Section 17 – Water Reclamation Plans

Content

a. Status Report, Presentation, and Maps

Summary

In 2005 the City of Lubbock completed a Preliminary Engineering Report for improvements to the Southeast Water Reclamation Plant (SEWRP) that would enable the discontinuance of land application and enable stream discharge. Now in 2007 the City is near completing the Final Design for the proposed improvements.

Due to the size of the project and cost, it is proposed that the improvement projects be completed in three phases with Phase I beginning the first quarter of 2008. The first phase will upgrade and expand Plant #4 to 18 million gallons per day capacity for stream quality discharge plus nutrient removal. Plant #3 will be upgraded to stream quality discharge but not to nutrient removal. In addition there will be other improvements at the plant, like the improvements to the head works of the plant with improved screening facilities. These improvements will move the City a majority of the way towards the completion of its goal for stream quality reclaimed water. Phase 2 and Phase 3 will complete that process along with upgrading the solids handling equipment.

The proposed improvements to the SEWRP will take the City towards the option of using reclaimed water as a water source rather than as a problem to dispose of.

Office of Water Utilities

Report on progress for SEWRP proposed Improvements
Slide Presentation and Report by Larry Chapple of Black and Veatch
February 28, 2007

Larry Chapple, Project Manager for Black & Veatch, gave a report for water improvements for the Southeast Water Reclamation Plant (SEWRP). He indicated that the Black & Veatch Corporation is under contract to prepare final plans and specifications for improvements to the SEWRP in order to meet or exceed stream quality discharge standards. They began this project three years ago with the 2005 Preliminary Engineering Report (PER) for wastewater facility improvement needs.

To begin the update (showing slide #2) Larry said that this project was prompted because in the past most treated effluent was disposed of at one of two land application sites. This has created environmental concerns and other methods for effluent disposal must be pursued to allow the City to get away from this practice. As we look for other disposal methods it is important to note that Lubbock is a place where water is at a premium and solutions should have the flexibility to accommodate methods of beneficial reuse.

The PER evaluated different alternatives and methods of treatment while making use of existing facilities as much as possible with upgrades to newer technologies and presented a recommended plan. Based on recommended plan, design began to produce specifications and drawings to build these improvements. This is where we are at today.

Showing slide #3, the existing facility has three different treatment plants totaling 31.5 mgd capacity; plant 2 at 7 mgd, plant 3 at 13 mgd and plant 4 at about 11.5 mgd. What is unique about the SEWRP is that each facility uses a different type of treatment process. Each process produces a different level of effluent quality which poses challenges for staff in operating these facilities and where they can sent effluent from each facility.

Plant 2 has been taken offline as far as being used to treat water to the point that it's being discharged. Flow coming to the treatment plant currently is in the range of about 22-23 mgd. Plants 3 and 4 have the capacity to handle this flow.

Plants 2 and 3 basically can produce effluent that only allows disposal by using the land application program and this is at the lower end of acceptable method of effluent disposal. When plant 4 was built, it had the capability to produce an effluent quality suitable for discharge to the stream. The original reason for producing this higher quality effluent was to have a backup means of disposal, should they not be able to send water to the land application site. But with the environmental challenges at the land application sites, stream discharge of Plant 4 effluent to Outfall 001 has become more of a common practice. Treated effluent is also discharged at the power plant.

TCEQ will continue to raise the levels of quality that they require for treated effluent going to the streams. For design, we have established what we think will be a near-stream discharge permit criteria that TCEQ will be requiring. The main difference between the current discharge limits and the near future is the nutrient removal (nitrogen and phosphorus), which we see happening in many other surrounding communities as their new permits come up for renewal. Slide #5 shows technical numbers of the effluent quality used in design that we anticipate to be in the range of what will TCEQ require. This level of treatment has satisfied "indirect reuse" criteria for other locales in Texas for effluent reuse and places Lubbock in the position of having effluent quality that could go into some type of reuse. Certainly the idea of this wastewater effluent being used in conjunction with the Lake Alan Henry project is being considered which will complement the two projects.

