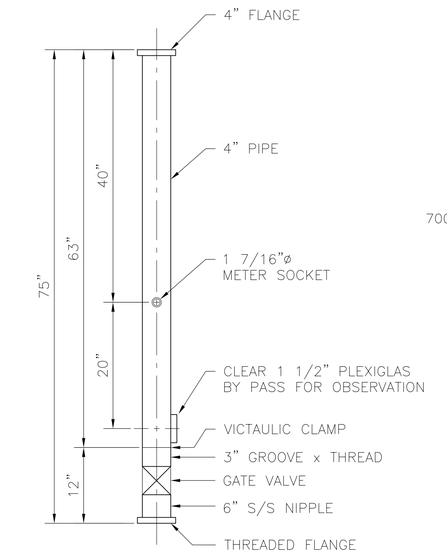
4 FILTER SKID
(2 REQUIRED)

0 2 4

SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 1/2" = 1'-0"
SCALEABLE IN 11x17 - 1/4" = 1'-0"

BILL OF MATERIAL			
ITEM	QTY	PART NO.	DESCRIPTION
1	1	PFS–CPL03	4" GROOVED COUPLING, CAST IRON W/ BOLTS & GASKET
2	3	PFS–CPL04	6" GROOVED COUPLING, CAST IRON W/ BOLTS & GASKET
3	1	PFS–CAP08	8" GROOVED END CAP
4	1	PFS–CPL08	8" GROOVED COUPLING, CAST IRON W/ BOLTS & NUTS
5	1	PFS=HHP11	11"x15" HAND HOLE PLATE
6	1	PFS–HHG11	11"x15" HAND HOLE GASKET
7	1	PFS–HHGS11	11"x15" HAND HOLE BOLT SET
8	1	PFS–HHCR11	11"x15" HAND HOLE HOLD DOWN CRAB
9	1	V–BF4	4"x4"x3" SERIES 350 BERMAD BACKWASH VALVE
10	1	UA SS48	UNDER–DRAIN ASSEMBLY 316L SS W/ SCH 80 PVC CAP COMPLETE

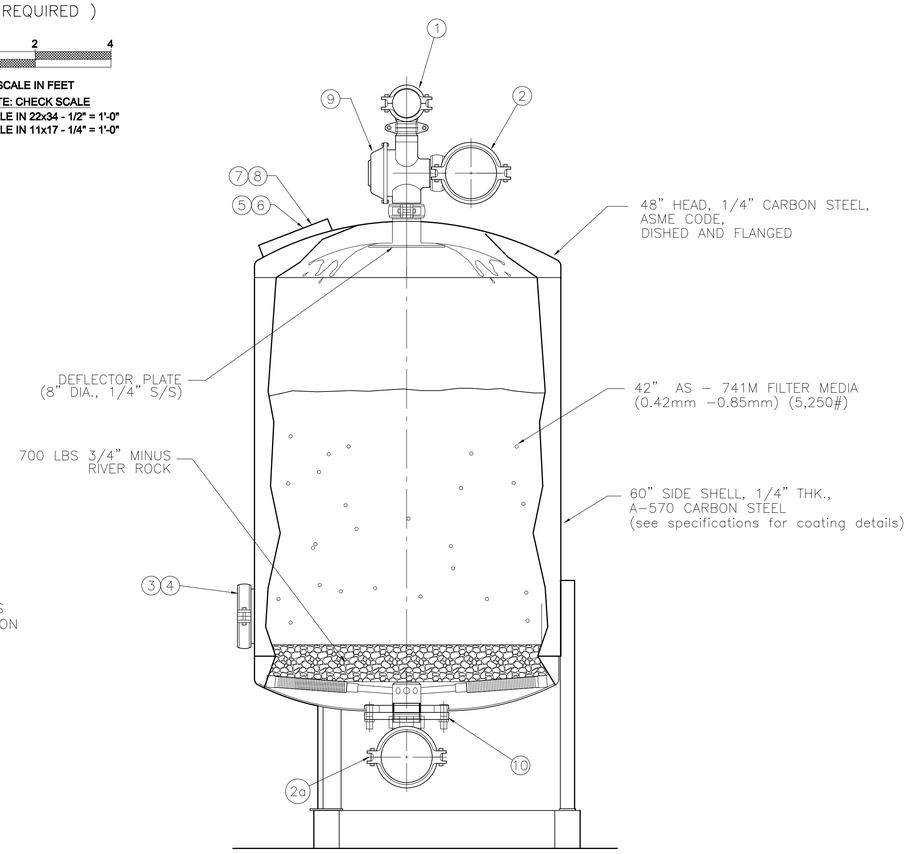
NOTE: QUANTITIES FOR ONE (1) TANK



STANDARD BACKWASH ASSEMBLY
SCALE: 1" = 1'–0"

0 1 2

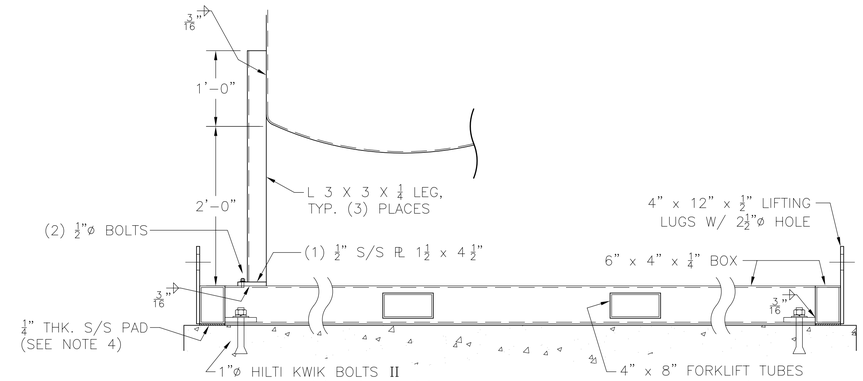
SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 1" = 1'-0"
SCALEABLE IN 11x17 - 1/2" = 1'-0"



TANK SECTION
SCALE 1" = 1'–0"

0 1 2

SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 1" = 1'-0"
SCALEABLE IN 11x17 - 1/2" = 1'-0"



SECTION A–A
SCALE 1" = 1'–0"

0 1 2

SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 1" = 1'-0"
SCALEABLE IN 11x17 - 1/2" = 1'-0"

FILTER/SYSTEM INFORMATION	
ITEM	
CAPACITY	. GPM
Fe	mg/L
mN	mg/L
COLOR	
BACKWASH	350 GPM
.	
.	
.	

ATEC SYSTEMS ASSOCIATES
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DESIGN BY:	.
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APR'D BY:	.

NO.	DATE		BY	APVD

SCALE
AS NOTED

STANDARD EIGHT FILTER
48 - INCH SYSTEM
ATEC TREATMENT SYSTEM

FILTER DETAILS

SHEET NO. 2 of 2
DWG. NO.
DATE: 11-7-2011
FILE: **Standard 8 - Filter 48**