Proposal for

North Water Reclamation Facility

Engineering Report

RFP NO. 1213-17
AUGUST 27, 2017

INSIDE

SAFEGUARDING NORMAN'S WATER SUPPLY & UTILITY SUSTAINABILITY THROUGH:

- Treatment that is Cost-Effective & Flexible
- Seamless Integration with COMCD & ODEQ
- Informed & Confident Citizens & Regulators

Brought to You by the National Leader in Innovative Wastewater Solutions

HDR

Supported by the Unmatched Water Reuse Expertise of

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

NORMAN

Norman Utilities Authority
City of Norman

August 27, 2012

Mr. Mark Daniels, PE
Norman Utilities Authority
201 W. Gray, Building C
P.O. Box 370
Norman, OK 73070

RE: *Proposal for North Water Reclamation Facility (WRF) Engineering Report*
RFP-1213-12

Dear Mr. Daniels and Selection Committee members:

Norman is a thriving community and a great place to live. The education level is high and the citizens take pride in Norman's history and direction. A safe and economically viable water/wastewater utility is the bedrock of any prospering community, yet for many years now there have been divergent viewpoints on how to handle wastewater planning in the northern part of the City. Primarily, the divergence rests in two areas: first, whether the northern part of Norman should be available for real estate development and, secondly, whether effluent from a new plant servicing this north area should be allowed to flow to Lake Thunderbird, Norman's primary drinking water source.

Selecting the HDR team for the North WRF project will safeguard Norman's water supply and utility sustainability. To accomplish this, our team offers the following unique benefits to Norman:

1 *We will develop a wastewater treatment scheme that is both cost-effective and flexible.* There are a multitude of options available for various levels of wastewater treatment and discharge locations. The City needs a design team who has the knowledge and experience to develop the appropriate mix of innovative and established technologies. Through the leadership of HDR's J.B. Neethling, one of the country's top wastewater experts, we will recommend schemes that provide flexible, multi-barrier protection where needed – while also providing cost-saving measures on a life-cycle basis. Conceptual schemes are presented in this proposal to demonstrate our methodology and approach.

2 *Our team will provide seamless integration with ongoing COMCD and ODEQ planning efforts that no other team can match.* The City's efforts to investigate effluent discharge to the Little River for water supply augmentation is part of a wider Oklahoma initiative. COMCD, with assistance from our teaming partner, ***Alan Plummer Associates Inc. (APAI)***, is studying indirect potable reuse opportunities in Lake Thunderbird. Meanwhile, ODEQ has established a working group to recommend new rules regarding indirect potable reuse. Considering APAI's reuse involvement in Oklahoma, which includes Ellen McDonald's seat on the ODEQ working group and a trusted role with COMCD, our team ensures that the North WRF planning process is integrated with COMCD and ODEQ at a level higher than any other team can offer.

3 *We will facilitate informed and confident citizens and regulators.* Ultimately, the implementation of the North WRF will require citizen and regulatory favorability. As we did for the Northside Lift Station project, HDR will provide transparent costs and facts in our deliverables and presentations so that concerned citizens and decision-makers can do what is best for the future of the City and Oklahoma. We will consider aesthetical components such as wetlands, nature preserves, architecture, lighting and noise in our recommendations to create a positive and responsible vibe. It is unrealistic to believe that everyone will agree on one approach. However, we will ensure that everyone agrees that HDR's planning and design documentation is aboveboard.

HDR is enthusiastic and confident in our ability to appropriately assess and deliver the City's expectations of success on this project. We view the City of Norman as a 'Client for Life' and want to build on our past successes to provide superior service to you on this very important project.

Sincerely,
HDR ENGINEERING, INC.

Joel Cantwell, PE
Project Manager

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EXECUTIVE SUMMARY

This section presents a brief summary of the contents of HDR's proposal for the North Water Reclamation Facility (WRF) Engineering Report project. For more detail, see the individual sections at the page numbers listed in the Table of Contents.

GENERAL REQUIREMENTS

HDR has developed a detailed ***schedule*** that will meet the City of Norman's (City's) requirements for a Council presentation in early April 2013 followed by submittal of the ER to ODEQ for approval by the first of June 2013. We use a step-by-step, methodical approach, including a series of technical memoranda and workshops that is familiar to City staff from past projects with HDR to achieve consensus and understanding as the project progresses. Also, HDR's standard ***insurance*** coverages exceed the requirements in the RFP.

GENERAL QUALIFICATIONS OF THE FIRM

HDR is a global, employee-owned engineering consulting and construction firm with over 7,800 professionals in over 185 locations. We were the ***Number 7 ranked Wastewater firm by ENR in 2012***. Our firm's industry leadership in both ***advanced wastewater treatment and nutrient removal***, paired with the expertise of our teaming partner *Alan Plummer Associates Inc. (APAI)* in ***water reuse***, gives the City an unmatched blend of expertise, local knowledge and client service excellence.

REFERENCES

The HDR-APAI team has conducted several extremely relevant projects within the last 5 years in the areas of advanced wastewater treatment, reuse, and facility planning. Our reference projects for this proposal include:

1 *HDR* has conducted three wastewater projects for Norman, including the ***Northside Lift Station study / Lift Station D*** design, the ***Collection System Flow Monitoring and Modeling*** project, and the ***Norman WRF Sludge Handling Improvements***. These projects have given HDR intimate knowledge of the City's staff, facilities, and operations, and HDR has demonstrated a high degree of technical excellence and ethical responsibility.

2 *HDR* designed and operated the ***Low Phosphorus Demonstration Facility*** for the City of Coeur d'Alene, ID, to evaluate alternative treatment technologies to meet the lowest phosphorus limit in the nation of 0.036 mg/L. Design of the facility will begin this year.

3 *HDR* conducted preliminary design of 30-mgd expansion to the ***Dallas Southside WWTP***. Dallas desires to augment its drinking water supply in Lake Ray Hubbard with Southside effluent, so HDR evaluated and piloted technologies to achieve reuse quality water. The expansion, when built, will include biological removal and advanced tertiary treatment for potential indirect potable reuse.

4 *HDR* and *APAI* teamed on the ***Lubbock Northwest Water Reclamation Plant Feasibility Study*** to select a site and evaluate treatment processes for a new northwest plant to relieve the existing southeast plant. Options for meeting a low phosphorus limit of 0.1 mg/L were evaluated.

5 *APAI* is currently conducting a ***Water Supply Augmentation Study of Lake Thunderbird*** for the Central Oklahoma Master Conservancy District (COMCD). This is the first study to address indirect potable reuse in Oklahoma. The results of the study will need to be closely coordinated with Norman's plans for constructing a new North WRF in the future, which would potentially provide indirect potable reuse to Lake Thunderbird.

6 *APAI* designed ***East Fork Water Supply Project*** for the North Texas Municipal Water District (NTMWD), the largest reclaimed water project in Texas to augment a surface water supply. Wastewater treatment plan effluent is treated in an 1,840-acre constructed wetland before being sent to Lake Lavon to supplement NTMWD's raw water supply.

TECHNICAL APPROACH

The HDR team has reviewed the Request for Proposals and understands that the City desires to conduct the Engineering Report preparation phase for the North Water Reclamation Facility (WRF). Alternative treatment processes will be investigated and life cycle cost estimates will be developed to aid City leaders in determining if and/or when the North WRF will be constructed.

A project of this scope and importance demands the City staff receive assistance from engineers with a trusted track record both with the City and in the technical disciplines of wastewater treatment and reuse. We believe the HDR-APAI team is unmatched in this regard, and our team offers these ***key benefits*** to the City:

Benefit #1: A Cost-Effective and Flexible Treatment Process

There are two options for discharging the treated wastewater: the Canadian River (must be pumped 7 miles to the west) and the Little River. There are several alternative treatment schemes for discharging to the Canadian River, depending on the permit limits established by ODEQ. A more advanced treatment scheme will be needed to discharge into the Little River for indirect potable reuse. The handling of the biosolids produced at the North WRF will also be a critical consideration. HDR proposes evaluation of several cost-effective and flexible processes, including:

CANADIAN RIVER DISCHARGE

- Scheme 1A: *BOD/TSS Removal for Secondary Treatment Technology Requirements.* This option uses an oxidation ditch to eliminate the need for primary clarifiers.
- Scheme 1B: *Biological Nutrient Removal (BNR) Treatment for Future Nutrient Limits.* This option uses the A^2O process (anaerobic/anoxic/oxic) for potential phosphorus and nitrogen limits.
- Scheme 1C: *BNR with Cloth-Media Filtration for Agricultural/Industrial Reuse.* This option uses cloth-media (disc) filters to create reuse water that could be used for nonpotable purposes. When there is no reuse demand, effluent would be pumped to the Canadian River.

LITTLE RIVER DISCHARGE (INDIRECT POTABLE REUSE)

- Scheme 2A: *BNR with Membrane Filtration, Advanced Oxidation and Wetlands Polishing for Indirect Potable Reuse.* This option provides the most rigorous treatment of the proposed schemes. The potential site layout for this option is shown on the adjacent figure.
- Scheme 2B: *Initial BNR for Canadian River Discharge with Future Add-on Processes for Little River Discharge.* This option provides flexibility to adapt to changing regulatory and citizen acceptance of indirect potable reuse by building BNR plant and then adding membranes, advanced oxidation and wetlands at a later date.

Benefit #2: Seamless Integration with ODEQ and COMCD for Planning Reuse in Lake Thunderbird

COMCD operates Lake Thunderbird and is currently conducting an evaluation of alternatives for augmenting its raw water supply. HDR team member APAI is conducting this study. ***Because of APAI's intimate knowledge of options for augmenting the lake, including reuse from Norman's WRFs, there will be no learning curve on this project and Norman's North WRF planning will integrate seamlessly with COMCD's planning.***

Also, ***ODEQ*** has recently issued regulations for indirect nonpotable reuse, but is yet to allow indirect potable reuse. ***Ellen McDonald of APAI is a member of the working group that is helping ODEQ develop these rules, and her role on the HDR team will allow Norman's planning to integrate seamlessly with ODEQ's ongoing rulemaking efforts to reduce risks down the road for the City.***

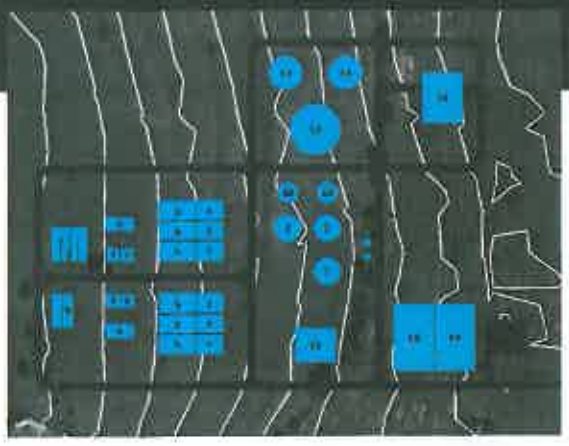
Benefit #3: Informed and Confident Citizens and Regulators

Establishing wastewater services on the north side of the City would open up new areas for residential and business development – which is favored by many. On the other hand, opening up this area would increase the population density and reduce the separation that now exists between Norman and Moore – which is opposed by many. Currently, a "compromise" solution is in place, which includes the recently rehabilitated Lift Station D pumping all northside wastewater to the existing South WRF. The compromise is that it has been designed to serve as the headworks facility for the North WRF if it is ever built. HDR was intimately involved in the planning of the Lift Station D project, and there was wide agreement by both sides that the work done by HDR was wholly without bias and was trustworthy for informed decision making. To ensure the City's northside wastewater planning reputation continues in this vein, HDR will do the following:

- Prepare high quality deliverables, as we did for the Northside Lift Station / Lift Station D project
- Provide transparent assumptions and calculations
- Conduct accurate and informed cost estimating
- Participate in strategic presentations and public meetings
- Consider aesthetics, including odor, architecture, lighting, noise, nature trials/preserves and wetlands
- Introduce norman to the sroi process for evaluating alternatives – triple bottom line (economic, social, environmental)

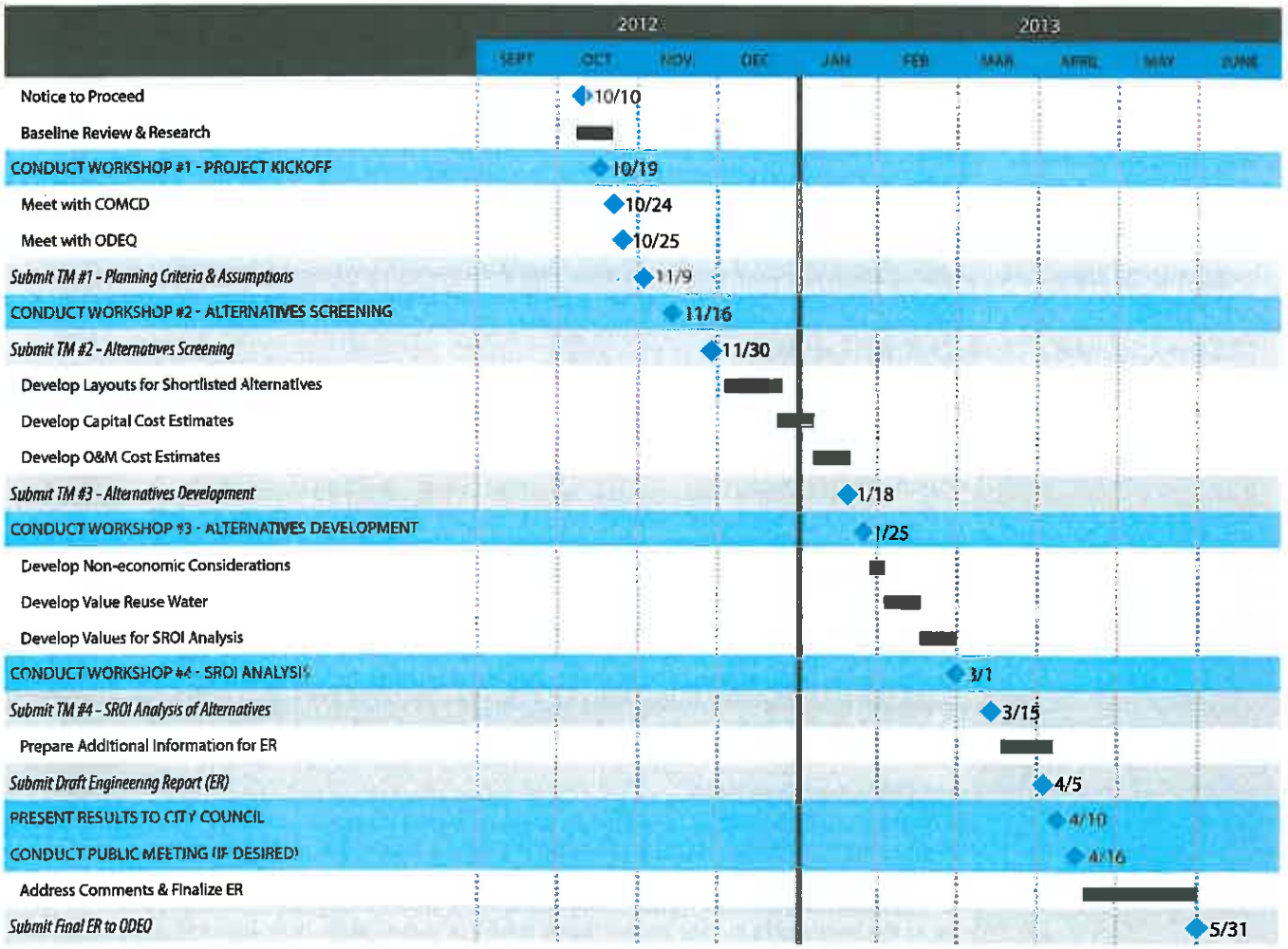
KEY PERSONNEL QUALIFICATIONS

The HDR team proposed for this project provides an unmatched combination of local knowledge and top-notch regional and national expertise. ***Joel Cantwell*** will serve as HDR's project manager. Mr. Cantwell has a 10-year track record of success with the City, both as a creative and thorough engineer and an effective communicator. ***Candy Staring***, located in HDR's Oklahoma City office, will serve as the Project Engineer. Key HDR technical staff include ***JB Neethling*** and ***Dave Clark*** (wastewater process and nutrient removal), while APAI staff will include ***Ellen McDonald*** (reuse) and ***Phil Spitzer*** (solids handling). We pledge that these individuals and the rest of the team will be committed and active participants in the project from the beginning to end.



