February 16, 2022

City of Fair Oaks Ranch
Wastewater Treatment Plant (WWTP) Study

CITY COUNCIL WORKSHOP – COMPREHENSIVE REPORT

GARVER

CITY OF FAIR OAKS RANCH • TEXAS

The goal of today's meeting is to present the findings of the City of Fair Oaks Ranch WWTP Study Draft Comprehensive Report.

No actions or decisions will be requested tonight.

- Review the project progress
- Review the Option 1 recommendations
- Review the recommended capacity improvements and rehab recommendations
- Discuss the WWTP Effluent Golf Couse Study
- Discuss project phasing alternatives
- Discuss updated opinion of probable costs
- Discuss Environmental Desktop Review findings
- Discuss project next steps
- Discussion and Q/A

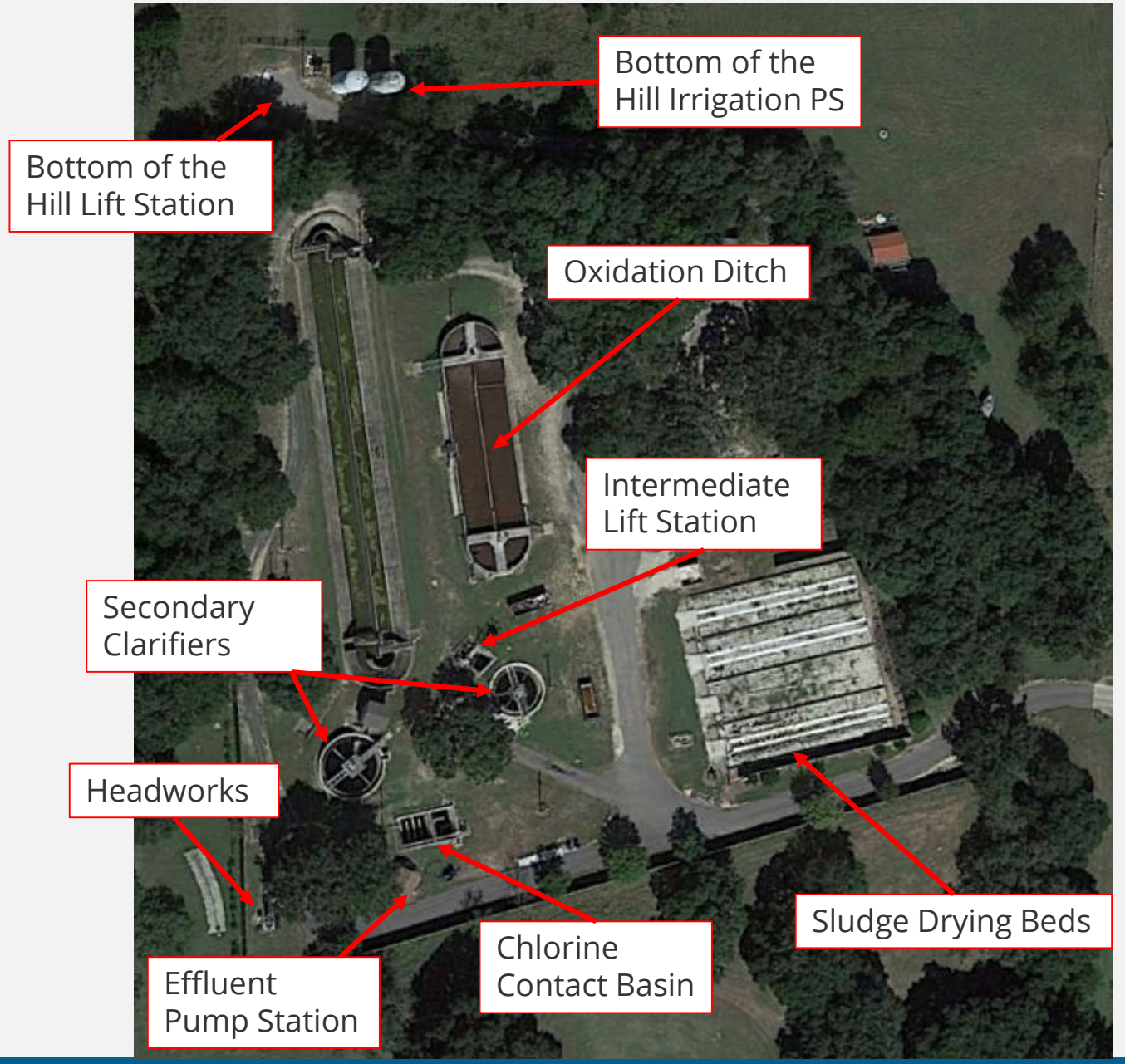
First, we will review the project progress status.