Summary of PER findings (slide #6):

- Biological nutrient removal process (BNR) using aeration, with integrated fixed-film activated sludge (IFAS) is recommended. The other method uses chemicals and can result in less expensive capital cost but quickly becomes more expensive with all the chemicals required and method of sludge disposal.
- Abandon plant 2 which is a trickling filter plant and completely different from plants 3 & 4. Staff will have more consistency in performance with plants 3, 4.
- For Plant 4 disinfection, Ultraviolet (UV) is to be used instead of chlorine. Although chlorine is effective it also creates risk-management plan challenges due to the large volume required. Not using chlorine will also provide a better quality effluent that goes to the stream and reduces the risk of fish kills that could result from excess levels of chlorine entering the receiving stream. So one risk for permit violations for those issues goes away by using UV disinfection, a very common trend in Texas as well as throughout the U.S.
- Identified upgrades and improvements required to aging facilities (screen, filters, pump stations).
- The liquid treatment upgrades will not result in a significant increase in sludge quantities. Therefore the capacity of the existing solids facilities will not have to be increased. .

Summary of major improvements to SEWRP (slide #7):

- Upgrade plants 3 and 4 to BNR system with IFAS to remove nitrogen, phosphorus and other substances.
- Provide UV disinfection facilities.

- Rehabilitation of existing facilities will provide a more efficient method for pumping, treatment and maintenance concern including:
    1. New submersible pumps for influent PS and plant 4 intermediate lift station.
    2. New grit and fine screening equipment.
    3. New effluent filter system that would be used at both plants #3 and #4. .

Once the PER was finished there are basically five steps to get to construction as shown by slide #8:

1) Conceptual design is to make sure we know the systems and processes are those that we want to use. We use technical memos are used as part of the evaluation to determine whether there were certain improvements applicable for odor, de-watering grid and pump stations.
2) Value Engineering (VE) is an independent study to look at designs already prepared for economy, improvement and detail to get a quality project.
3) Spatial design which means start putting it on site sees how it fits and determining the best arrangement. This has been accomplished with staff.
4) Detail Design which is putting the actual drawings of the physical layouts and doing specifications work. This work is currently 2/3rds to 3/4ths of the way completed. On slide #8, the 2nd arrow on the chart shows Spatial and Detail Design for the influent pump station. Because of the challenges with the failure of the screw pumps, this part of the project had to be expedited during 2007. The drawings are ready and we hope to advertise this within the next few weeks so that construction can begin. If the screw pumps went offline there would be no way to get the water up to the treatment plants for the proper treatment, so this is a critical item.
5) Solids handling studies are not needed due to the production of additional solids. The need arises due to de-watering and odor evaluations in order to take a look at other technologies beside the current belt filter presses and the gravity belt thickeners. These are basically large belts where sludge is dropped onto to try to get water out of it and it's exposed to the atmosphere within the building itself. There can be fairly strong odors and corrosion issues related to that and there are other technologies out there to where the problems related can be removed. The de-watering technology also has the ability to produce much drier cake which can reduce landfill disposal costs since disposal is paid for by the weight of the sludge. So if you get the same volume drier you can move more solids out for the same weight.

TCEQ permitting: If we going to get away from land application we need to have the ability to put that water somewhere. Currently the permit allows 9mgd discharged to the stream that will need to be increased and we're currently working with the State on this.

On slide #9, the Value Engineering study (VE study) looked at most all processes with scrutiny. The major items of cost that came out of that:

- Replacement of IPS and plant 4 screw pumps with submersible was suggested and the failure of another screw pump prompted the need to make this change.

- There are two types of blowers that can be used to provide air and oxygen for biological nutrient removal processes. Single-stage blowers are more expensive but are efficient enough that on a present worth basis they are more cost-effective than multi-stage blowers. However, at the VE team pointed out, as a capital cost savings measure you could purchase a multi-stage as a backup blower. By using the less expensive type of blower as a backup the City won't spend as much in capital dollars but still gain the cost benefits of the efficiencies of main blowers that are used all the time.

Result of these suggestions: Net increase because of pump stations going to a different kind of facility that is better but is a higher cost. Reliability of the new pumping system justifies these recommendations.

Tom Adams commented that the screw pumps are from Europe and when there are failures there will not be repair parts and service nearby. This is a critical issue because if the screw pump isn't working then you don't get the water lifted and the plant doesn't run and spills and major problems will follow. Going to submersible at the front end allows for local parts and service and the reliability is significantly improved. Staff supports this change.

Larry said (showing slide #10) the total project cost for the PER was about $75 million including a 25% contingency and also includes ELA factor, engineering legal administration factor, at 20%. That is to cover whatever the engineering costs are but also if there are associated costs of legal fees or administrative costs that are independent of engineering. This approach has been done for planning purposes to consider not just construction costs but all costs that are involved in a project. One factor significantly impacting cost since the report was put together in July 2005 is the impact of Katrina which occurred after the report was completed. Since that time construction prices have increased throughout the country as a result. Larry indicated that cost increases due to Katrina have been in the 15-20% range for other projects.