SCHEDULE

HDR's proposed schedule is shown on the following figure. We are confident that we can complete the North WRF project within the timeframe given in the RFP. This is an important project for the community's future, and our schedule and approach are geared to methodically achieve understanding and consensus. We use a series of workshops and technical memoranda to foster open communication and to prevent us from getting too far down the road before our work is thoroughly reviewed, understood, and modified to support the City's values.



INSURANCE

HDR's standard insurance coverages, shown in the table, exceed the requirements shown in the Request for Proposal. We will comply with the City of Norman's insurance requirements.

TYPE OF INSURANCE	POLICY NUMBER	EFFECTIVE DATE	EXP DATE	LIMITS	CARRIER
General Liability	37CSEQU0950	6/01/2011	6/01/2012	$2,000,000	Hartford Fire Insurance Co
Automobile Liability	37CSEQU0951	6/01/2011	6/01/2012	$2,000,000	Hartford Fire Insurace Co
Excess Liability	QK08000912	6/01/2011	6/01/2012	$1,000,000	St. Paul Fire & Marine Insurance Co
Workers Comp	3621195 (Master) 3621196 (CA)	6/01/2011 6/01/2011	7/01/2012 7/01/2012	Statuatory Statuatory	New Hampshire Insurance Co Insurance Company of the State of PA
Professional Liability	EOC9260026-03	6/01/2011	6/01/2012	$1,000,000	Zurich American Insurance Co

HDR

AN INTEGRATED FIRM

HDR is a global, employee-owned firm founded in 1917 providing engineering, architecture, consulting, construction and related services through our various operating companies. Our more than 8,100 professionals in over 185 locations worldwide are committed to helping clients manage complex projects and make sound decisions. As an integrated firm, HDR provides a total spectrum of services for our clients. Our staff of professionals represents hundreds of disciplines. They partner on blended teams worldwide to provide solutions beyond the scope of traditional A/E/C firms. *HDR's operating philosophy is to be an expertise-driven national firm that delivers tailored solutions through a strong local presence.* HDR's ability to draw upon company-wide resources and expertise is a great strength in meeting and exceeding our clients' expectations.

HISTORY AND SIZE

- Founded in 1917
- More than 8,000 employee-owners
- More than 185 locations worldwide
- Full-service, multidisciplinary staff

HDR CULTURE

HDR's culture can be easily summarized in a single sentence: *We believe in doing the right things for the right reasons—for our employees, our clients and our communities.*

We can trace this culture back to 1917 when the firm was founded as the Henningson Engineering Company. In those early days, the company's motto was "Work Well Done." In addition to designing infrastructure, the company looked out for the client's best interests during construction. That commitment to quality and integrity still drives HDR nearly a century later. We believe that the best way to achieve a "job well done" is to let people do what they do well and get out of the way, while offering the support and mentoring they need to accomplish their best work. Employees are encouraged to keep learning through internal training, external education and a variety of work experiences. Recent hires say they like HDR's personality and values-based culture, and the professional respect for clients and colleagues. They are attracted to the employee ownership model because they can help increase the company's value through their hard work.

HDR was named the #7 Wastewater Firm by Engineering News-Record in 2012.

WATER REUSE EXPERTISE

Although water was once considered an abundant if not unlimited resource, population growth, drought and shortages are straining our finite water supply. Water quality and quantity concerns are the largest environmental issue facing the United States in the 21st century.

In addition to finding new sources of water, public water systems must educate water consumers on wise water use and audit their own business practices to better manage physical water loss and "paper" losses resulting in lost revenue. HDR engineers and scientists are helping utility executives around the nation find innovative ways to reuse water, from reducing water loss to developing water for irrigation, and from expanding the uses of high-pressure membranes to developing satellite reuse facilities that create economies of scale while improving the nutrient balance.

ADVANCED WASTEWATER TREATMENT EXPERTISE

Wastewater treatment plant owners and operators face newer and more stringent discharge permit limits related to nutrient removal. Allowable discharges of nitrogen, phosphorus and other nutrients are being restricted to surface water bodies, and are further limited in groundwater infiltration and land applications. Maximizing existing facilities, along with innovative use of advanced technologies and processes, can help owner-operators meet these challenges and lessen the economic impact of additional permit requirements.

HDR is at the forefront of research evaluating the technological limits of nutrient removal from wastewater. In addition to designing new and upgraded advanced treatment systems, HDR is currently the principal investigator leading Water Environment Research Foundation's (WERF's) 5-year nutrient removal challenge, a program directed towards finding new technological answers for efficient, cost effective, advanced nutrient removal.

Led by JB Neethling, HDR's Nutrient Challenge project for WERF is providing owners the most up-do-date treatment performance data for nutrient removal.

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

FIRM QUALIFICATIONS

Alan Plummer Associates, Inc. (APAI) has conducted business with quality and integrity for over 30 years. A regional firm founded in 1978 with a vision to uphold environmental stewardship and technical excellence, APAI is committed to serving its clients with distinction and integrity. Today, with nearly 100 employees and four Texas offices in Fort Worth, Dallas, Austin, and Houston, as well as locations in College Station, Texas, Phoenix, Arizona and Oklahoma City, APAI continues that commitment.

Dedicated to water resources and environmental engineering, this firm balances sound engineering principles with innovative technology tailored to clients' needs. From initial project kick-off, through stringent QC review, to a completed project, APAI's focus stays on developing cost-effective solutions for its clients.

Coeur d'Alene A
Coeur d'Alene Low Phosphorou
Spokane County Re
M
E
Rock Creek A
Durham
Hangtc
El Dc
Hi

REUSE QUALIFICATIONS

APAI aids municipal and water district customers in the planning and design of water and wastewater treatment and conveyance systems. APAI is also a nationally recognized leader in the planning and implementation of water reuse projects. From the planning and design of one of the first major nonpotable reuse projects in Texas to the development of over 200 million gallons per day of indirect reuse water supply in North Texas alone, this firm have demonstrated its commitment to supporting clients with sound expertise and guidance as they address the unique set of technical, regulatory and institutional challenges of each project.

APAI, with its experience on numerous related innovative supply projects, understands both the potential benefits and the challenges of implementing strategies associated with reclaimed water. APAI has worked side-by-side with clients pursuing water reuse projects from the early planning stages to implementation. As part of this process, APAI has helped to identify stakeholder and public concerns and to develop project plans that not only address these concerns, but has often rallied the public and stakeholders behind the projects to become supporters and advocates. A broad understanding of the benefits as well as the limitations and potential concerns associated with the use of reclaimed water plus the ability to articulate this understanding will be a critical component for the success of this project. APAI's success working with stakeholders, regulators, and the public on related projects is unmatched in this regard.

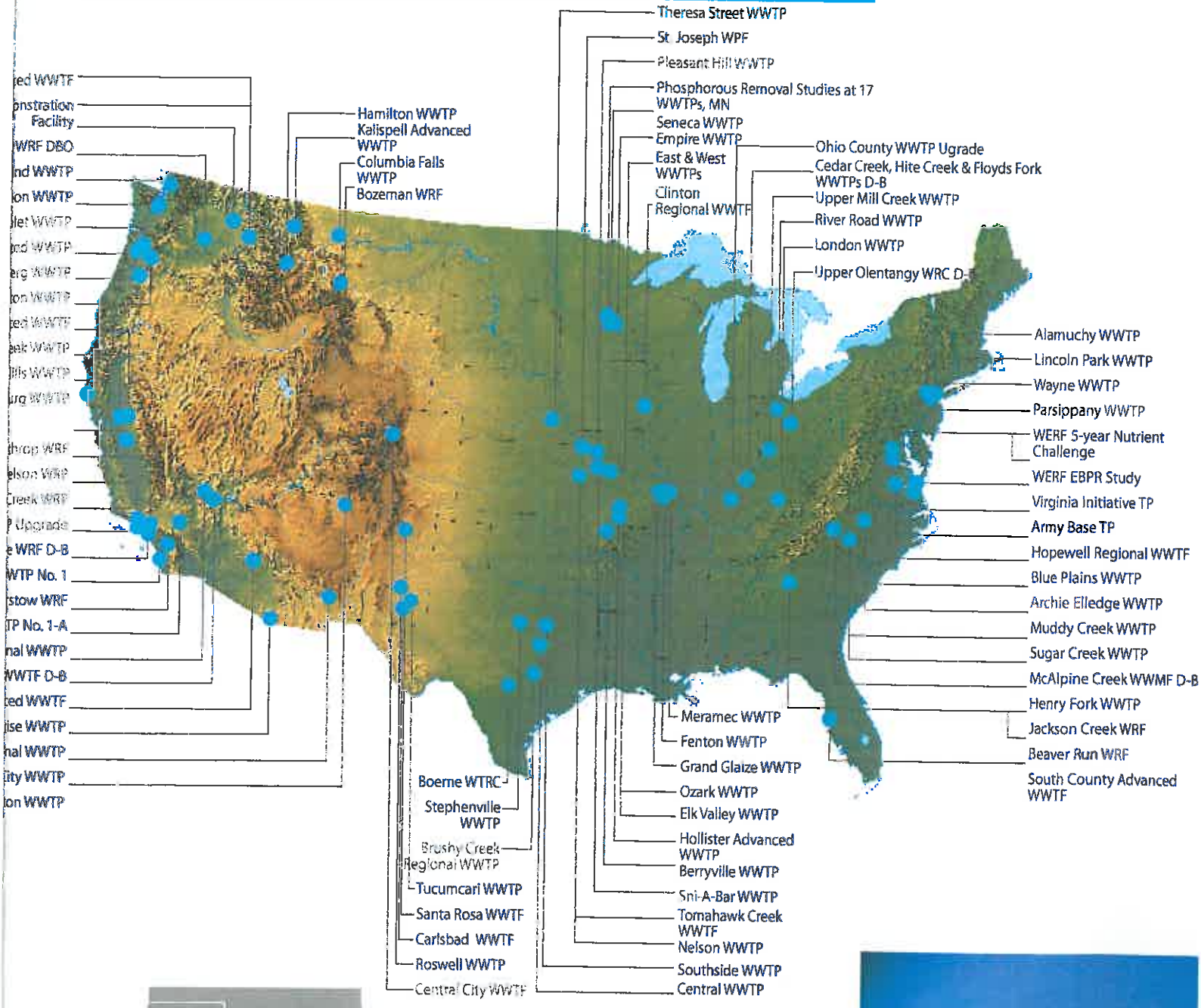
East & West Sar
Pomo
Edward
Orange Co
Coroi
Victorville
Coyote Sp
Las Vegas
Nogales Int
Fa

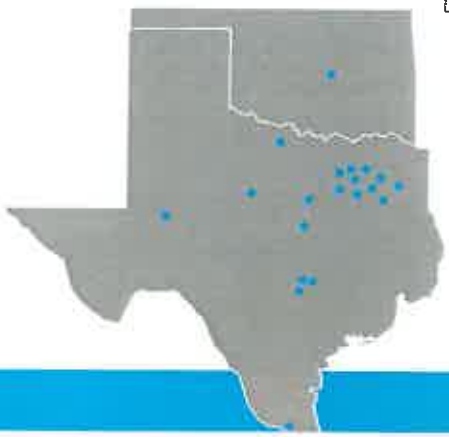
THE BLENDED HDR-APAI TEAM PROVIDES UNMATCHED QUALIFICATIONS TO MEET NORMAN 'S NEEDS.

3. REFERENCES

HDR and APAI are national and regional leaders in wastewater treatment and water reuse solutions. The following maps graphically illustrate HDR's nationwide resume of nutrient removal related wastewater treatment projects as well as APAI's many reuse-related projects that have been completed for area clients. The following pages give descriptions and references for several recent projects completed by HDR and APAI that are relevant to the North WRP project. Our team will use the knowledge gained from these projects to exceed the City's expectations for the North WRF engineering report.

HDR WASTEWATER TREATMENT NUTRIENT REMOVAL PROJECTS





APAI WATER REUSE PROJECTS

Central Oklahoma Master Conservancy District
Guadalupe-Blanco River Authority
North Texas Municipal Water District
San Antonio Water System
Tarrant Regional Water District
Trinity River Authority of Texas
Upper Trinity Regional Water District
City of Abilene
City of Burkburnett
City of Dallas
City of Denton
Town of Flower Mound
City of Fort Worth
City of Greenville
City of Irving
City of McAllen
City of Odessa
City of San Marcos
City of Stephenville
City of Weatherford

1 NORMAN NORTHSIDE LIFT STATION / LIFT STATION D
Norman, OK

FIRM
HDR

CONSTRUCTION COST
$6M

DURATION
2005-2012

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Mark Daniels
City of Norman
(405) 366.5377

Norman's 2001 wastewater master plan recommended a new gravity collection system and wastewater treatment plant in the northeast part of the city which was served by multiple lift stations. The first step in possibly implementing this long-term plan was to define the new gravity collection system and Northside Lift Station that would eliminate the need for five existing lift stations.

HDR used collection system modeling along with spreadsheet flow equalization modeling to find the most cost-effective combination of three factors: lift station pumping capacity, peak flow equalization at the lift station and flow handling capacity of the Bishop Creek interceptors. As a result, a 6-mgd lift station and 4.8-MG equalization basin were selected, which are sized to pump all water from a 5-yr storm to Bishop Creek within two days' time to limit odors. The rehabilitation of Lift Station D to serve as the Northside Lift Station was designed by HDR and was brought online in 2011.

There was a high level of interest in this project from the citizens of Norman, and HDR helped communicate the project goals and facts to the public in multiple council meetings and a town hall meeting. HDR gained trust from citizens on all sides of the issues as a non-biased and trustworthy consultant, which helped facilitate project implementation.

2 NORMAN COLLECTION SYSTEM FLOW MONITORING & MODELING
Norman, OK

FIRM
HDR

CONSTRUCTION COST
N/A

DURATION
2010-Present

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Mark Daniels
City of Norman
(405) 366.5377

HDR is developing a system model of the City of Norman's collection system using the Infoworks software platform. The model is calibrated using flow monitoring, rain gauge and Doppler rainfall data collected as part of the project. The model run will be performed for the existing system and 2030 build-out condition, using a 5-year, 4-hour storm event as the design storm. The model will be used to analyze the overall capacity of the collection system, including identification of potential overflow locations. After a master plan was done in 2001, the City instituted an aggressive rehabilitation schedule in order to reduce the amount of I/I into the collection system. The model results will be analyzed to previous data to generally determine how effective this I/I program has been.