The goal of the Comprehensive Report (TM3) is to summarize all the findings and recommendations of this study

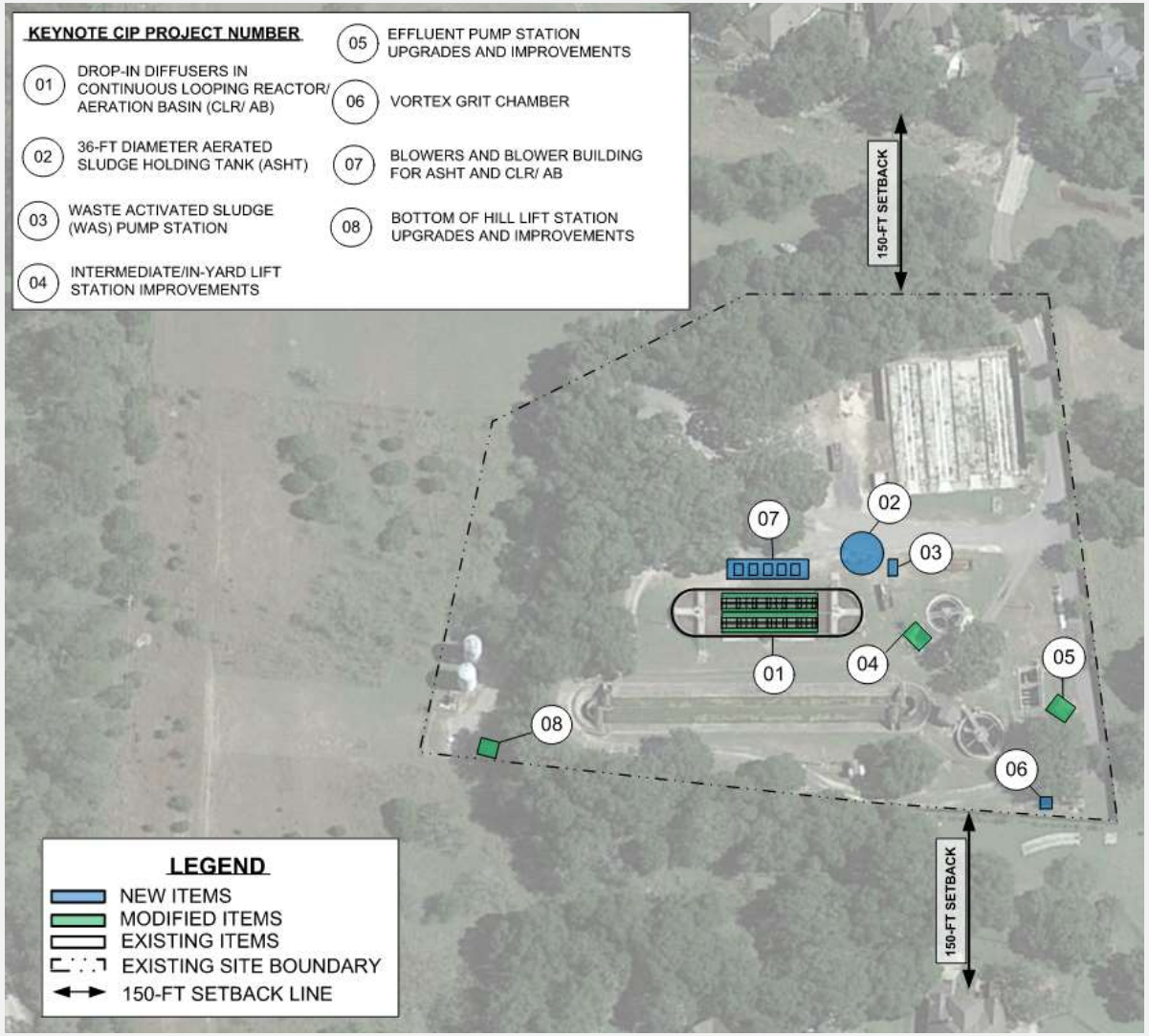
To date, Garver has performed the following as part of this study:

- Review of the previous Master Plan
  - Review land development plans
- Perform a condition assessment of the existing facility
- Develop flow and load projections for the WWTP
- Evaluated 5 options to develop a path forward to meet future needs

The figure to the right shows the layout of the existing Fair Oaks Ranch WWTP



Garver presented the TM 1 and TM 2 findings to City Council on 11/3/22. Garver was given the notice from the City to continue evaluating Option 1 on 11/18/22



Option 1 evaluated the feasibility of improving the current WWTP capacity to 0.5 MGD

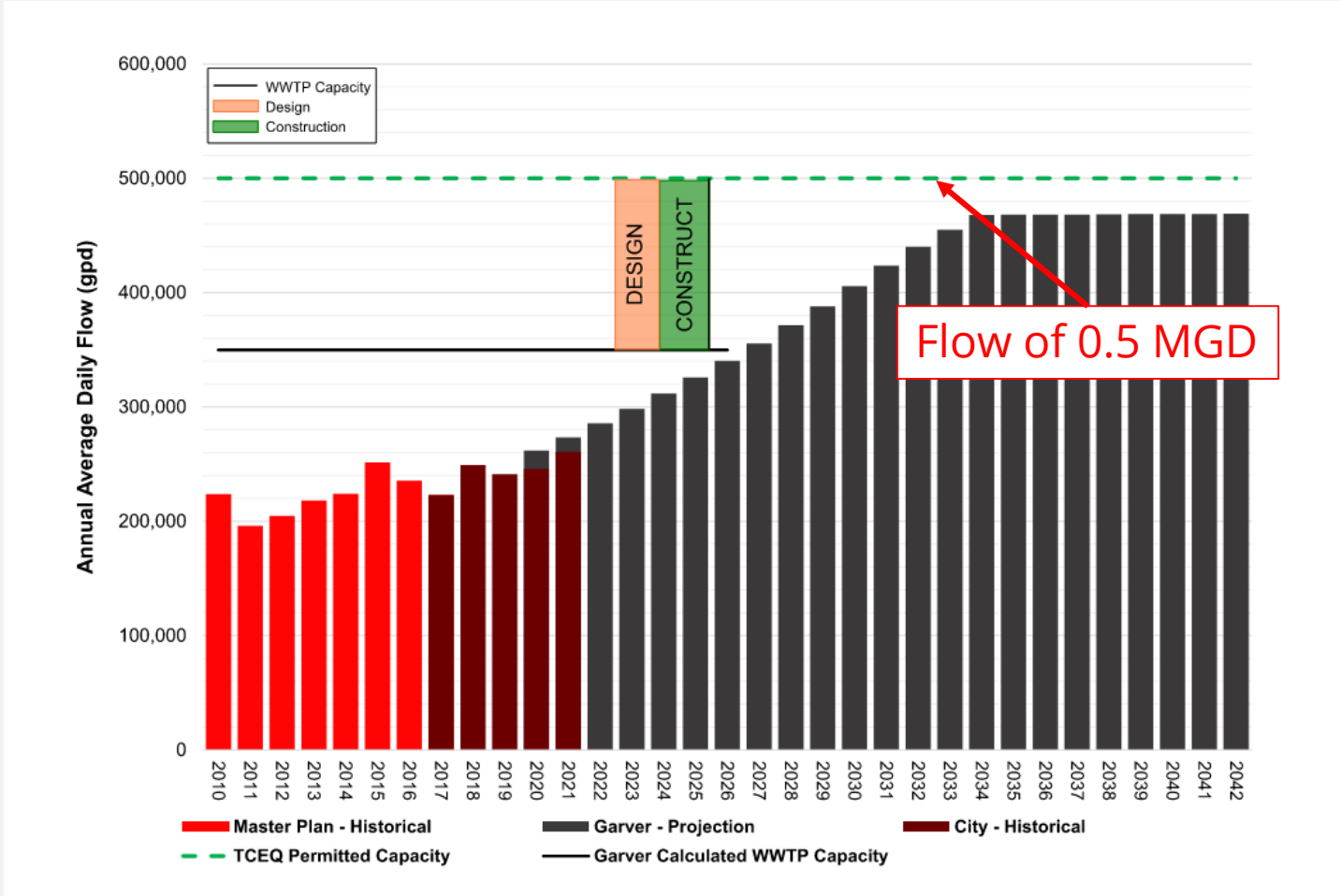
The comprehensive report builds on the previous reports by:

- Investigating the infrastructure required to meet the projected flows and loads
- Refining unit sizing and placement
  - Consider buffer zone requirements
  - Update preliminary cost estimates
  - Evaluate project phasing
- Performing a desktop environmental review of the project area

Next, we will discuss selected Option 1: Improvements to the existing WWTP.