The other thing he pointed out was that they have maintained the 25% contingency to date even though their design is well along and the contingency could be reduced. Contingency amounts are included at the start of design to They will look at the market for bid competition and will determine whether this contingency can be reduced. The contingency also covers design changes, enhancements and potential construction occurrences. There are often surprises in construction improvements. At final design, the percent contingency will be reviewed and the price may go down. This is main cost going from the PER to where we are today.

As we progress through design, there may be additional things staff identifies as they go along to be included in the work. For example, you might have to add another facility for temporary power. Experience is that this has been what happens. Tom Adams said staff was actively involved in the VE process and also through regular meetings with Black & Veatch, have had opportunity to continuously review the design and they are hoping most

of the unknowns have been identified so the contingency now is more of a protection. This is a safety factor for planning purposes.

Larry indicated that another reason for the contingency to that there are projects where you never know until bid day how many bidders will bid the project, which impacts how bidders will price the project. The same project bid one year versus another year could be 25-30% difference in cost due to bidders' position.

Change orders are another factor that is considered in establishing contingency. Larry indicated that Black & Veatch's history has been changes are much less than 5% over projected cost estimates and are usually less than 2%. The contingency amount is should protect market conditions and unknowns coming up through design. If change orders occur then something wasn't on the existing drawings. It's not a contingency to cover change orders.

Dale Cherry discussed the practice of having a contingency, and mentioned that the Corps of Engineers has a policy of a 5% contingency at the time of award of contract. He agreed with Larry that their company's history is less than 5% for bids that come in over estimates. Dale mentioned concerns about the price escalations for cost of copper, aluminum, stainless steel, etc. He indicated that it has stabilized somewhat from what it was a year ago, but they put in a 7% and as high as 9% in their estimates to try to allow for cost escalation for materials and labor to the mid-point of construction. This construction estimated is a 42-month construction period and they've allowed that 7-9% to midpoint of construction just for material and labor escalations that may or may not be there. He indicated that the 25% contingency will come down. He indicated that a 10% contingency might be sufficient at this time.

The other notable cost increase is for new solids rehabilitation improvements. Rehabilitation and upgrades of solids handling facilities were not part of what was studied in the PER. This is because the primary focus of the study was to develop methods to upgrade the liquid treatment to move away from land application of effluent. From preliminary tech memos, a budget-level cost of what those improvements may need to be was done. These are reflected in the costs presented. As work moves through conceptual and detailed design, these costs can be better defined.

Dale Cherry said he expected 3 hard bids, Archer Western being one of them, maybe Barr Constructors they see quite often on their projects as well as Cajun here locally. Then Dale said there may be some 4th party which is out of state contractor who may be exploring. He said we don't want 2 bidders and they've seen that recently since there's a lot of work now with pipelines and plant work. Larry Chapple said he guessed for the actual construction package between $45 and $50 million, so that should attract construction companies. Archer Western just finished up 3 big projects for them at Wilson Creek, Fayetteville and Bartlesville. They've been working in all those areas and they know our work and like what they see in their drawings quality, they can count on it being reliable and that helps tremendously with change orders.

Larry said new TCEQ regulations do impact plant design, but not this project in their opinion. The biggest issue they've seen in those regulations has been the wet weather or the Peak 2-hour condition. He indicated that this generally impacts the size or number of clarifiers at a plant. He also indicated that there are other options like holding facilities that can allow wastewater stored until it can be treated later when the flow decreases. Our suggestion is to see what shakes out on enforcement before deciding what needs to be done. The improvements we're doing is staying with the same hydraulic capacity, we're just improving the quality. Also there is an ongoing study with the collection system. This will give the City more information about what the peak 2-hr flow might be. He indicated that it might be better to use historical information to make a case for lowering the regulations if they are adopted. He said this is an arid area with very little rain, that peaking factor is not nearly as common, not nearly as severe as further east closer to the gulf with their peaking factors. Larry said that places in the Kansas City area have a 9 to 1 peak to average ratio. Before spending a tremendous amount of money on clarifiers, it might be better to take a position on this requirement and perhaps point out why it may not be applicable. This requirement would impact the headworks facilities as well. Your head works pump station does not have the peak to average capacity to handle what TCEQ is proposing. A whole new facility of pumping, screenings, etc. would be required to comply with this requirement. This would be a significant impact.