The model will also be used to evaluate what collection system improvements are required if the existing South WRF continues to serve the entire city and what collection system improvements are needed if a new North WRF is constructed.

3 NORMAN WRF SOLIDS HANDLING IMPROVEMENTS
Norman, OK

FIRM
HDR

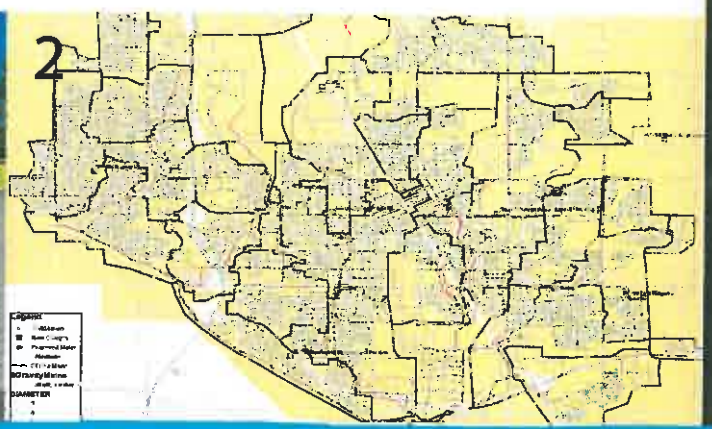
CONSTRUCTION COST
$6M

DURATION
2005-2009

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Mark Daniels
City of Norman
(405) 366.5377

The Norman WRF had significant operational problems due to the lack of sludge dewatering and storage facilities. HDR designed new sludge thickening and dewatering facilities utilizing centrifuges. The new centrifuges allow for separate thickening of the waste activated sludge so the existing gravity thickeners can be used for primary sludge only. A new dewatered sludge storage facility was also created on the site of the existing south RBCs. Improvements were also made to the existing primary digesters, including new fixed covers, new jet-type mixing systems, and new gas handling piping and equipment. The project also included a new effluent flow measurement facility with an integrated nonpotable water pumping system to use effluent for nonpotable uses throughout the plant. Construction was completed in 2009.



FIRM
HDR

CONSTRUCTION COST
N/A

DURATION
2010-2011

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
H. Sid Frederickson
City of Couer d'Alene, ID
(208) 769-2277

LOW PHOSPHORUS DEMONSTRATION FACILITY
Coeur d'Alene, ID

The City of Coeur d'Alene, Idaho, is facing an ultra-low effluent phosphorus limit of 0.036 mg/L (the lowest in the nation), driving the need for treatment upgrades. Meeting these limits requires substantial investment in additional treatment capacity and new technology. The water chemistry of both the wastewater influent and the receiving stream, coupled with the Northwest climate, greatly influences selection of the appropriate treatment processes. In May 2010, the City and HDR began a large scale, 18-month pilot facility demonstration to investigate three candidate phosphorus removal treatment technologies: a 2-stage moving bed sand filter, a tertiary membrane filter, and a membrane bioreactor. Together with HDR, the City is pushing the limits of technology and developing treatment strategies that reduce the impact to **rate**payers. All technologies were tested under real-world conditions and the challenges of routine plant operation, providing valuable information for full-scale design, process control and redundancy. All three candidate processes produced impressive effluent quality less than 0.05 mg/L TP. UV disinfection was used to produce Class A recycled water for demonstration landscape irrigation. The city is moving forward with design of process treatment improvements to meet proposed TMDL requirements.

FIRM
HDR

CONSTRUCTION COST
Estimated $100M

DURATION
2003-2009

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Dallas Water Utilities
Richard Wagner
(214) 948-4516

DWU SOUTHSIDE WWTP PHASE IV EXPANSION STUDY

Dallas, TX

HDR conducted preliminary design for the 30-mgd Phase IV expansion to DWU's Southside WWTP. The $100M expansion would increase the treatment capacity to 140 mgd on an average daily basis. Treatment process alternatives included modified Ludzack-Ettinger (MLE), Bardenpho step-feed plug-flow, cyclic aeration and membrane bioreactors. Disinfection alternatives evaluated included UV disinfection, gaseous chlorine and sodium hypochlorite. The filtration evaluation included a pilot study of cloth-media filters, microstrainers and microfiltration membranes. HDR's recommendation for the Phase IV expansion included the Bardenpho BNR process, UV disinfection and cloth-media filters. HDR's ENVision model was used to predict performance of the recommended treatment scheme as well as the alternatives considered. ***The recommended process is capable of phosphorus removal to 0.5 mg/L for indirect potable reuse to Lake Ray Hubbard, part of DWU's long term water supply plan.***

The expansion is currently in the preliminary design phase and is on hold pending need for expansion. However, a portion of the project was designed by HDR and is in service. This $16M construction project included improvements to the screenings handling and peak flow pumping at Influent Pump Station C and a new structure to split influent flow between the nine treatment trains.

PHOSPHORUS REMOVAL PILOTING FOR INDIRECT POTABLE REUSE

As part of the Phase IV Expansion Evaluation, HDR conducted a filtration pilot study to accomplish two goals: to test cloth-media filtration as an alternative to granular media filtration for Phase IV and to test microfiltration membranes as a technology to remove phosphorus for indirect potable reuse. Two cloth-media filtration technologies were piloted, Aqua Aerobic's AquaDisk and Kruger's Hydrotech DiscFilter; and two microfiltration membrane technologies were pilot tested, Pall's Microza pressure system and Siemens' CMF-S vacuum membrane system. In order to generate the maximum amount of useful data for the Phase IV Expansion, a three-phase pilot test was designed to challenge the cloth media filters and to provide multiple feed water options for the microfiltration membranes. The schematic below displays the pilot plant set up, illustrating the various options for filtration and data collection.

Cloth-Media Filtration	<2	0.3 to 1.0	Moderate
Microfiltration	<0.1	0.5 to 2.0	High

The pilot study determined membrane performance on secondary and tertiary effluent, established conditions and chemical pretreatment requirements for meeting anticipated reuse regulations, and produced design information for loading rates and backwash requirements. Specifically, it was determined that the cloth-media filtration technology provided excellent filtration during normal operating conditions; however, it struggled during simulated process upsets and could not approach the requirements set for phosphorus removal for indirect potable reuse.

Overall, the pilot study confirmed the assumption that microfiltration membranes would likely be required for indirect potable reuse from Southside if the permit is set with relatively low phosphorus and turbidity limits unless process modifications (such as Bio-P or chemically-enhanced clarification) were undertaken upstream of tertiary treatment. Moreover, despite good flux rates through the microfiltration units when filtering secondary effluent, the membranes were not able to efficiently handle high solids spikes, necessitating upstream filtration. Additionally, it was confirmed that cloth media filtration provides an excellent alternative to conventional granular-media filtration and in many cases surpasses the performance of the Phase III anthracite filters. The table below displays a comparison of the technologies tested.

LUBBOCK NORTHWEST WATER RECLAMATION PLANT FEASIBILITY STUDY

Lubbock, TX

FIRM
HDR & APAI

CONSTRUCTION COST
Estimated $40M

DURATION
2010-2012

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Wood Franklin
City of Lubbock
(806) 775-2343

APAI and HDR, in conjunction with two other local firms, conducted a feasibility study for the City of Lubbock to evaluate and select a site for a new water reclamation plant called the Northwest Water Reclamation Plant (NWWRP). The service area currently generates 4 mgd annual average flow and could increase to an ultimate average flow of 18 mgd. The initial plant capacity/permit is sized at 6 mgd with a Phase 1 initial plant of 3 mgd.

This new plant is being proposed to reduce flow impacts and overloading of the collection system for the existing Southeast Water Reclamation Plant (SEWRP) and to provide capacity to serve proposed development in the northwest area of the City. The NWWRP is expected to discharge effluent into the North Fork of the Double Mountain Fork of the Brazos River that will maintain flows in the Jim Bertram Canyon Lakes, a system of lakes that run through the north side of the City.

ADMIN. BUILDING - CONCEPT 2
LUBBOCK NWWRP

Due to the lack of diluting base flows in the North Fork of the Double Mountain Fork of the Brazos River to which the NWWRP will discharge, the anticipated effluent limits are extremely low. Water quality modeling indicates that the required effluent TP concentration will need to be approximately 0.1 mg/L to be protective of existing water quality in the Bertram Lakes. Therefore, the NWWRP will have some of the most stringent effluent limits in the State of Texas.

In the study, the team evaluated and recommended a discharge location, determined anticipated permit limits, and evaluated then recommended an appropriate treatment process. Four treatment options were evaluated, including conventional activated sludge and membrane bioreactor systems, both with and without primary clarifiers. Sludge handling options were also assessed, as were odor control concepts and integration with effluent reuse

LAKE THUNDERBIRD WATER REUSE FEASIBILITY STUDY

Norman, OK

FIRM
APAI

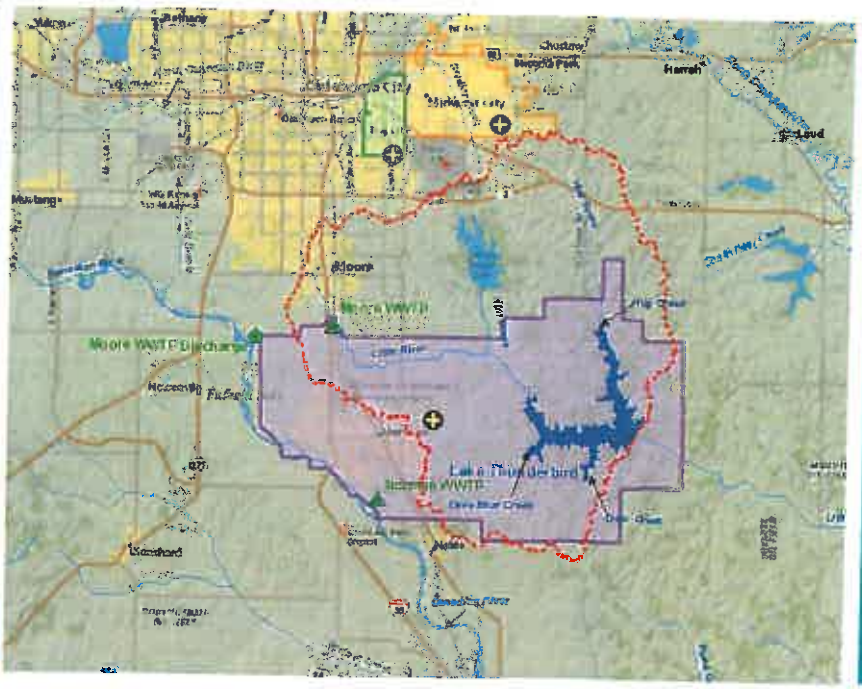
CONSTRUCTION COST
N/A

DURATION
2011-2012

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Randy Worden
District Manager
(405) 325-5229

COMCD is currently conducting its own study of augmenting Lake Thunderbird's water supply. For several years, Central Oklahoma Master Conservancy District (COMCD) has been developing concepts and actively pursuing solutions for augmentation of Lake Thunderbird after a severe drought and increasing customer demands caused concerns about the Lake's sustainability. COMCD is currently contracted with Alan Plummer Associates Inc. (APAI) to perform the Lake Thunderbird Water Reuse Feasibility Study. This study is the first reuse study in Oklahoma that addresses indirect potable reuse into a surface water supply and evaluates several alternatives related to water reuse for Lake Thunderbird. Water reuse alternatives considered in the study include augmentation of Lake Thunderbird with highly treated effluent from the communities of Norman and Moore and diversion river water from the Canadian River downstream of the Moore and Norman discharges. These reuse alternatives are compared with traditional water supply alternatives, including obtaining water from the proposed Scissortail Lake in Ada; obtaining water from Kaw Lake; and obtaining water from proposed Oklahoma City Southeast Oklahoma water sources. This study is scheduled to be complete in September 2012.



FIRM
APAI

CONSTRUCTION COST
$264M

DURATION
2004-2010

SCHEDULE/BUDGET COMPLIANCE
On time, within budget

CLIENT REFERENCE
Mike Rickman
North Texas Municipal Water District
(972) 442-5405

EAST FORK RAW WATER SUPPLY PROJECT

Dallas, TX

Representing the largest project in Texas using reclaimed water to augment a surface water supply source, the East Fork Raw Water Supply project provides the North Texas Municipal Water District (NTMWD) with over 102,000 acre-feet of water per year, which is enough water to serve 500,000 people. Completed at a cost of less than 25% of developing a new reservoir, in about 20% of the time, the East Fork Raw Water Supply Project is a signature solution of innovation.

The source of water for the project is return flows from wastewater treatment plants owned or operated by NTMWD or NTMWD customers that discharge to the East Fork Trinity River upstream of the project. As the prime consultant, APAI developed the reuse strategy alongside NTMWD, successfully worked with regulators to obtain the necessary water rights and environmental permits, and ultimately designed the $264 million project. APAI continues to provide ongoing support related to operations and water quality monitoring.

A primary goal of the project was to ensure that the water quality in Lavon Lake, the primary water supply for NTMWD, would not be compromised. Through APAI's knowledge and experience with water reuse, together with APAI's water quality expertise, an approach was established which used multiple treatment and monitoring barriers, providing a sound basis for moving forward with implementation. APAI performed extensive water quality modeling on both the wetland system and within Lavon Lake as a part of this evaluation.

The East Fork Raw Water Supply Project includes six major components:

- 165-million-gallons-per-day (mgd) peak-capacity diversion pump station to take water from the East Fork of the Trinity River
- 1,840-acre constructed wetland to provide polishing treatment of the diverted East Fork water
- 150-mgd-peak-capacity conveyance pump station to pump the polished water to Lavon Lake
- Electrical substation to provide power for the conveyance pump station
- 43.5 miles of 84-inch-diameter pipeline transferring water from the wetland to Lavon Lake
- John Bunker Sands Wetland Center to provide educational opportunities

At capacity, the project will divert an average of 91 mgd of return flows from the East Fork of the Trinity River and provide polishing treatment (including sediment and nutrient removal) of the water in one of the largest constructed wetlands in the country (1,840 acres). After passage through the wetland, the water is pumped to Lavon Lake for storage, blending, and water supply use. A multi-year project, work first began on the constructed wetland in 2004 with the design and construction of the first of two nursery wetlands. The initial nursery, 20 acres in size, was used to provide plant stock of selected wetland species for a 200-acre second-phase nursery. The 200-acre nursery, completed in early 2006, was used to provide over 1.6 million plants for the full-scale wetland that was completed in 2009.

The East Fork Raw Water Supply Project exemplifies the value of public and private entities working together to provide multiple benefits to the community. Through its partnership with the Carolyn Hunt Trust Estate and construction of the John Bunker Sands Wetland Center, the project not only provides water supply, but also offers opportunities for research, education, wildlife observation, and community gatherings. As a result, the project has been visited and embraced by the public, regulators, and legislators locally, nationally and internationally.

4. TECHNICAL APPROACH

The HDR team has reviewed the Request for Proposals and understands that the City of Norman (City) desires to conduct the Engineering Report preparation phase for the North Water Reclamation Facility (WRF). Alternative treatment processes will be investigated and life cycle cost estimates will be developed to aid City leaders in determining if and/or when the North WRF will be constructed. Although cost is very important, other factors will weigh heavily including acceptability of indirect potable reuse (North WRF effluent discharge into the Little River which will augment water supplies in Lake Thunderbird) by citizens and regulators, the timing of this acceptability, potential solids handling options, and plans for residential/industrial development of northern Norman versus retaining the current rural setting.