Option 1 - Expansion at the City's existing WWTP site to meet 100% of the projected required capacity.

- The existing WWTP has the space for additional facilities
- This option considers the restoration of the current permitted capacity of **0.5 MGD**
- Improvements include:
  - Improvements to the effluent pump station
  - Upgrade effluent 8-in pipe to 12-in
  - Retrievable fine bubble diffusers
  - Addition of grit removal
  - New aerated sludge hold tank (ASHT)
  - Rehab/optimization of existing units



Upgrading the effluent pump station will improve operability and conveyance

- The existing effluent pumps are not rated to handle Peak 2-hr Flow
  - Reconfigure the effluent PS valves to allow the WWTP to discharge to multiple locations (ie. Blackjack and Live Oak Ponds simultaneously)
  - 120 feet head required at 1,200 gpm based on hydraulic calculations
- 3 new pumps rated at 610 gpm/each, 25 hp each to meet Peak 2-hr Flow

Design Criteria for Effluent Pump Station

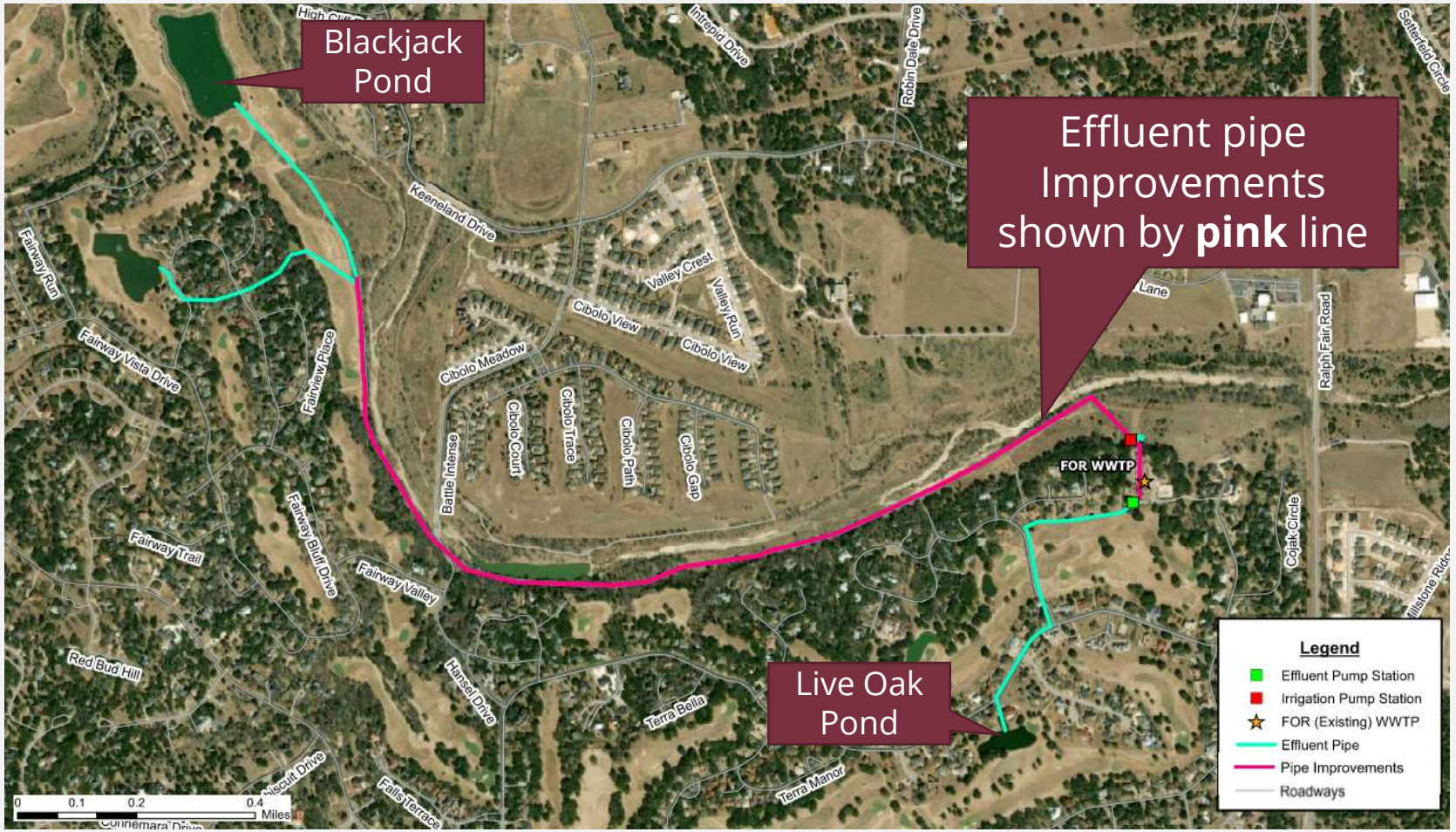
Criteria	Effluent Pump Station
No. of Pumps	3 (2 duty, 1 standby)
Flow, ea.	610 gpm
Power, ea.	25 hp