Larry said the regulations are trying to address the fact that during wet weather events, many treatment plant experience really high peak flow rates that TCEQ regulations do not cover. Peak flows occur when water other than sewage enters the collection system. This additional water is defined as infiltration or inflow of water, and is commonly combined and defined as I&I (infiltration and inflow). Larry said that Lubbock, like much of west Texas, is more arid that other Texas communities where they experience heavier rainfalls and resulting inflow or have pipelines that are constructed below groundwater tables where water can continually seep in through existing cracks and breaks in the sewer line. What the EPA and State are basically saying is that if it gets in your system you have to treat it and that's the bottom line. TCEQ with the new regulation is indicating that to protect your system you must account for peak flows that are 3 to 4 times the average plant flow. Dale Cherry added that they are encouraging cities to tighten up their collection system and keep the rainwater, storm water getting in and having to run it through collection water. Larry indicated that design of the SEWRP facilities are basin on a peaking factor of 2.

Referring to slides #11-14 Larry said they've worked to identify phasing the construction with the intent to get as much value for the dollar in this first phase without having to spend the entire amount of money and then look at when we would actually have to do the other improvements in subsequent phases. Phase I would include adding the 3rd train (additional capacity) to plant 4 and that replaces plant #2's hydraulic capacity with a higher quality effluent. Plant #4 would be upgraded to do the nutrient removal with a capacity of 18 mgd. UV treatment and new filtration would be added to both plants #3 and #4. Most of the flow can be safely discharged to the stream with continued use by

the power plant. As a result, very little if any would need to go to the land application sites.

In the second phase, they would look at the solids handling. This part may be necessary before finishing the upgrades on plant #3. This project would include replacing existing facilities with new centrifuges, new thickening facilities that will reduce the odors as well as produce a drier sludge for disposal. The 3rd Phase would complete improvements to Plant #3 for nutrient removal quality effluent.

Larry indicated that the IFAS technology is in use by other cities and that there is no replacement of the media anticipated. The plastic media stays there and you may add a little more but with no major impact. He confirmed that the plastic media is an inert substance, and said it's basically a hotel for the bugs in the wastewater that break down the BOD. He also confirmed that the IFAS media is manufactured in U.S.

Larry said operators of other IFAS facilities give provide a positive report on the IFAS and that the Lubbock staff visited a facility in Colorado. That plant has required no replacement since start up per Larry and this is a European technology that works with compact designs.

Larry again stated that the proposed technology would meet regulations and is a good start for producing a quality of effluent that can be used for beneficial re-use. Depending on the type of re-use higher levels of treatment might be required. As an example, groundwater injection in Chandler Arizona requires reverse osmosis level of treatment. He indicated that for Lubbock this level of treatment should only be completed on an "as needed" basis for the desired use and only for the water that is dedicated to that use. The location of this type of treatment would not likely fit at the SEWRP due to spacing considerations.

Larry indicated that the PER did not include the $21 million for improving the solid handling facilities. Mary Gonzales indicated that the solids equipment is already about 14 to 15 years old, and that the useful life of the equipment is limited.

Larry indicated that the infrastructure has a long life span, and that some plans are as much as 100 years old. Larry indicated that the facility should address growth issues until about 2030. It was indicated that design for expansion may be necessary prior to that date to assure that the facilities are there for growth beyond 2030. Except for maintenance on pumps and other items that wear out, the plant should operate without any major expenditures.

Larry said maybe he could help with some numbers to put in perspective how much of the cost is for liquid treatment process upgrades and how much is for plant rehabilitation. Of the $105 million in liquid improvements, approximately $30-$35 million is rehabbing existing facilities and has nothing to do with the proposed quality improvements. He also indicated that he would classify the solids as a rehab and that project will cost about $21 million. So of that $125 million we're talking about $56 million of that is rehab.

Now, to look at the liquid treatment upgrade for proposed quality improvements, the remainder of that is $69 million. Of this, the additional train for plant #4 will cost between $15 and $20 million for 6 mgd. The cost for rehabilitation, upgrading and expanding the liquid treatment side is about $2.5 to $3 per gallon. That's pretty inexpensive compared to today's cost for new facilities. A new plant site could be in the range of $5, $6, or $7 a gallon with the solids handling added in as well.

Larry said indicated that an additional pipeline would be necessary to discharge at the current permitted site called outfall 001. 14 miles of pipeline for this purpose could cost between $24 to $30 million. This project is not included in the proposed projects. Larry said that the modeling now under way would provide for discharge at or near the SEWRP and reduce pipeline and pumping costs. Tom Adams indicated we can discharge up to 9 mgd at the current discharge location, and that if we can discharge 10-12 mgd at the plant then a new pipeline would not be necessary at this time. As an alternative, a shorter pipeline might be possible using the existing system for about half of the distance.