A project of this scope and importance demands that the City staff receive assistance from engineers with a trusted track record both with the City and in the technical disciplines of wastewater treatment and reuse. We believe the HDR-APAI team is unmatched in this regard, and our team offers these ***key benefits*** to the City:

- A COST-EFFECTIVE AND FLEXIBLE TREATMENT PROCESS
- SEAMLESS INTEGRATION WITH ODEQ AND COMCD FOR PLANNING REUSE IN LAKE THUNDERBIRD
- INFORMED AND CONFIDENT CITIZENS AND REGULATORS

Our team's approach to provide each of these benefits is presented below.

BENEFIT #1: COST-EFFECTIVE AND FLEXIBLE TREATMENT PROCESS

There are two options for discharging the treated wastewater: the Canadian River and the Little River. Both have advantages and disadvantages which are summarized in the following table:

NORTH WRF EFFLUENT DISCHARGE LOCATION	ADVANTAGES	DISADVANTAGES
CANADIAN RIVER	• Less stringent discharge permit limits (BOD/TSS only or possibly some nutrient limits) • Much easier to gain public and regulatory acceptance • Less complicated treatment process scheme	• High operational cost to pump the effluent 7 miles west to the river • Opportunity for reclaimaing as water supply is less practical
LITTLE RIVER	• Opportunity to create additional water supply in Lake Thunderbird from effluent • Effluent pumping is not required • Opportunity for river beautification and wetlands education center at WRF site	• Difficult to obtain public and regulatory acceptance • More complicated treatment process scheme • Lake Thunderbird is already a 303(d) impaired water body

There are several alternative treatment schemes for discharging to the Canadian River, depending on the permit limits established by ODEQ. A more advanced treatment scheme will be needed to discharge into the Little River for indirect potable reuse. The handling of the Biosolids produced at the North WRF will also be a critical consideration. This section describes some of the treatment concepts that HDR will consider in working with the City to develop a treatment scheme that is cost-effective. A treatment scheme is also presented that would provide significant flexibility for the City in the future. Process flow schematics are provided for all five treatment schemes presented below.

CANADIAN RIVER DISCHARGE

Treatment for discharge into the Canadian River involves a straightforward process scheme to meet treatment technology and/or water quality standards requirements. Two basic approaches have been identified:

SCHEME 1A: ***BOD/TSS Removal for Secondary Treatment Technology Requirements.*** An effective yet simple approach to Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) removal for a smaller plant in the 4.5-mgd range is an oxidation ditch based system. For this system, primary clarifiers will likely not be necessary. The long retention time in the aeration basin ensures a high-quality effluent, lower solids yield, and a mixed liquor with good settleability. Following settling, disinfection is applied, giving a good quality effluent for discharge into the Canadian River.

Major advantages to this approach include lower capital investment, straightforward and consistent operations, and reduced solids production. Some disadvantages include high aeration needs and reduced flexibility for future process changes. High efficiency aeration systems are available to help offset the higher aeration demand.

SCHEME 1B: ***Biological Nutrient Removal (BNR) Treatment for Future Nutrient Limits.*** A nutrient treatment process scheme, or a system designed to accommodate a nutrient removal mode, may be applied to address the changing regulatory environment in which nutrient limits may be imposed on the Canadian River in the future. In this approach, the activated sludge process would have swing zones that operate as or can be switched to operate as anaerobic and anoxic zones in order to reduce the concentrations of total phosphorus and total nitrogen.

Advantages of this approach include operational flexibility and reduced aeration demand. A higher solids yield would result in more sludge production, but anaerobic digestion may be employed to recover energy from the solids.

SCHEME 1C: ***BNR with Filtration for Agricultural/Industrial Reuse.*** Even if the Little River is not chosen as the preferred discharge location, it does not mean that reuse of the effluent is not possible. One proposed treatment system approach to consider would generate reclaimed water suitable for agricultural irrigation or industrial uses. In this system, a secondary biological process would be employed that removes BOD and TSS with swing zones that allow flexibility for nitrate removal. A cloth-media (disc) filter system and disinfection would be provided for reuse with the option to bypass directly to disinfection. A storage basin would be available to ensure that reuse water is available to match demand. When a reuse application is not available, the effluent would be pumped to the Canadian River. This scheme has the potential to significantly reduce the cost of effluent pumping and recover much of the pumping cost by charging reuse customers for the water.

LITTLE RIVER DISCHARGE (INDIRECT POTABLE REUSE)

Because the Little River flows directly to Lake Thunderbird, the City's drinking water source, effluent discharge criteria would be much more stringent than for the Canadian River. In the current regulatory environment, effluent discharge to the Little River would not be allowed. However, the City could benefit by exploring this option because it could then augment its raw drinking water supply by the amount that is discharged. This could be a cost-effective option for some additional water supply, especially when considering the high cost of raw water from Southeast Oklahoma and the fragile state of the City's groundwater sources due to the presence of hexavalent chromium and arsenic.

SCHEME 2A: ***BNR/Membrane Filtration for Indirect Potable Reuse.*** A system targeted to provide indirect potable reuse water would require the most rigorous treatment requirements and effluent quality. In this treatment scheme, membrane filtration would be exploited to provide a positive barrier to pathogens and contaminants, advanced oxidation (discussed below) would be used to further destroy organics, and a wetland system would be installed to provide an additional barrier between the discharge and reuse side. The wetland system offers an attractive separation between reclamation and reuse that could be further developed for recreation with trails and parks. The aerial figure on the following page shows a potential layout for this plant, wetland and recreation area.

SCHEME 2B: ***Flexible Treatment System for Initial Canadian River Discharge with Future Add-on Processes for Little River Discharge.*** Depending on the regulatory environment and citizen acceptance of indirect potable reuse, the base treatment system could be installed initially and add-on unit processes could be installed in the future to polish effluent to reuse standards. This would give the City significant flexibility to cost-effectively react to changing perceptions of reuse.

Advanced Oxidation Processes. Organic residual compounds, resistant to standard processes, may linger; particularly compounds resistant to biological degradation. This may include **Endocrine Disrupting Compounds (EDCs) and Pharmaceutical and Personal Care Products (PCPPs)** or microbial products produced by microorganisms. Removal of these residual compounds may be accomplished by the use of chemical oxidation or advanced oxidation processes (AOPs). The use of AOPs requires: 1) a chemical oxidizer and 2) contact time for the reaction. Some potential oxidizers include ozone, hydrogen peroxide, hydrogen peroxide with ultraviolet radiation, and Fenton's reagent (hydrogen peroxide plus an iron catalyst). These are effective oxidizers due to the fact that they form highly reactive hydroxyl or peroxide radicals. Contact time for the reactions with the oxidizers and the residuals is usually accomplished in a plug flow basin.

Constructed Wetlands for Wastewater Polishing. A variety of natural, biological processes occur in wetlands in order to provide tertiary polishing of wastewater effluent. The remaining dissolved and particulate biodegradable material present in the effluent is removed in a wetland through the process of decomposing microorganisms which live on the surfaces of the thriving plants and soils. The plants of a wetland are instrumental by feeding oxygen to the water and taking up nutrients such as nitrogen and phosphorus.

SCADA and Instrumentation. The City desires remote operation and automation of the WRF to minimize staffing requirements. HDR offers staff who have vast experience in this area. HDR is highly experienced with SCADA system design and trained in the latest software. Our unique combination of process expertise and extensive experience in the delivery of SCADA systems affords us the opportunity to support Norman in the following ways:

- Technical aspects of SCADA planning; system designs that are highly reliable and available; and development of monitoring and control strategies
- Delivery of hands-on implementation, software development, start-up, commissioning and owner training
- Assistance and continued support to our clients in becoming self-sufficient in operating and maintaining the SCADA system
- Evaluations of communication options including radio, telephone, analog microwave versus digital microwave, etc. for remote sites
- Integration of SCADA system with processes, existing and new monitoring and control systems, electrical systems, O&M personnel and maintenance management systems

BIOSOLIDS TREATMENT AND HANDLING

In addition to evaluating alternatives for the liquid treatment train, the study will include an evaluation of the solids treatment train. Various approaches and technologies will be considered for each step of the solids treatment processes. The HDR-APAI team will undertake these investigations in the following five areas:

Solids Thickening. Thickening the sludge streams benefits the treatment step and reduces the volume of material to be handled by separating excess water. Typically, primary solids are thickened by the use of gravity settling basins. Secondary solids are thickened by gravity belt thickeners, dissolved air floatation, or centrifuges.

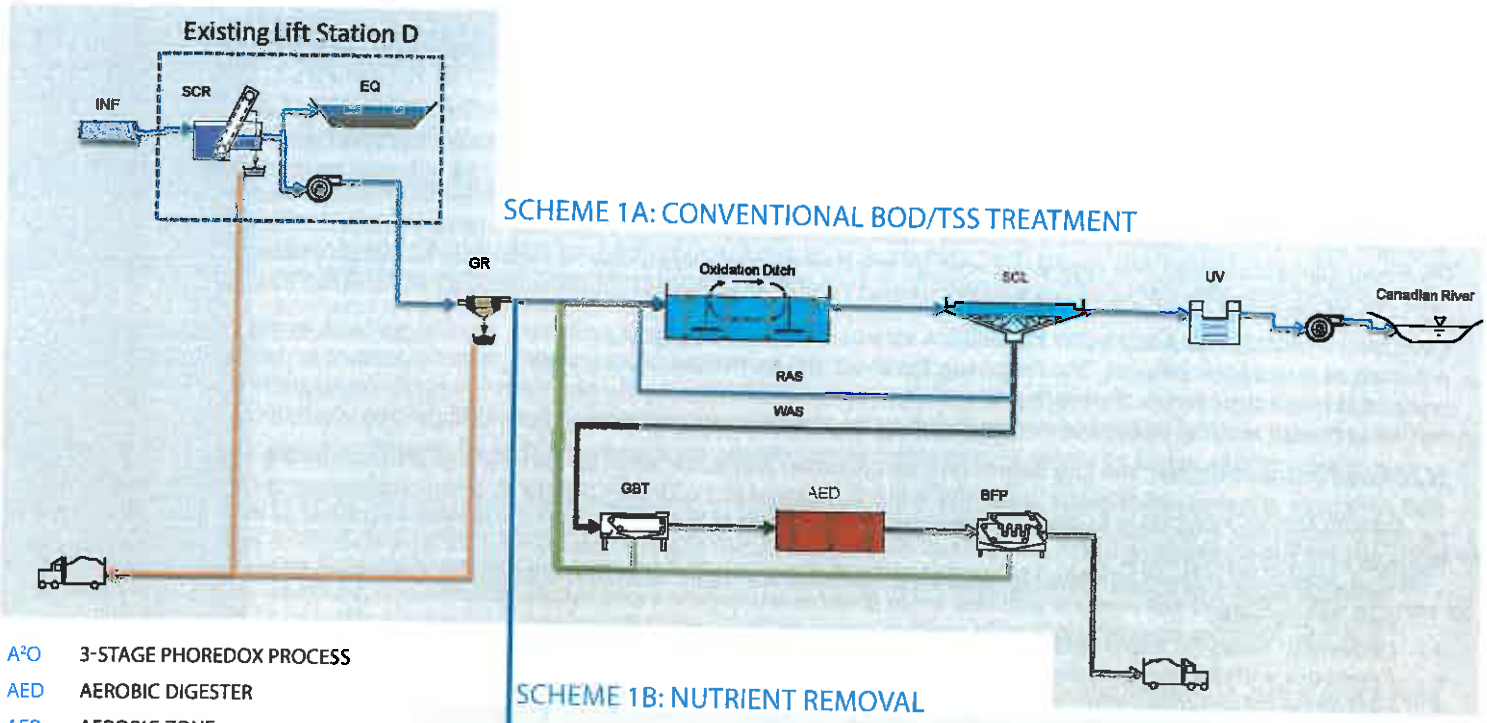
Solids Reduction. Often, as done at the City's existing WRF, anaerobic digestion is used for reducing the amount of solids to be disposed and converting the biomass to energy that can be employed in other areas of the plant. Aerobic digestion is another alternative, but it is very energy-intensive due to the air being used to biologically breakdown the organic matter. Our team recommends aerobic digestion in Scheme 1A due to the absense of primary clarifiers, but anaerobic digestion for the other treatment schemes.

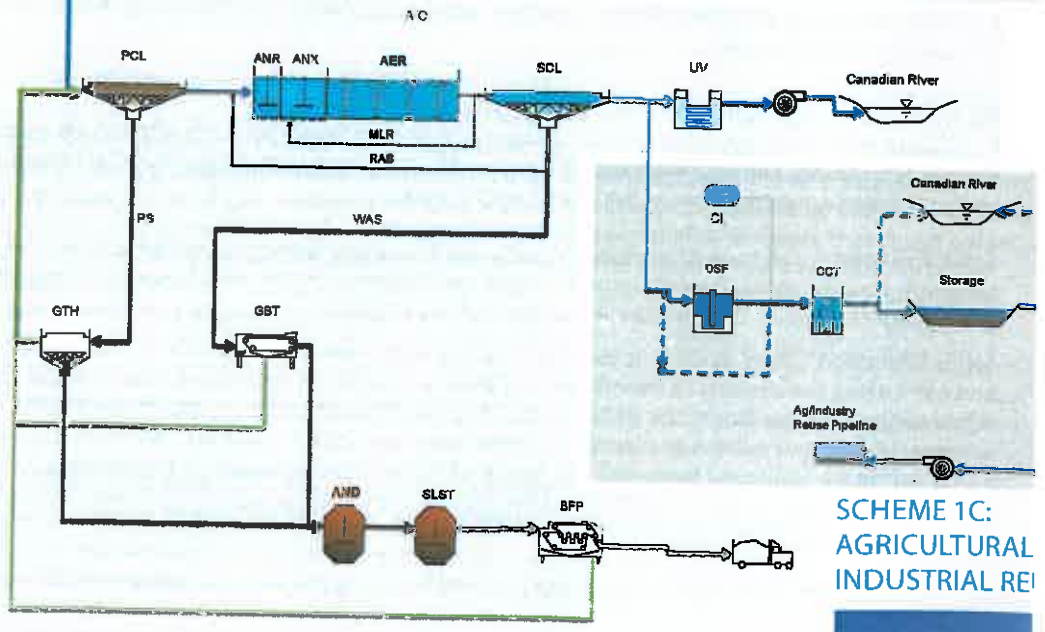
Solids Dewatering. Typically, solids are dewatered to 20 to 30% solids for more cost-effective transportation and disposal. Dewatering can be accomplished through belt filter presses, rotary press, or centrifuges. Currently, the City relies on centrifuges for both thickening and dewatering at its existing WRF.

Ultimate Disposal. Currently, the City applies what is known as Class B biosolids to farm fields to enrich the soil in a monitored and controlled environment. The Class B designation is achieved by anaerobic digestion to reduce the objectionable compounds and the threat of spreading pathogens. Changing regulations or markets could eliminate this disposal technique. The other course of action is to process the biosolids to a Class A ranking. This is a further reduction in pathogens to where it is uncontrolled and can be sold or given to the general public for soil enrichment. Class A can be achieved through several methods: thermal drying, advanced digestion, pasteurization, composting, and chemical treatment. Norman currently operates a yard and woody material compost facility adjacent to the wastewater treatment plant. This material could be combined with wastewater biosolids for a co-composted material that could be sold commercially.