Upsizing the effluent pipes to the Blackjack Pond will improve flow, energy, and operability

- Existing piping is 8 in. diameter
- Recommend upsizing to 12 in. pipe
  - Pipe sizing coordinated with pump sizing
  - Reduce velocities at P2HF

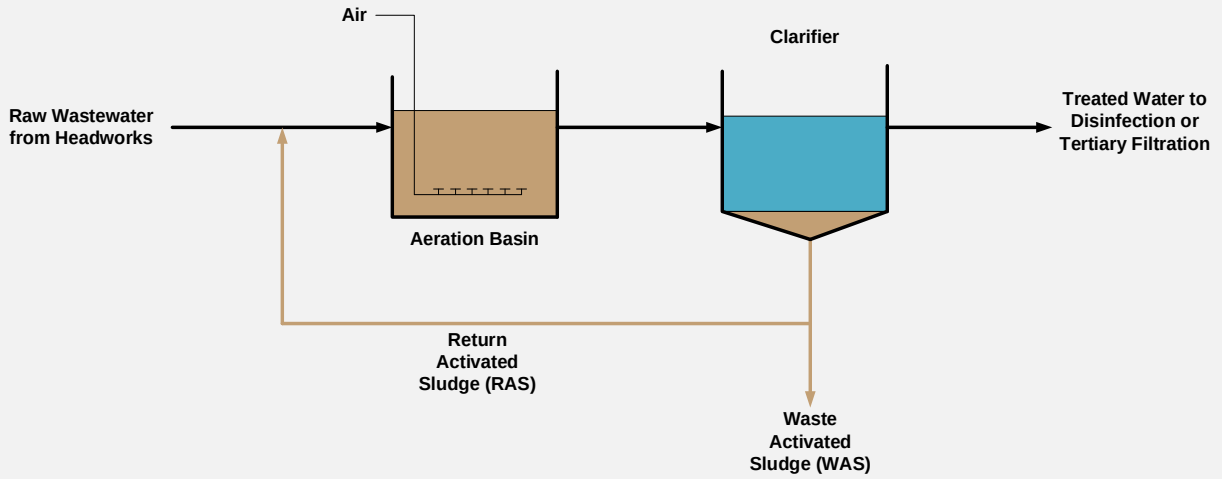
Design Criteria for Effluent Pipe

Criteria	Value
Pipe Diameter, in.	12
Pipe Length, ft	~8,700



Upgrading the existing oxidation ditch process will allow it to handle higher BOD loads

- Conventional activated sludge process provides more organic removal
- Conversion occurs by updating the existing aeration system to retrievable fine bubble diffusers
- Benefits of conversion:
  - Improved energy efficiency
  - Flexibility meeting redundancy TCEQ requirements (ability to remove diffusers)
  - Continue to produce high quality effluent



Converting the existing oxidation ditch involves installing retrievable fine bubble diffusers to replace the current surface aerators as the primary means of aeration