Larry also mentioned that in the future there might be even tighter limits on phosphorus. To reduce phosphorus even more will require some chemical treatment. The plant is being designed with the option of some chemical treatment in order to provide a guarantee for water quality and provide a system that can help reduce phosphorus levels should regulations required lower levels.

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Water Resources Improvements Project at SEWRP

LWAC Briefing – February 28, 2007

Project No. 140092

Presented by Larry Chapple, Project Manager B&V

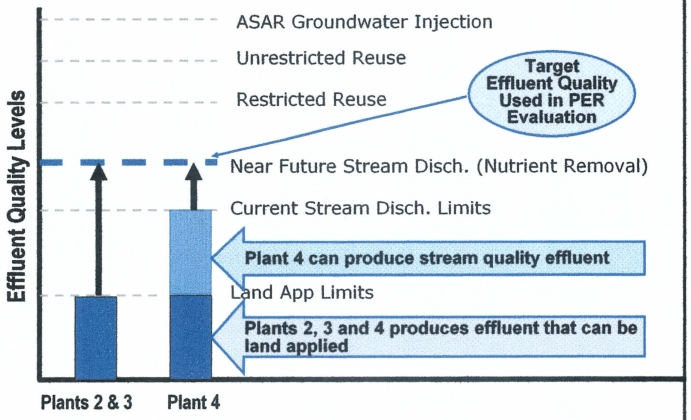
Parkhill, Smith & Cooper, Inc.
Engineers . Architects . Planners

Water Resources Improvements

- Purpose of project:
  To implement liquid treatment improvements at the SEWRP to produce an effluent suitable to move away from land application disposal – an immediate need.
- Improvements would have flexibility to add processes to produce higher effluent quality for future reuse - long term need.
- Major tasks include:
  - 2005 Preliminary Engineering Report (PER).
  - Design to prepare specs and drawings to construct PER recommended improvements.

Existing SEWRP Facility
Three Separate Plants 31.5 mgd Capacity

Existing Effluent Quality



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PER Evaluation - Treatment Capacity and Effluent Quality Design Criteria Used

- Capacity = 31.5 mgd (Projected Year 2030 flow)
- Effluent quality:
  - BOD conc < 5 mg/L
  - TSS conc < 5 mg/L
  - Total Nitrogen < 8 mg/L
  - Phosphorus < 1 mg/L

Meets Anticipated Near Future TCEQ Stream Discharge Limits

- *This level of treatment has met "indirect reuse" criteria for other locales in Texas*

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PER Findings

- Biological Nutrient Removal (BNR) w/ Integrated Fixed Film Activated Sludge (IFAS) media Was best liquid treatment solution

- Abandon Plant 2 and upgrade Plants 3 and 4 w/ BNR process.
- Switch from Chlorine to UV disinfection
- Identified upgrades and improvements required to aging facilities (screens, filters, pump stations)
- *Projected solids produced from the liquid treatment improvements are within capacity of existing solids equipment*

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Major Improvements to SEWRP Include:

- Upgrade Plants 3 and 4 to Biological Nutrient Removal (BNR) system with Integrated Fixed Film Activated Sludge Media (IFAS) to remove nitrogen and phosphorus
- Provide ultraviolet (UV) disinfection facilities
- Rehabilitation of existing facilities including:
  - New submersible pumps for influent PS and Plant 4 intermediate lift station
  - New grid and screenings equipment
  - New effluent filter system at Plant 4

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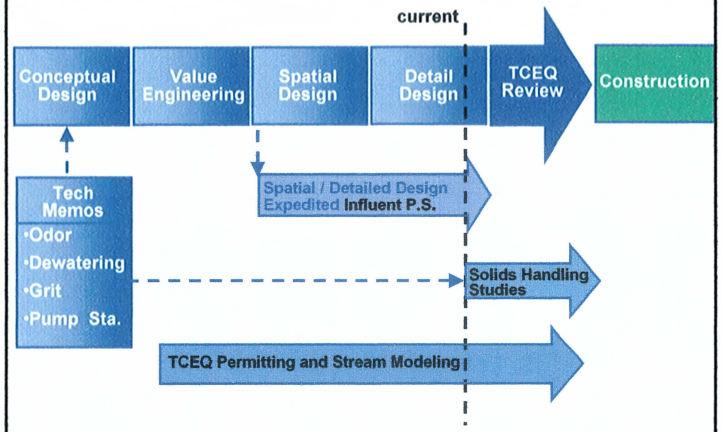
Steps Since Preliminary Engineering Report



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Independent Value Engineering Study by HDR