Location of Solids Treatment Facilities. With solids treatment facilities already located at the existing WRF, with many of the elements already sized to handle solids from the north sewer basins, it will need to be determined whether or not to transport the solids generated at the North WRF to the existing plant (by pumping into the Bishop Creek interceptor, pumping all the way to the plant, or hauling by trucks) or to construct solids treatment facilities at the North WRF. This evaluation will be done in conjunction with the analysis of the above items to determine which location provides the lowest life cycle cost and favorable non-economic factors for solids treatment. By sending all solids to the existing WRF, the new North WRF would essentially be classified as a "scalping" plant, where water is removed and solids are sent to another system for treatment. This is a widely-used practice in arid areas where the water is reclaimed for reuse.

POTENTIAL TREATMENT SCHEMES FOR DISCHARGE INTO THE CANADIAN RIVER





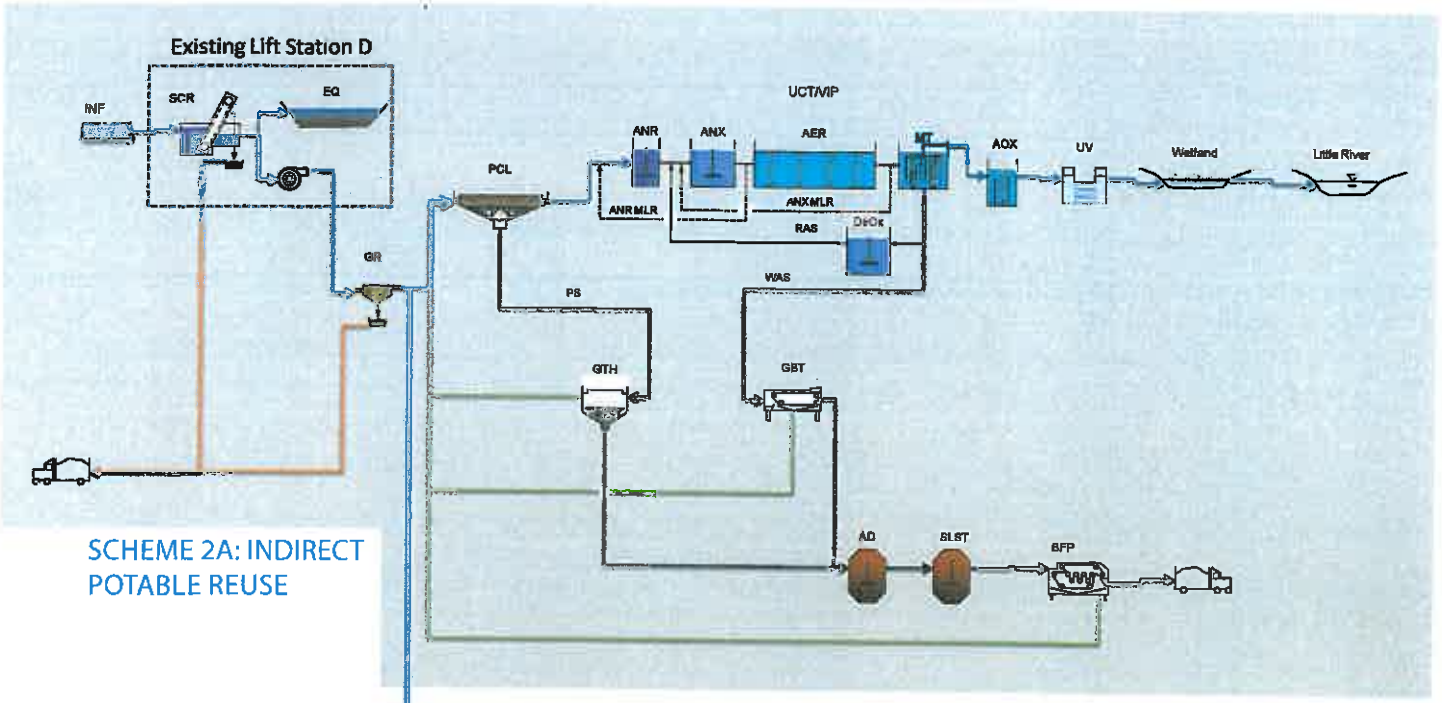
SCHEME 1C: AGRICULTURAL INDUSTRIAL RE

For Las Vegas, HDR designed flexible basins to operate in both the UCT and A^2O modes for removal of phosphorus to meet a challenging 0.17 mg/L permit limit. This greatly reduced the oxygen demand in the plant, saving substantial dollars in operating cost.

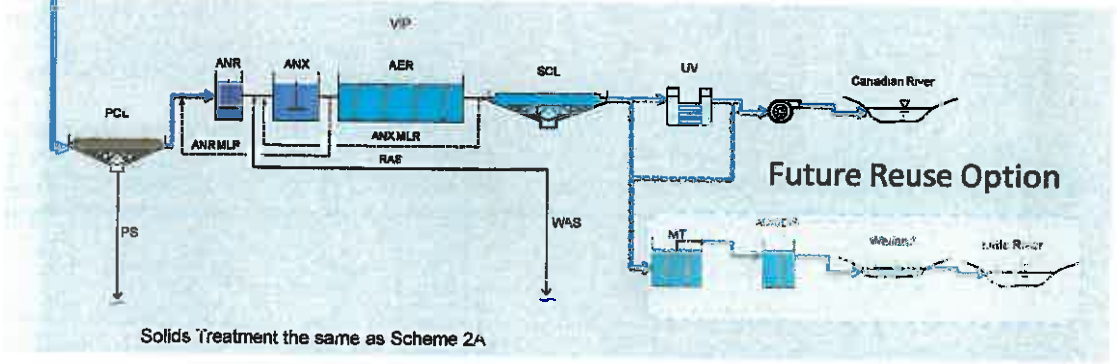
A^2O	3-STAGE PHOREDOX PROCESS
AED	AEROBIC DIGESTER
AER	AEROBIC ZONE
AND	ANAEROBIC DIGESTER
ANR	ANAEROBIC ZONE
ANX	ANOXIC ZONE
AOX	ADVANCED OXIDATION
BFP	BELT FILTER PRESS
CCT	CHLORINE CONTACT TANK
Cl_2	CHLORINE FEED
DeOx	DEAERATION TANK
DIS	DISINFECTION
DSF	DISC FILTER
EQ	EQUALIZATION BASIN
GBT	GRAVITY BELT THICKENER
GR	GRIT REMOVAL
GTH	GRAVITY THICKENER
INF	INFLUENT
MLR	MIXED LIQUOR RECYCLE
MT	MEMBRANE TANK
PCL	PRIMARY CLARIFIER
PS	PRIMARY SLUDGE
RAS	RETURN ACTIVATED SLUDGE
SCL	SECONDARY CLARIFIER
SCR	SCREENING
SLST	SLUDGE STORAGE
UCT	UNIVERSITY OF CAPE TOWN PROCESS
UV	ULTRAVIOLET DISINFECTION
VIP	VIRGINIA INITIATIVE PROCESS
WAS	WASTE ACTIVATED SLUDGE

scheme with the appropriate levels of cost-effectiveness and flexibility for the North WRF.

POTENTIAL TREATMENT SCHEMES FOR DISCHARGE INTO THE LITTLE RIVER FOR INDIRECT POTABLE REUSE



SCHEME 2A: INDIRECT POTABLE REUSE

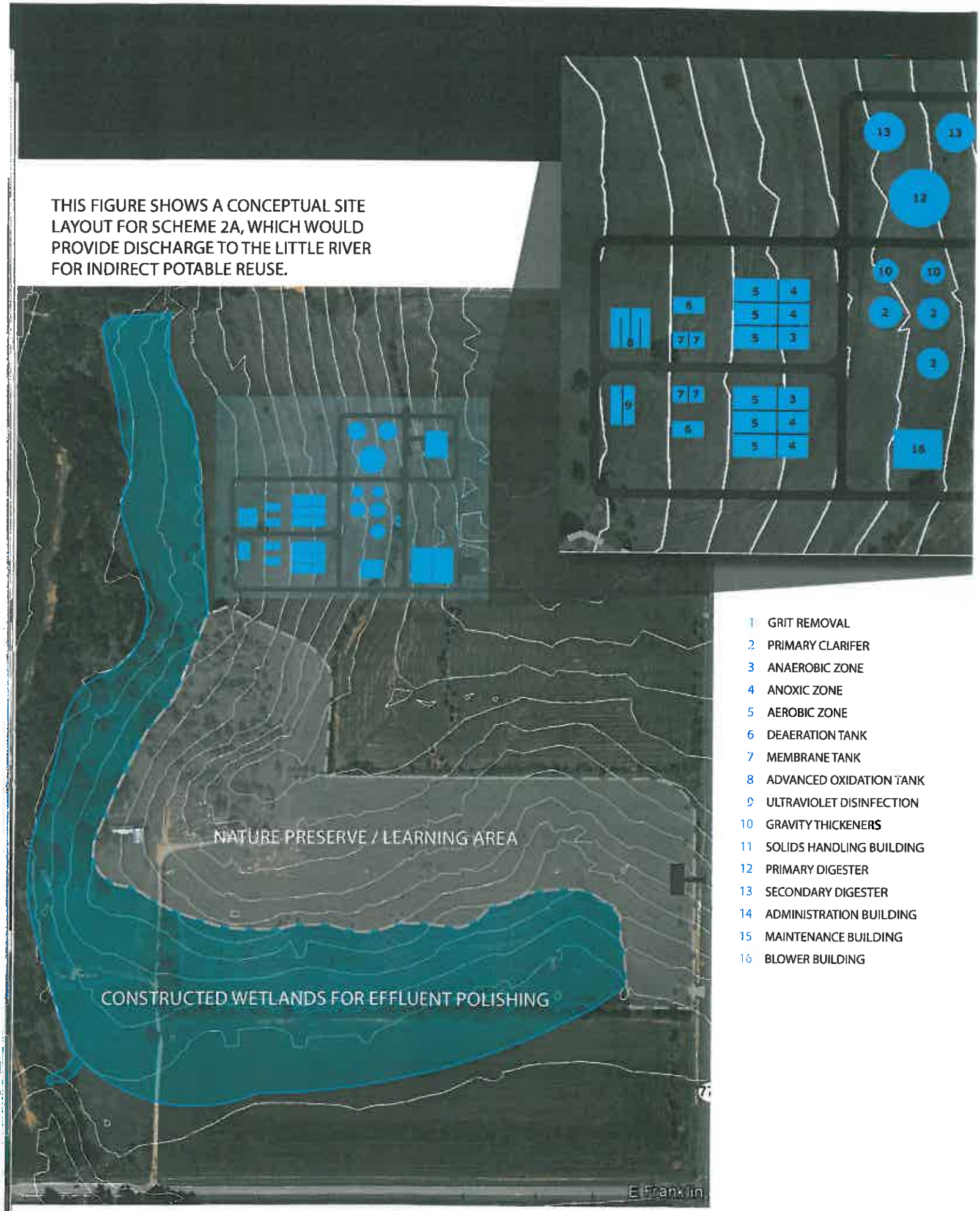


SCHEME 2B: STAGED NUTRIENT REMOVAL/INDIRECT POTABLE REUSE FOR FLEXIBILITY

For nutrient removal basins, HDR often designs ANR, ANX, and some AER zones to operate in all 3 of these modes to provide operators with flexibility to meet changing regulations, seasonal temperatures, and influent quality. This photo shows an example of this type of "swing zone" design.

HDR is proposing that submerged membranes be used for tertiary treatment to produce reuse quality water. This photo shows a membrane tank designed by HDR in California for a similar application.

THIS FIGURE SHOWS A CONCEPTUAL SITE LAYOUT FOR SCHEME 2A, WHICH WOULD PROVIDE DISCHARGE TO THE LITTLE RIVER FOR INDIRECT POTABLE REUSE.



1 GRIT REMOVAL
2 PRIMARY CLARIFER
3 ANAEROBIC ZONE
4 ANOXIC ZONE
5 AEROBIC ZONE
6 DEAERATION TANK
7 MEMBRANE TANK
8 ADVANCED OXIDATION TANK
9 ULTRAVIOLET DISINFECTION
10 GRAVITY THICKENERS
11 SOLIDS HANDLING BUILDING
12 PRIMARY DIGESTER
13 SECONDARY DIGESTER
14 ADMINISTRATION BUILDING
15 MAINTENANCE BUILDING
16 BLOWER BUILDING

KEY CONSIDERATIONS IN COST-EFFECTIVE TREATMENT

- Select processes that accomplish multiple treatment objectives (for example, membranes provide solids separation and act as a barrier to pathogens and contaminants)
- Apply the right balance of innovative versus established treatment technologies
- Use a well-developed approach for facility layout to streamline system hydraulics

KEY CONSIDERATIONS IN TREATMENT FLEXIBILITY

- Use a design approach that overcomes challenges synergistically (meets treatmer objectives, accommodates operations staff, minimizes O&M effort)
- Provide one system with the capability to achieve multiple treatment objectives (secondary treatment, ammonia conversion, nutrient removal, pathogen reductio
- Select processes that can be operated in several modes (such as swing zones)
- Develop an upgradable system for meeting future regulatory uncertainty

BENEFIT #2: SEAMLESS INTEGRATION WITH ODEQ AND COMCD FOR PLANNING REUSE IN LAKE THUNDERBIRD

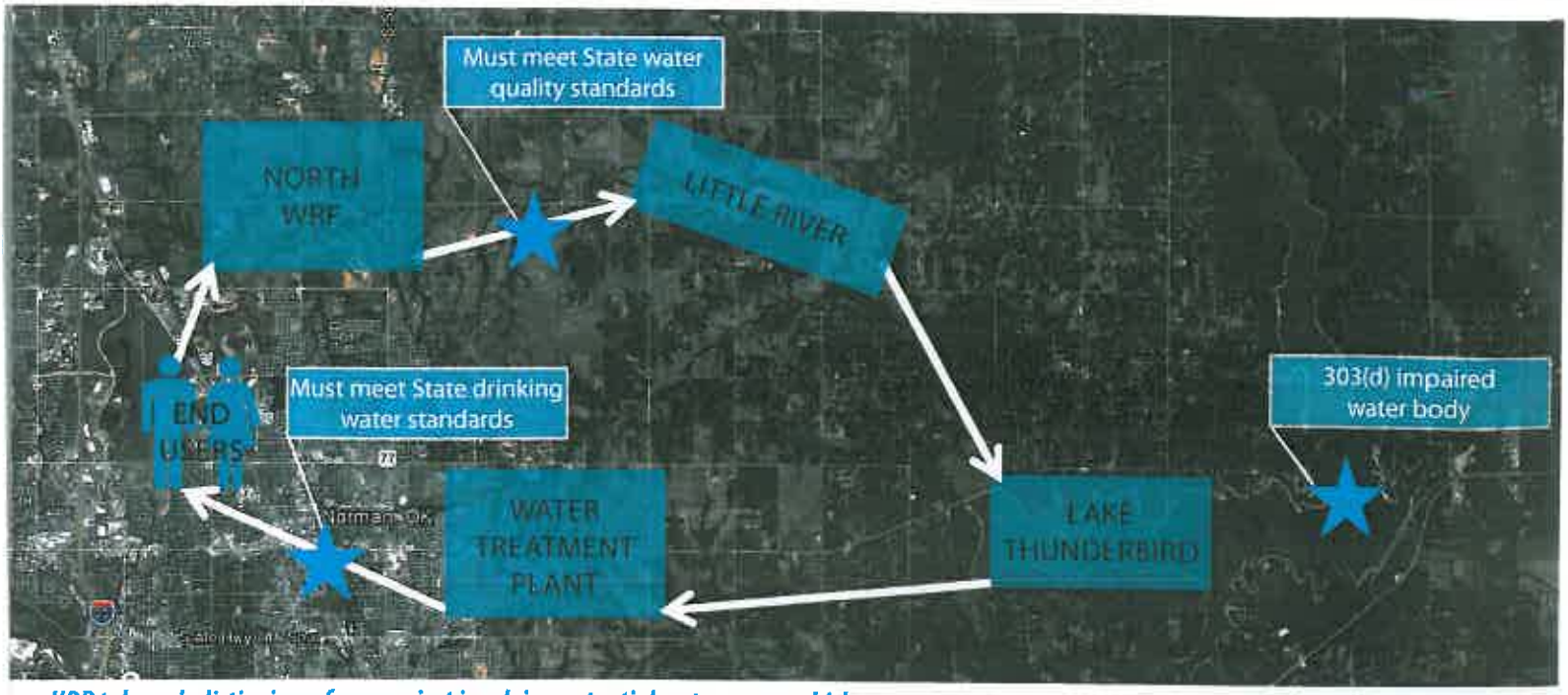
COMCD

For several years, the Central Oklahoma Master Conservancy District (COMCD) has been developing concepts and actively pursuing solutions for augmentation of Lake Thunderbird after a severe drought and increasing customer demands caused concerns about the Lake's sustainability. COMCD is currently contracted with Alan Plummer Associates Inc. (APAI) to perform the ***Lake Thunderbird Water Reuse Feasibility Study***. This study is one of the first reuse studies in Oklahoma that evaluates indirect potable reuse into a surface water supply and evaluates several alternatives related to water reuse for Lake Thunderbird. Water reuse alternatives considered in the study include augmentation of Lake Thunderbird with highly treated effluent from the communities of Norman and Moore and diversion of river water from the Canadian River downstream of the Moore and Norman discharges. These reuse alternatives are compared with traditional water supply alternatives, including obtaining water from the proposed Scissortail Lake in Ada; obtaining water from Kaw Lake; and obtaining water from proposed Oklahoma City Southeast Oklahoma water sources. This study is scheduled to be complete in September 2012. ***Since HDR team member APAI is conducting this study, there is no learning curve and Norman's North WRF study will seamlessly integrate with COMCD's planning***. Selecting the HDR-APAI team will provide the City a renewed partnership with COMCD. With both the City and COMCD having common reuse interests and by selecting the team with the leading Oklahoma reuse firm, APAI, information sharing between Norman and COMCD will become beneficial to both parties. Essentially, ***the City and COMCD are stronger as a unified voice in support of indirect potable reuse regulations – and this unified vision will be more likely realized through the common thread of APAI's involvement.***

ODEQ

According to the Oklahoma's water quality standards, ***Lake Thunderbird*** is classified as a Sensitive Water Supply (SWS) with turbidity, dissolved oxygen and Chlorophyll-a impairments. Additionally, certain segments of the ***Little River*** are impaired for turbidity, dissolved oxygen, lead, copper, sedimentation/siltation, thallium and chloride. Due to these identified impairments, Oklahoma Department of Environmental Quality (ODEQ) will not allow new point-source discharges to the Lake Thunderbird drainage basin unless, as the water quality standards state, the discharge ***"will result in maintaining or improving the water quality of both the direct receiving water and any downstream waterbodies designated SWS."*** Additionally, ODEQ has recently issued the first version of indirect non-potable reuse regulations for the State of Oklahoma. These regulations went into effect July 1, 2012, and identified four classes of non-potable reuse, Class 2 through Class 5. The classes decrease in their treatment requirements with Class 2 requiring coagulation/filtration/disinfection following secondary treatment and Class 5 requiring only lagoon treatment. ***Oklahoma Senate Bill 1043 requires ODEQ to create a working group and promulgate reuse regulations for the indirect potable reuse of wastewater by July 1, 2013.***

The reuse working group is comprised of regulatory, consultant and municipal professionals and their first meeting regarding the indirect potable reuse regulations is August 29, 2012. ***HDR team member Dr. Ellen McDonald of APAI is on this working group and will help Norman seamlessly integrate its North WRF study with ODEQ's rulemaking process for indirect potable reuse.*** The HDR-APAI team anticipates that with less than a year remaining for development of these indirect potable reuse regulations, and a possible ODEQ sticking point of endocrine disrupting compounds (EDCs), the resulting indirect potable reuse regulations will default to California's rules. California's rules require reverse osmosis (RO) treatment with advanced disinfection using UV and peroxide. Considering the limited options for RO waste stream disposal in Oklahoma, this treatment scheme will not be feasible for most Oklahoma communities unless ODEQ loosens the discharge limits to allow for such a waste stream. The potential Oklahoma reuse regulations present challenges for the new North WRF with an effluent discharge to the Little River. ***ODEQ has confided in the City (Ken Komiske) and APAI (Dr. Ellen McDonald) to participate in Oklahoma's reuse rule making, and continuing with this team for Norman's North WRF offers the greatest chances for project success.*** Essentially, teaming with the HDR-APAI group will allow the City to leverage the regulatory process by being more aware of the status, impacting the working group's technical considerations and by influencing the process through APAI's involvement.



HDR takes a holistic view of any project involving potential water reuse, which we term Integrated Water Planning. The entire water use cycle must be collaboratively considered, ensuring robust protection of the Little River, Lake Thunderbird and, most importantly, the drinking water consumers.

BENEFIT #3: INFORMED AND CONFIDENT CITIZENS AND REGULATORS

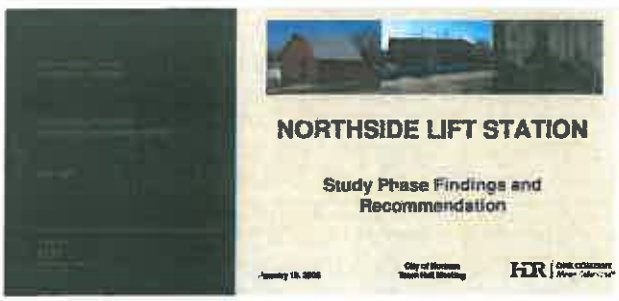
Norman's residents have a passion for their city. Because of this passion, they have specific preferences for Norman's future. **Some desire growth; others do not.** Establishing wastewater services on the north side of the City would open up new areas for residential and business development – which is favored by many. On the other hand, opening up this area would increase the population density and reduce the separation that now exists between Norman and Moore – which is opposed by many. The two groups collide and with so much opposition, establishing wastewater services in the north areas of Norman has had mixed results. Currently, a "compromise" solution is in place, which includes the recently rehabilitated Lift Station D pumping all northside wastewater to the existing South WRF. But the compromise is that it has been designed to serve as the headworks facility for the North WRF if it is ever built.

The current Lift Station D solution was facilitated by City leaders with significant contributions by HDR and the HDR team's proposed project manager, Joel Cantwell. Although not all concerned citizens agreed with the "compromise" solution, there was wide agreement by both sides of the issue that **the work done by HDR was wholly without bias and was trustworthy for informed decision making.** To ensure the City's northside wastewater planning reputation continues in this vein, **HDR will do the following:**

PREPARE HIGH QUALITY DELIVERABLES

Norman residents are thoughtful, careful and approach the future cautiously. They doggedly ensure that their tax money is used responsibly. Independent groups in the City constantly observe, watch and thoroughly review Norman's plans and path for the future. This situation, albeit difficult at times, provides excellent checks and balances that many cities do not have.

With HDR's commitment to a thorough QA/QC process for each project, we appreciate the citizen's ideas and comments and we applaud their level of interest in Norman's projects. HDR takes pride in our purpose of doing what's best for the project and the community. **Our deliverables for the North WRF project will be high-quality documents that will earn the appreciation of the City staff, leaders and citizens – similar to our Northside Lift Station / Lift Station D project.**



HDR produced transparent and high quality deliverables and conducted multiple public meeting presentations for the Northside Lift Station project to build a high level of trust in the community, something we will continue to uphold on this project.

PROVIDE TRANSPARENT ASSUMPTIONS AND CALCULATIONS

Like our college professors used to preach, we will "show our work." Like we have done in the past, our team's assumption and calculations will be clearly outlined in a simple to understand manner in each of our reports. HDR wants to be known for doing what's best for both the project and for the community, and we go the extra mile to prove this by checking and double checking our evaluation criteria. The information we use for evaluating options is derived from documented sources and when assumptions are needed, they will be based on historic trends.

CONDUCT ACCURATE AND INFORMED COST ESTIMATING

This project cannot be successful without accurate cost estimating. The HDR team will put a specific emphasis on using our in-house cost estimating professionals with **HDR Constructors, Inc.**, for estimating facility capital costs.

We will also use our in-house plant operations and energy efficiency specialists to develop annual O&M costs for various treatment processes. We will then convert all of these costs into **20-year life cycle costs,** assuming full build-out flows are received at the North WRF for the duration of the 20-year period. We will clearly show the assumptions used so that there is no question how the life cycle cost for each alternative was developed.

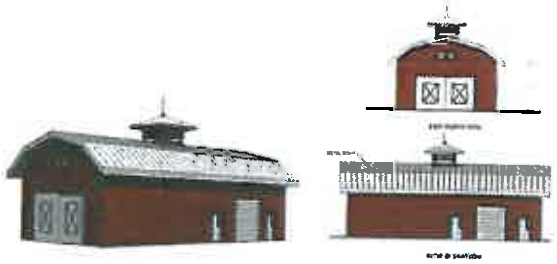
PARTICIPATE IN STRATEGIC PRESENTATIONS AND PUBLIC MEETINGS

Although there exists a certain population in every city that will never agree with the chosen path forward, most citizens simply want to have confidence that their tax dollars are spent wisely and their safety is protected. To gain this level of confidence, citizens must see transparency in the process and clearly understand how the path forward was selected. HDR believes this is better accomplished through conversations with the public than by formal presentations. Most citizens prefer casual question and answer sessions that allow back and forth information sharing over reading a technical report or hearing a technical presentation. HDR's open-book philosophy will make citizens comfortable with the process which will improve project's favorability. Furthermore, HDR's public involvement approach is careful listening to the public's concerns. We respond with factual information that illustrates how project issues were evaluated and reasons supporting the decision forward.

Our proposed approach to public meetings includes a come-and-go type atmosphere with the majority of the meeting time dedicated to informal conversations and one-on-one or small group discussions with a conjunctive process to capture the input received at the meeting and be able to respond at a later date as necessary.

CONSIDER AESTHETICS IN PLANNING AND COST ESTIMATING

HDR believes that what will change the public's opinion of a project like the Norman WRF is keeping the public's interests at the forefront of the planning process. This means aesthetics will play a large role in the final design. HDR's plan will include **odor control** components, **architectural design** that does not distract from the natural beauty of the plant site, **lighting design** that provides site security while minimizing spillage, **noise control** features to prevent loud equipment noises from traveling off-site, inclusion of **nature trails and preserves** that coordinate nicely with the City's current greenways master planning efforts, and use of **wetlands** to facilitate project acceptance and create nature wildlife habitats. The use of wetlands as a critical design feature is discussed below.



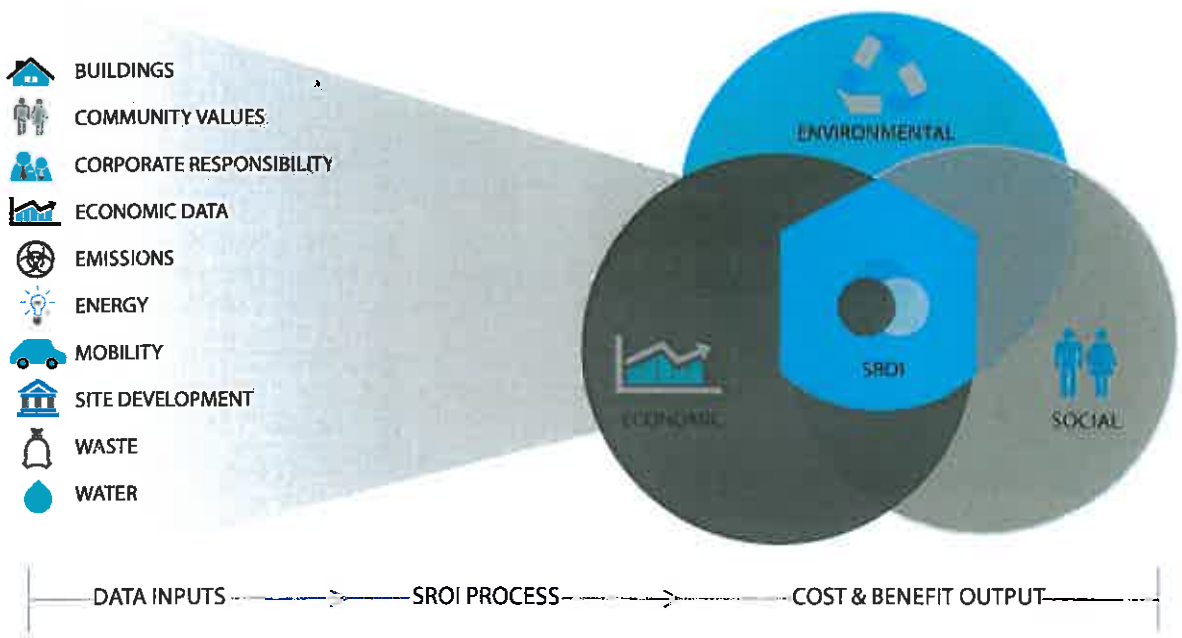
For the Northside Lift Station, which was designed by HDR but not built due to the City's decision to rehabilitate Lift Station D instead, HDR designed the building with a barn-like look. We will provide similar specialized architectural design if desired by the City.

Use of Wetland Treatment for Water Quality and Public Acceptance. In order for the City's North WRF to discharge treated effluent to the Little River, four non-monetary criteria, at a minimum, must be met: 1) an effluent water quality must be produced that improves the Little River and Lake Thunderbird's water quality; 2) ODEQ must approve the treatment process for Class 1 indirect potable reuse; 3) operation of Norman's drinking water plant must not be significantly impacted; and 4) the Norman residents must be in favor. HDR can plan and design a treatment process that is affordable to Norman's capital and operations budget and meets all four of these criteria. To earn the favor of the public, wetlands must be considered.

The public tends to believe that the best and most appropriate method of wastewater polishing is through wetlands. This thinking likely stems from the idea that if plants and animals can thrive in a wetlands environment, the water must be safe. Most likely, for the new North WRF project to be publically acceptable, wetlands must be considered. Fortunately, Norman has acquired a 160-acre quarter section with ample space on a natural setting for a new City park inclusive of wetlands, walking and hiking paths, biking trails, play areas, public education, wetlands center, etc.