- Purpose - Independent view of design to identify any value-added enhancements to the project
- Concepts accepted with modifications
  - Replace influent PS and Plant 4 LS screw pumps with submersible pumps
  - Use multi-stage blowers for back up to single stage blowers.
  - Eliminate new Plant 3 LS
- Resulted in a net increase ($1.7M) in project cost but provided improved reliability of pumping

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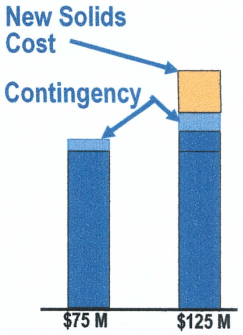
Total Project Costs in PER Have Escalated



Total Project Cost Plants 3 and 4

- Factors
  - Escalation since PER (2005 $) post Katrina
  - Design enhancements from VE study and value added design
  - New $21M solids handling improvements identified
  - Maintained 25% contingency to date

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Phased Construction Improvements

- To spread cost out over time but maximize early benefits; the project was divided into three phases:
  - Expedited Influent Lift Station ($3 Million)
  - Phase 1 ($66 Million) – Add 3rd train to Plant 4, with BNR UV treatment, add new filtration and UV to Plant 3 and rehab existing facilities
  - Phase 2 (new - $21 Million) – Rehab solids thickening / dewatering
  - Phase 3 ($35 Million) – Plant 3 conversions to BNR with IFAS

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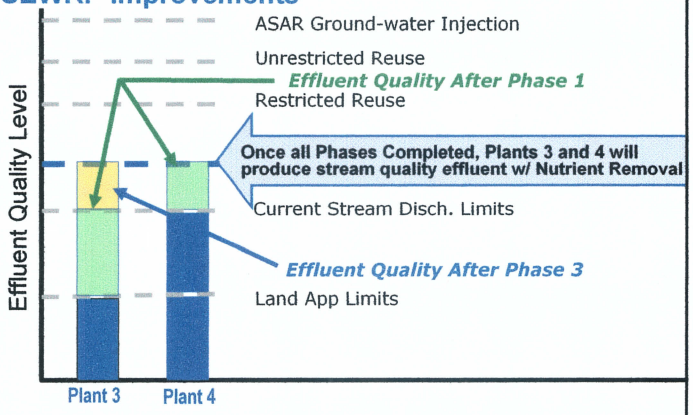
Effluent Quality After Phased Construction of SEWRP Improvements



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Phased Construction - Benefits as you Build

Phase 1 – 2008 Start	Phase 2 – 2001 Start	Phase 3 – 2012 Start
Can Send 18 mgd of Effluent to Stream Discharge and Potential Indirect Re-use. Abandon Plant 2 Upgrade Plant 3 Effluent to Current Stream Quality and send to Power Plant. Significantly Reduce Land Application Disposal. Maximum between 2-6 mgd of Higher Quality Effluent.	Rehabilitate or Replace Existing Solids Thickening and Dewatering Facilities. Produce a drier sludge which will reduce cost for disposal. Significantly reduces the odor and corrosion problems being experienced in Solids Building	Deferring Until later Allows City to Spread Out Project Cost and Rate Impact Over a Number of Years. Will Be Able to Move Completely Away From the Land Application Program.
Plant 4 upgrade and facility rehab **Cost: $66 Million**	**Solids Improvements (new)** **Cost: $21 Million** **New cost not in PER**	**Plant 3 Upgrade** **Cost: $35 Million**

★ Influent Lift Station Improvements Cost $3 Million Complete 2007

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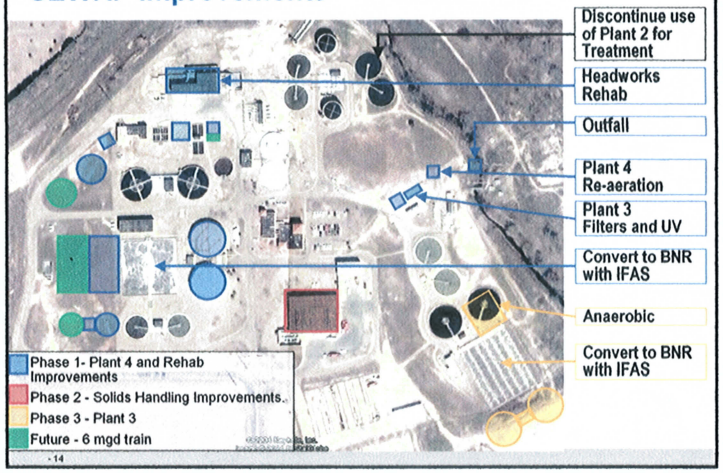
SEWRP Improvements



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TCEQ Permitting – Need to Revise Permit to Discharge More Effluent to the Stream

- To move away from land application need to discharge more flow to the stream.
- Current permit allows 9.0 mgd to be discharged to existing outfall 001 (14 miles from SEWRP).
- Building a New 14 mile pipeline to 001 would cost $24 to $30 million.
- City pursuing new 7 mile extension of existing pipeline to 001 to reduce cost.
- City also pursuing discharge points closer to SEWRP.