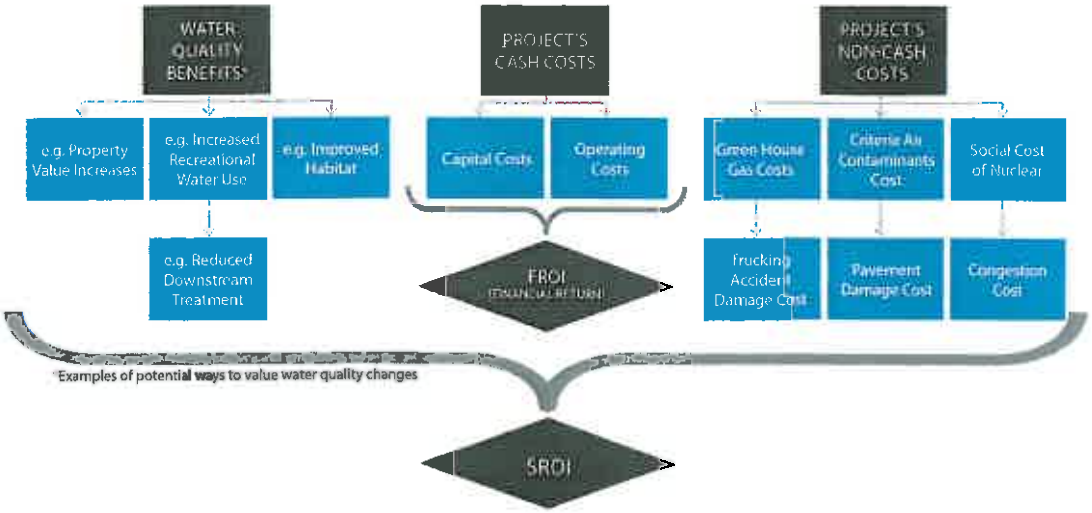
INTRODUCE NORMAN TO THE SROI PROCESS | TRIPLE BOTTOM LINE (ECONOMIC, SOCIAL, ENVIRONMENTAL)

Sustainable Return on Investment (SROI) was developed by HDR with input from Columbia University's Graduate School of International Public Affairs, specifically to address the public value of an investment. SROI involves identifying, quantifying, monetizing and summing in dollars the value of all possible incremental costs and benefits over the life of a project, including environmental, social and economic impacts. SROI resulted from the escalating popularity of economic analyses for prioritizing projects at local, State and Federal levels. SROI methodology not only allows Norman to place a financial value on the social and environmental aspects of the North WRF project, but more importantly, it will help with prioritizing the project by providing an "apples to apples" comparison of alternatives. **SROI goes beyond the typical life cycle cost analysis that is commonly used in the industry by further accounting for factors which in the past were considered non-quantifiable.**



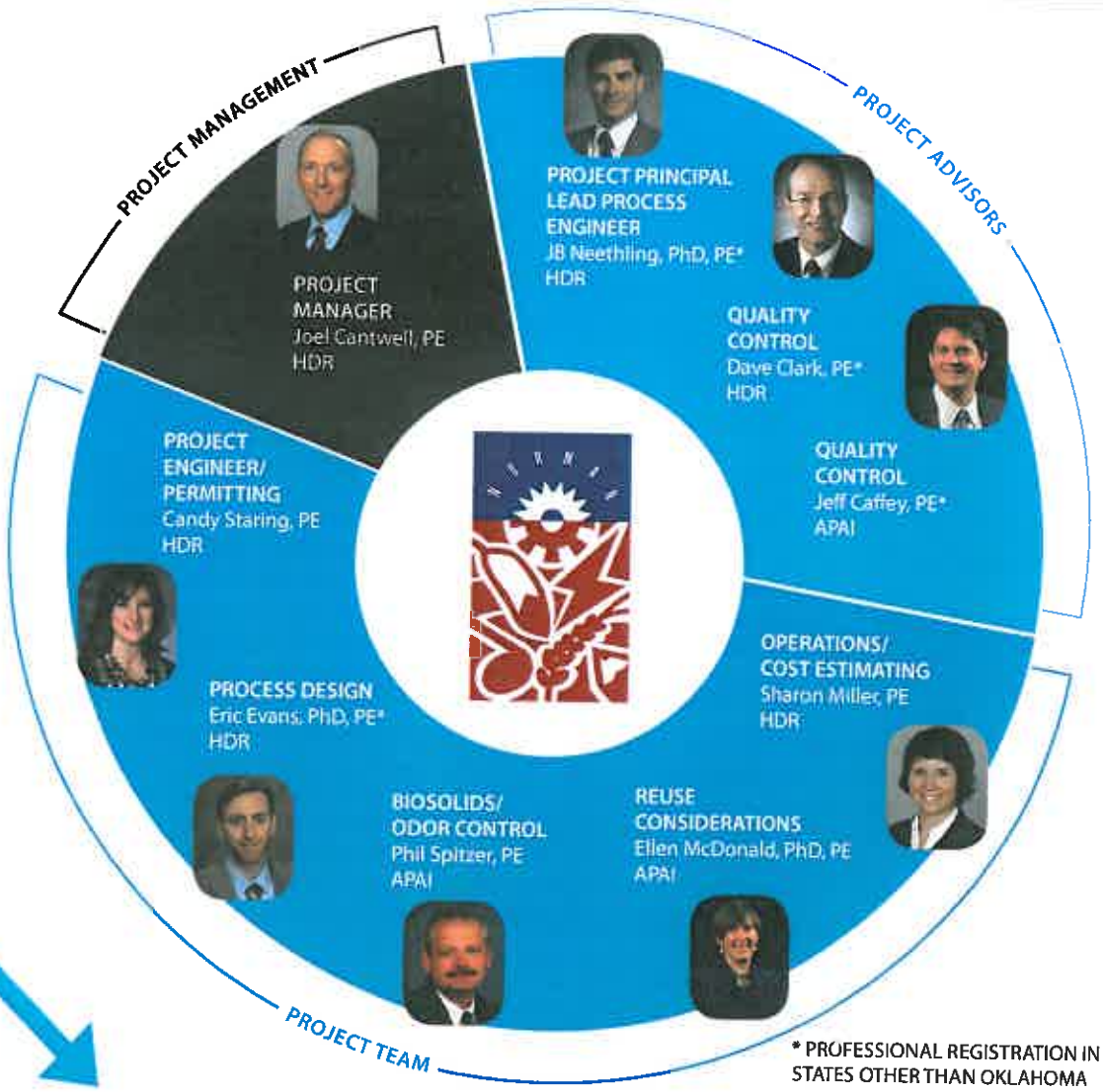
HDR's SROI process involves four distinct steps:

1. Develop the structure and logic of the business case.
2. Quantify input assumptions and assign risk ranges.
3. Facilitate a Risk Analysis Process (RAP) sessions: These are workshops lead by HDR team member Dave Clark whereby management and key stakeholders are brought together to develop and reach consensus on SROIO model inputs and assumptions. This step could also include public involvement if desired.
4. Simulate outcomes and quantify probabilistically: The final step in the process involves generating SROI metrics such as Net Present Value, Discounted Payback Period as well as user friendly graphs and tables.



HDR proposes to use the SROI framework to evaluate the various alternatives for the North WRF. The resulting data will help the City make informed decisions that balance economic, environmental, and social impacts. As a result, the decision that is ultimately made will be transparent and defensible.

HDR recently used the SROI process for the Denver Metro Wastewater District for a project very similar to Norman's North WRF. Denver Metro hired HDR to evaluate alternatives for a new Northern Treatment Plant. Various processes are considered for liquids and solids treatment (16 in all) and a triple bottom line evaluation was done for all of the factors shown in the above figure. The evaluation resulted in the selection of conventional activated sludge with filtration over some of the more advanced technologies.



* PROFESSIONAL REGISTRATION IN STATES OTHER THAN OKLAHOMA

PROJECT TEAM

HDR has assembled a team of individuals with unmatched local knowledge and experience, coupled with national expertise, to successfully deliver this project. Our pledge to the City is that the key staff will be engaged in the project from start to finish. The following pages provide an organizational chart and brief resumes of key team members.

The team presented to the City is constructed to provide top-notch, quality service. ***Joel Cantwell*** will serve as Project Manager. Joel has successfully conducted study and design projects throughout the City's wastewater system, and he is intimately familiar with the City's staff, facilities and procedures. He has proven that he will deliver tailored, thoughtful solutions and communicate them effectively, both written and spoken. Joel will be assisted by Project Engineer ***Candy Staring***, who is located in HDR's Oklahoma City office. Candy also has a very successful track record with the City, completing the design of the recent well field expansion while with another firm.

HDR's proposed team brings unique qualifications related advanced wastewater treatment and nutrient removal. ***JB Neethling*** will serve as the Lead Process Engineer and Project Principal on this project. He is HDR's top wastewater process expert and one of the nation's leaders in nutrient removal issues. He is the project manager for the ongoing WEF Nutrient Challenge project to identify existing and new phosphorus and nitrogen removal technologies to help utilities meet nutrient limits. Dave Clark is closely connected with the EPA and multiple state governments, advising them on strategies for realistic implementation of nutrient removal and wastewater reuse. He is an advocate for utilities' efforts to balance available funds with environmental protection, and he will champion the City's cause for cost-effective implementation in his role as lead for Quality Control.

HDR is proud to have APAI as a teaming partner for this project to provide services in its firm's particular areas of technical expertise: water reuse and biosolids handling. ***Ellen McDonald*** is widely considered the leader in reuse in this region of the nation, and she will lead the team's efforts related to indirect potable reuse in the Little River. Ellen also currently serves on ODEQ's advisory council for implementing reuse regulations as well as a key team member in APAI's current augmentation study of Lake Thunderbird for COMCD. ***Phil Spitzer***, who has a successful wastewater treatment track record with the City, will lead the team's evaluation of biosolids treatment options.

OUR TRUSTED LOCAL STAFF, FAMILIAR PARTNERS AND NATIONAL EXPERTS WILL PROVIDE NUA UNPARALLELED RESPONSIVENESS, COMMUNICATION AND TECHNICAL SOLUTIONS.

JOEL CANTWELL, PE
Project Manager

Mr. Cantwell is a professional engineer with more than 17 years of experience in civil and environmental engineering with emphasis on the design of water and wastewater treatment facilities. He is well-versed in treatment process design, and is a very accomplished project manager and design engineer. He is responsive to his clients and is adept at communicating technical concepts in public forums.

YEARS EXPERIENCE
17

EDUCATION
ME Civil Engineering
Texas A&M University

BS Civil Engineering
Texas A&M University

REGISTRATION
Professional Engineer
Oklahoma No. 20155

// CITY OF NORMAN. Mr. Cantwell served as Project Manager for the following projects:

Norman WRF Headworks and Westside Lift Station Improvements. The project included the design of a new headworks facility with screening and grit removal. Joel conducted the analyses that eliminated the existing screw pump station and allowed use of the screw pump station structure to house the new screens. The project also included a new 13.5-mgd Westside Lift Station was designed to pump a portion of the WWTP influent flow.

Norman WRF Sludge Handling Improvements. The project improved solids handling operations at the WRF by adding new centrifuges for thickening and dewatering; dewatered sludge storage; new primary digester covers, mixing system, and gas handling equipment; a WAS storage facility; and a new effluent flow measurement structure.

Northside Lift Station / Lift Station D Improvements. The project sized a new gravity collection system in the north sewer basins and evaluated alternatives for a new lift station to replace seven existing lift stations. Ultimately, Lift Station D was rehabilitated to serve as the new lift station, including new pumps and screens and a new 4.8-MG flow equalization basin. The facility is designed to handle the peak 2-hour flows for full build-out of the north sewer basins and is designed to serve as the headworks facility for the future North WRF.

Collection System Flow Monitoring and Modeling. The project included city-wide flow monitoring of the City's sewer sub-basins and conversion of the City's model to InfoWorks. The model is currently in the calibration stage. When complete, the project will determine the effect of capital improvements made over the last decade as well as updated design flows for the north and south sewer basins.

// DWU SOUTHSIDE WWTP PHASE IV DESIGN EVALUATION, DALLAS, TX. Mr. Cantwell served on the design team for the study phase of the Phase IV expansion of DWU's Southside WWTP from 110 mgd to 140 mgd. As a part of this project, HDR evaluated alternatives for aeration basin complex design, including modified Ludzack-Ettinger (MLE), Bardenpho BNR step-feed plug-flow, cyclic aeration, and membrane bioreactors. The evaluation considered net present worth analysis, ease of operation, and maintenance. The team utilized BIOWIN, a wastewater biological process model, to size basins and predict performance. Bardenpho was selected as the recommended process. The estimated $100M project has been subsequently placed on hold due to influent flows that are well below the City's projections.

// TEXARKANA WATER UTILITIES SOUTH REGIONAL WWTP MASTER PLAN, TEKARKANA, TX. Mr. Cantwell served as project manager for a master plan for the TWU South Regional WWTP. The evaluation included the development of cost estimates and comparisons of improvements necessary at the existing plant to meet capacity and performance goals. Options for meeting the project goals were to refurbish existing treatment facilities or the conversion of those facilities with the installation of new equipment. The plan resulted in a 3-phased design and construction plan to implement new screening, grit removal, UV disinfection, and other improvements. HDR also conducted a detailed treatment process assessment that recommended new anoxic zones and replacement of coarse bubble diffusers with fine bubble diffusers.

// STILLWATER WWTP IMPROVEMENTS AND DIGESTER IMPROVEMENTS, STILLWATER, OK. The Stillwater WWTP was expanded from 5 to 10 mgd average daily flow, with the entire treatment process being replaced with new construction ($16M). Mr. Cantwell was responsible for the mechanical/civil design of new aeration basins, clarifiers, blowers, ultraviolet disinfection, and sludge pump stations. Mr. Cantwell also conducted the construction services for the project. Mr. Cantwell served as project manager for the design and construction services for a new digester control building, new hydraulic mixing systems in two primary digesters, and a new floating digester cover. Responsibilities included process/mechanical design of the digester mixing system, layout of the new control building, yard piping and site/civil design.

DAVE CLARK, PE
Quality Control

Mr. Clark is the National Director of Wastewater at HDR and leads the strategic efforts in understanding wastewater market issues as they affect HDR clients. Dave works alongside the Regional Directors to integrate the national wastewater strategic plan with the regional and local office strategic plans. In addition, Dave works with the business class technical leads to outline technical skills that we need to develop in order to assist our clients. Dave leads the effort to promote HDR's wastewater image, leveraging our technical skills, engaging in research activities and increasing participation in professional organization activities.

YEARS EXPERIENCE
31

EDUCATION
MS, Civil Engineering
University of Washington

BS, Civil Engineering
University of Washington

REGISTRATION
Professional Engineer
Idaho No. 10112

// WASTEWATER TREATMENT PLANT UPGRADE AND EXPANSION (PHASES 1, 2, 3, 4, AND 5), COEUR D'ALENE, IDAHO. Mr. Clark is the Principal-in-Charge of the wastewater program for the City of Coeur d'Alene, Idaho with more than 25 years devoted to all aspects of the City's collection and treatment system including facilities planning, detailed design, financial analysis, user charge development, and asset management. Current improvements are focused on upgrade of a 6 mgd treatment plant to meet one of the lowest effluent phosphorus requirements in the nation at 0.036 mg/L for discharge to the Spokane River. Low phosphorus demonstration testing facility with three process trains at 0.05 mgd each operating at less than 0.020 to 0.030 mg/L (MBR, tertiary membrane, dual sand filtration).

// WATER ENVIRONMENT RESEARCH FOUNDATION (WERF) NUTRIENT CHALLENGE. Mr. Clark was the regulatory liaison for WERF nutrient removal research program, a five-year program with a goal of leading to new treatment methods, technologies, and solutions for nitrogen and phosphorus removal. Lead author for a recently published Nutrient Regulatory Issues white paper for WERF subscribers titled "Nutrient Management: Regulatory Approaches to Protect Water Quality Volume 1 Review of Existing Practices" addressing receiving water quality issues, treatment technology challenges and appropriate NDPES discharge permit structures. Currently preparing the third volume in this series titled "Volume 3 Nutrient Effluent Discharge Permitting Guidelines."

JEFF CAFFEY, PE
Quality Control

Jeff Caffey has experience in wastewater system planning and design. His areas of expertise include treatment processes, engineering design, and construction support. He has served in key positions on wastewater projects throughout the State, including the design of pioneering treatment techniques.

YEARS EXPERIENCE
23

EDUCATION
ME Civil Engineering
University of Texas

BS Civil Engineering
Texas A&M University

REGISTRATION
Professional Engineer
Texas No. 81896

// TRA CRWS PHASE IV REHAB DIAMOND FILTERS/BACKWASH, TRINITY RIVER AUTHORITY OF TEXAS. As project manager, Jeff researched an alternative to traveling bridge sand filters due to having reached the peak flow at the treatment plant. Diamond cloth media filters were installed as a retrofit to traveling bridge filters. These particular filters use a cloth media sleeve wrapped around a diamond-shaped tube. TRA replaced two existing 114-ft-long sand media traveling bridge filters with two 80-ft-long diamond cloth media filters. This enhancement provided a significant reduction in the amount of backwash water and increased the solids removal rate at high flows. Considerable hydraulic modeling and evaluations were performed to assess the flow splitting and hydraulic capacity increases.

// WASTEWATER TREATMENT PLANT EXPANSION TO 10.0 MGD, TOWN OF FLOWER MOUND. As project manager, Jeff was responsible for the 5-mgd expansion that increased the plant's capacity from 5 mgd to 10 mgd. The new process train design consisted of a preliminary treatment area with fine screens, grit removal, odor control biofilters, a three-basin sequencing batch reactor, and a blower building. The project also included three new cloth effluent filters, two additional UV channels, a new effluent metering structure, and a new belt press.

// WASTEWATER TREATMENT PLANT 4.5 MGD UPRATING, CITY OF WEATHERFORD. Jeff served as project manager for the plant uprating to 4.5 mgd. The improvements included an additional aeration capacity in the existing orbal unit, which is a three-channel oxidation ditch; modifying the process from extended aeration to single-stage nitrification; installing a fine screen and a third traveling bridge filter; and converting the existing primary clarifiers into aeration basins to reduce odor caused by handling primary sludge.

CANDY STARING, PE
Project Engineer / Permitting

Candy is a professional engineer and has participated in or managed a diverse range of projects including water resources, water treatment and conveyance, wastewater collection and treatment, pumping systems, regulatory reviews, storm water management, vulnerability assessments and emergency operations planning – among others. She is experienced in all project phases including conception to final design, permitting, pilot testing, bidding and construction oversight services and start-up activities. She has been successful at working with local and state agencies for groundwater rights, environmental assessments and facility construction permits – including projects requiring variances from regulations.

YEARS EXPERIENCE
15

EDUCATION
MS Environmental Engin. Oklahoma State Univ.

BS Civil Engineering Oklahoma State Univ.

REGISTRATION
Professional Engineer Oklahoma No. 20680

// GROUNDWATER WELLFIELD DEVELOPMENT, WELL HOUSES AND WATERLINE, NORMAN, OK. Project Manager and Project Engineer. Candy managed and participated in development of the Wellfield Development Plan for Norman's groundwater wellfield expansion efforts which included a total of 30 groundwater wells and associated facilities. This effort included multiple phases beginning with completion of a groundwater water rights strategy; identifying well sites, spacing and layout, assisting with property easement acquisition; and preparing, coordinating and submitting the groundwater rights permit applications. After the wellfield development plan was adopted, Candy managed and participated in Phases 1 and 2 of the wellfield design and construction. Phase 1 included developing test hole specifications, and performing preliminary and final design of eleven test wells, ten groundwater wells and associated houses. Phase 2 included fourteen test wells, twelve groundwater wells and 2-miles of waterline. Both phases included survey and geotechnical investigation subcontract oversight; equipment selection and project cost estimates; and providing bid assistance, testing oversight, and construction services.

// SANITARY SEWER REPLACEMENT PROJECT, BETHANY, OK. Project Manager. This project, which was under an accelerated schedule due to a consent order, included the replacement of 22,000-lf of sewer line, 108 manholes and 526 service connections in a neighborhood with homes more than 50 years old.

JB NEETHLING, PhD, PE
Project Principal / Lead Process Engineer

Dr. Neethling is considered HDR's top wastewater process engineer, with more than 35 years of wastewater engineering experience ranging from master planning, process evaluation, and modeling to design and startup of wastewater treatment plants. He is the lead process engineer for HDR's largest and most complex wastewater treatment plant projects nationwide. His experience includes the use of cutting-edge technologies and innovative process solutions, incorporating such techniques as stress testing, pilot plant (and full-scale plant) operations and studies, and development of an in-house treatment system modeling software program - ENVision - that is used for process analysis, plant mass balancing, hydraulics modeling, and capacity rating of wastewater treatment plants. He is also experienced in evaluating system capacity and bottlenecks, and in developing alternatives for improvements that save costs and produce effective and efficient results.

YEARS EXPERIENCE
35

EDUCATION
PhD Civil Engineering MS Civil Engineering University of CA Berkeley

BS Civil Engineering Univ of Stellenbosch So Africa

REGISTRATION
Professional Engineer California No. C-44101

As HDR's Technical Director for Wastewater, he assess new technologies and directs technology transfer and applied research activities within HDR. He stays abreast of changes in regulations through his established relationships with many regulatory agencies. Dr. Neethling is currently serving as the Principal Investigator for the Water Environmental Research Foundation (WERF) Nutrient Removal Challenge, a national program to address nitrogen and phosphorus removal from wastewater treatment plants.

// WATER ENVIRONMENT RESEARCH FOUNDATION (WERF), NUTRIENT REMOVAL CHALLENGE. Principal investigator for WERF's five-year nutrient removal program, the largest and most comprehensive research program ever funded by WERF.

// CITY OF BOZEMAN, BOZEMAN WRF PHASE 1 EXPANSION & IMPROVEMENTS, BOZEMAN, MT. Provided process engineering during design of improvements to the Phase 1 water reclamation facility expansion and improvements, which included new aeration basin bioreactors for nutrient removal, ultraviolet disinfection.

// COEUR D'ALENE WASTEWATER FACILITY PLAN AND 4B/4C WASTEWATER TREATMENT PLANT EXPANSION, COEUR DALENE, ID. Prepared a facility plan for the 6 mgd wastewater treatment plant, which identified upgrade and expansion improvements, including biological nutrient removal (BNR). Modeling was performed using BioWin.

ERIC EVANS, PhD, PE
Process Design

Mr. Evans is a wastewater process engineer with HDR based in the Des Moines, Iowa, office. He has worked on nutrient treatment projects for both municipal and industrial systems using both biological and chemical treatment mechanisms. His experience includes designing chemical phosphorus removal systems and evaluating and modeling biological nutrient removal activated sludge systems. He conducted research into nitrification in trickling filters and activated sludge kinetics. During the past year, Mr. Evans has accrued experience working on a number of wastewater studies and designs. Additionally, he has more than 11 years of experience in wastewater treatment process modeling, which includes Biowin simulations.

YEARS EXPERIENCE
11

EDUCATION
PhD Environmental Engin.
MS Civil Engineering
BS Civil Engineering
Iowa State University

REGISTRATION
Professional Engineer
Iowa No. 19685

// METROPOLITAN COUNCIL, EMPIRE WASTEWATER TREATMENT PLANT EXPANSION, EMPIRE, MN. HDR was retained by the MCES to design the expansion of MCES' Empire Wastewater Treatment Plant from a 12 mgd two-stage nitrification plant to a 24 mgd biological nutrient removal (BNR) plant. Project elements included the replacement of septage receiving screening and grit removal facilities, additional primary clarifiers, expansion/modification of the aeration system and secondary clarifiers, 60 mgd influent pump station and a 60 mgd effluent pump station.

// WASTEWATER TREATMENT PLANT FACILITY PLAN, ELK RIVER, MN. Project involved a study and analysis of Elk River Wastewater Treatment Facility. Firm capacity of facility is to be upgraded from existing 2.2 MGD to 5.9 MGD in order to meet design demands for the projected 2025 population. A major component of this project involved upgrading the facility with a chemical phosphorus removal system to meet the new 1.0 mgP/L effluent discharge requirement imposed by Minnesota Pollution Control Agency (MPCA). A chemical feed system was added to the Headworks to allow for chemical precipitation of phosphorus and removal through settling. Multiple chemical feed injection ports were designed to allow for flexibility and to ensure adequate phosphorus removal. A separate chemical storage building was designed to house either ferric chloride or aluminum sulfate hydrate (alum).

PHIL SPITZER, PE
Biosolids / Odor Control

Phil Spitzer has 24 years of experience as a project engineer, project manager, and client service manager. He has experience as a project manager and designer on over 50 projects. His expertise includes wastewater collection, treatment and pumping facilities, plant rehabilitation, upgrades, and modernization of facilities. His experience ranges from developing wastewater master plans to construction-phase administration and startup. He has studied existing treatment systems for upgrading and modernization and has designed new facilities and improvements to existing plants, including odor control systems and wastewater residuals handling.

YEARS EXPERIENCE
24

EDUCATION
BS Biology
Kansas State University

BS Civil Engineering
Kansas State University

REGISTRATION
Professional Engineer
Oklahoma No. 22506

// WILSON CREEK WASTEWATER TREATMENT PLANT EXPANSION, NTMWD, WYLIE, TX. Project Manager. Managed the design and construction of a 16-mgd expansion to an existing 32-mgd wastewater treatment plant. The work included a new headworks for the entire plant, primary settling, biological nutrient removal for phosphorus and total nitrogen, secondary settling, effluent filtration, ultraviolet disinfection, and a new outfall pipe and structure. The solids processing included gravity belts for thickening waste activated sludge, belt filter presses for dewatering combined primary and waste activated sludge, and lime stabilization. At the time, it was the largest biological nutrient removal plant in Texas and had the most restrictive effluent limits. Effluent is discharged directly to Lavon Lake, a major drinking water source located in north Texas, to augment the water supply.

// CENTRAL REGIONAL WASTEWATER SYSTEM PHASE I & II SOLIDS IMPROVEMENTS, TRINITY RIVER AUTHORITY OF TEXAS. Project Manager. Managed design of improvements to the plant to increase capacity of the solids handling system. The improvements included one new primary sludge gravity thickener adapted to work with the existing four. Also included was a new thickened primary sludge pump station connected to the new sludge screens and screenings disposal system. The final portion consisted of two new three-meter gravity belt thickeners for secondary sludge with the associated polymer system and pumps.

ELLEN McDONALD, PhD, PE
Reuse Considerations

YEARS EXPERIENCE
25

EDUCATION
PhD, Water Resources Eng. Environmental Fluid Mechanics Stanford University

MS Water Resources Engin. Stanford University

BS Civil Engineering Bucknell University

REGISTRATION
Professional Engineer Oklahoma No. 25462

Ellen McDonald has a strong technical background and over 20 years of experience in water resources and water reuse planning, hydraulic and water quality evaluations, and water and wastewater system studies. Ellen leads APAI's water resources practice team and is committed to developing practical, innovative, and cost-effective solutions to meet the water resources needs of APAI's clients. She has managed or played a major role in the planning of a number of major water supply, water reuse, and water quality projects. This involvement has included data analysis, water quality modeling, hydraulic and hydrologic evaluations, development of supporting technical information required for water rights and water quality permitting, and as a facilitator for meetings with stakeholders and regulators. During the course of these projects, Ellen has worked closely with regulatory staff both in the areas of water supply and water quality.

// OKLAHOMA WATER REUSE STANDARDS DEVELOPMENT SUPPORT, ODEQ. Ellen served as a key technical resource to the ODEQ during development of nonpotable water reuse standards which went into effect July 1, 2012. As a member of the technical committee, Ellen assisted the team by providing information related to treatment and disinfection practices, appropriate uses, and operation, maintenance, and implementation issues. Ellen will be serving on the technical committee that will address rules for indirect potable reuse starting in August 2012.

// LAKE THUNDERBIRD WATER REUSE FEASIBILITY STUDY, COMCD. Ellen served as project manager for this endeavor, evaluating the feasibility of augmenting Lake Thunderbird with reclaimed water. This project, which is nearing completion, considered several augmentation options, both from the Norman and Moore wastewater treatment plants and from the effluent-dominated Canadian River. The study included evaluation of water quality impacts in Lake Thunderbird, development of water quality goals, and selection of treatment strategies to meet those goals. Life-cycle costs were developed and the water reuse alternatives were compared to other reservoir water supply alternatives, including Kaw Lake, Southeast Oklahoma water, and the proposed Scissortail Reservoir. The study was supported by a U.S. Bureau of Reclamation grant and meets the requirements of feasibility studies under the Bureau's Title XVI funding program.

SHARON MILLER, PE
Operations / Cost Estimating

YEARS EXPERIENCE
17

EDUCATION
MS, Environmental Engin. University of Nebraska

BS, Civil Engineering University of Nebraska

REGISTRATION
Professional Engineer, Oklahoma No. 23554

Ms. Miller's emphasis is on the design and construction of rehabilitation and expansion projects at wastewater treatment facilities and lift stations. She spent many years "hands-on" working at a wastewater treatment facility, giving her valuable experience in operations, maintenance, and troubleshooting that she applies to all of her projects. Ms. Miller serves as project manager /engineer on several projects, and her experience includes mechanical/process design, hydraulic design, construction services, and preparation of plans, specifications, cost estimates, and engineering reports.

// WMARRS CENTRAL WWTP CAPACITY EXPANSION AND IMPROVEMENTS, WACO, TX. HDR was hired to evaluate the treatment capacity of the WMARSS Central WWTP and to develop improvement recommendations to increase the permitted treatment capacity by approximately 8 MGD. HDR performed preliminary design service identifying a list of proposed improvement. The TCEQ approved the uprating of the Central WWTP based on the results of the preliminary engineering analysis. Improvements designed included Main Lift Station piping modifications, raising the headworks influent structure and replacing sluice gate operators, installing flow meters and VFD's to enable flow paced RAS pumping, automating aeration basin gate actuators and design of a Flow Equalization Basin to handle the peak flows anticipated at the plant.

// LICK CREEK WWTP IMPROVEMENTS, COLLEGE STATION, TX. Planning level evaluation of various plant improvements documented in a technical memorandum (TM) that includes the following: Modifications to the aeration system to improve dissolved oxygen (DO) control in the aeration basins, Modifications to the return activated sludge (RAS) system to improve sludge drawdown from the final clarifiers, improve pump control, improve RAS and waste activated sludge (WAS) metering and correct air-locking of the pumping system, Increase of storage capacity at the Aerated Sludge Holding Tank, including additional diffusers for mixing and improvements to the decant system, and interlocks at a centralized control panel, Installation or relocation of the following meters: RAS flow, WAS flow, DO, percent solids of RAS, and mixed liquor suspended solids (MLSS).