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We Thank the Staff for Their Participation Throughout the Project

- Vision and Leadership for the Project
- Monthly progress meeting workshops have been occurring throughout design
  - Staff participation and input has been invaluable to assure that the project is providing them what they need to produce quality effluent
- Visiting other facilities
  - Staff has made trips to other facilities to view processes and technologies that are new to them but necessary to meet new effluent criteria

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PSC Parkhill, Smith & Cooper, Inc. Engineers . Architects . Planners

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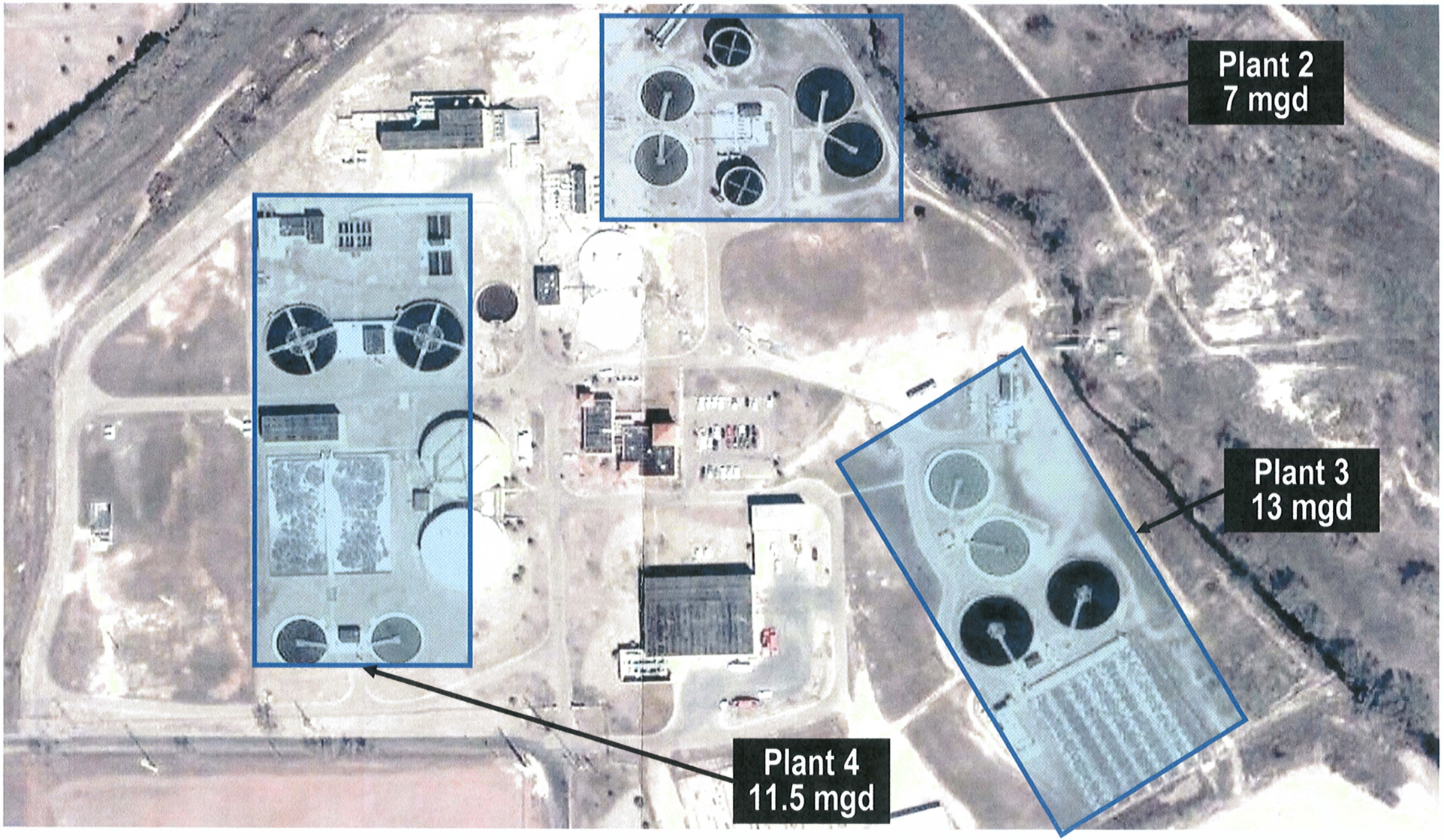
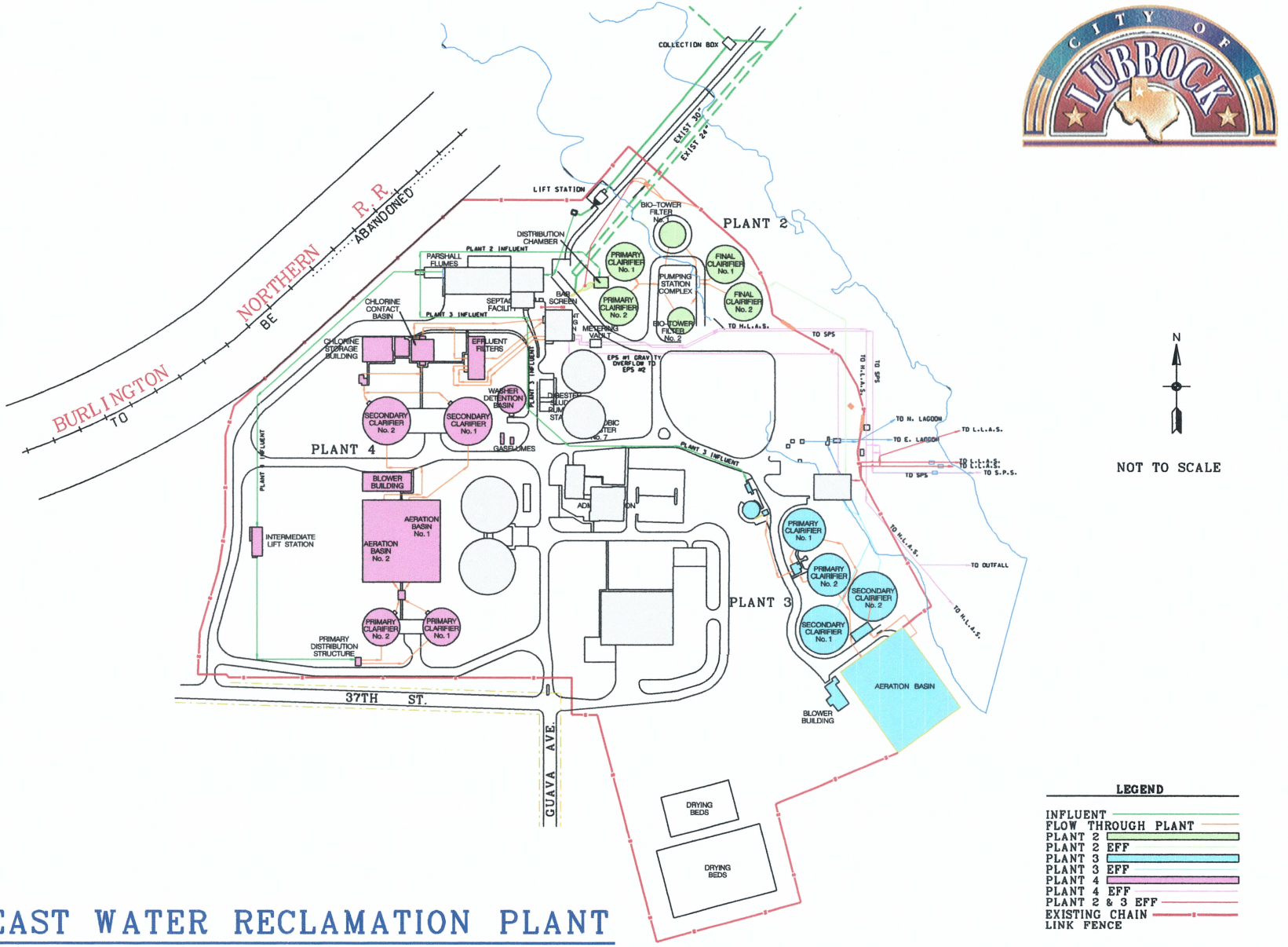
QUESTIONS ?

CITY OF LUBBOCK

Existing SEWRP Facility
Three Separate Plants 31.5 mgd





SOUTHEAST WATER RECLAMATION PLANT

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