- Existing basin structure make retrievable (drop-in) diffusers the most feasible alternative

Design Criteria for Retrievable Diffusers

Criteria	Value
Submergence, ft	7
Air Rate, scfm	~2,400
No. of Grids	8
No. of Diffusers per Grid	~186
Total No. of Operating Diffusers	~1,488

Multistage centrifugal blowers and fine bubble diffusers will improve oxygen transfer and turndown efficiency

- Multistage blowers are designed to deliver air to diffusers through high-speed rotating impeller
- Blowers should be located adjacent to existing oxidation ditch in proposed blower building
  - Building will also be used to house ASHT blowers
  - An enclosure will protect equipment and reduce noise

Design Criteria for Aeration Blowers

Criteria	Value
Blower Type	Multistage centrifugal
No. of Blowers	3 (2 duty, 1 standby)
Air Flow, scfm	~1,200
Motor Horsepower, hp	40
Blower Mechanical Efficiency	65-80%
Gauge Pressure, psig	~3.9

The implementation of an aeration basin system would be complemented with the addition of an upstream vortex grit removal system

- Vortex grit removal relies on settling as primary means of grit removal and has a high percentage of grit removal
- Improve efficiency of aeration basin by reducing formation of heavy deposits
- Protection of downstream mechanical equipment from abnormal wear

Design Criteria for Vortex Grit Removal

Criteria	Value
No. of Vortex Grit Units	1
No. of Grit Classifiers	1
No. of Grit Concentrators	1
No. of Grit Washers	1

Constructing an aerated sludge holding tank (ASHT) for temporary sludge storage will increase operational flexibility

- The aeration basin retrofit is projected to produce approximately 24,000 gal/day of waste activated sludge at design max month flow
- ASHTs provide a reduction in odors produced from digesting sludge
- ASHT design criteria is coordinated with the Sludge Press (currently being installed)
- An ASHT will meet 30 TAC 217.250(c)(4)(A)
  - Allows for intermittent operation

Design Criteria for Aerated Sludge Holding Tank

Criteria	Value
Volume, gallons	80,000
Volume, cubic feet	10,700
Dimensions, Dia. x H (ft.)	28 x 18
Days of storage	~3.3
No. of Blowers	2(1 duty,1 standby)
Air Flow, scfm	~214
Motor Horsepower, hp	20

The condition assessment revealed two facilities that had a medium risk classification that could be improved to add a layer of redundancy and resiliency

Intermediate (in-yard) Lift Station

- Received a risk classification of medium
- This facility cannot be offline for a long duration
- Upgrade pumps and add a third pump for flexibility and resiliency
- Proposed pump sizing is based on peaking factor of 3.5

Bottom of the Hill Lift Station

- Received a risk classification of medium
- Lack of redundancy and inability to be offline for a long duration
- Proposed pump sizing is based on peaking factor of 3.5

Design Criteria for Intermediate LS and Bottom of Hill LS

Criteria	Intermediate Lift Station	Bottom of Hill Lift Station
No. of Pumps	3 (2 duty, 1 standby)	2 (1 duty, 1 standby)
Flow, ea.	610 gpm	1,215 gpm

The City indicated issues with the blending of the effluent discharged from the WWTP to the golf course and the potable water purchased by the golf course

- Under the current Texas Land Application Permit (TLAP), the City is authorized to dispose their treated wastewater effluent at a daily average flow not to exceed 0.5 MGD via surface irrigation on the 280-acre Fair Oaks Ranch Golf and Country Club
- The treated effluent from the WWTP is being combined with the potable water purchased by the golf course. The combined storage pond water is then land applied for irrigation purposes
- The TCEQ views this application of the combined water in the storage pond which contains components of WWTP effluent and the purchased potable water on the golf course counting toward the 2.0 acre-ft/acre permitted application rate limit
- This has effectively increased the volume of effluent being applied for irrigation purposes
- The current application rates might be reconsidered by the TCEQ if the City pursued a minor permit amendment, but an amendment may affect the permit itself by reclassifying it under the TCEQ Chapter 210 rules since the City is applying the effluent on public accessible land
- City Staff has requested guidance from TCEQ on what corrective action, if any, is needed

If necessary, after guidance from TCEQ, Garver recommends that the City perform a study that identifies solutions to rectify the application rate issue

At a high level, this study should consider the following:

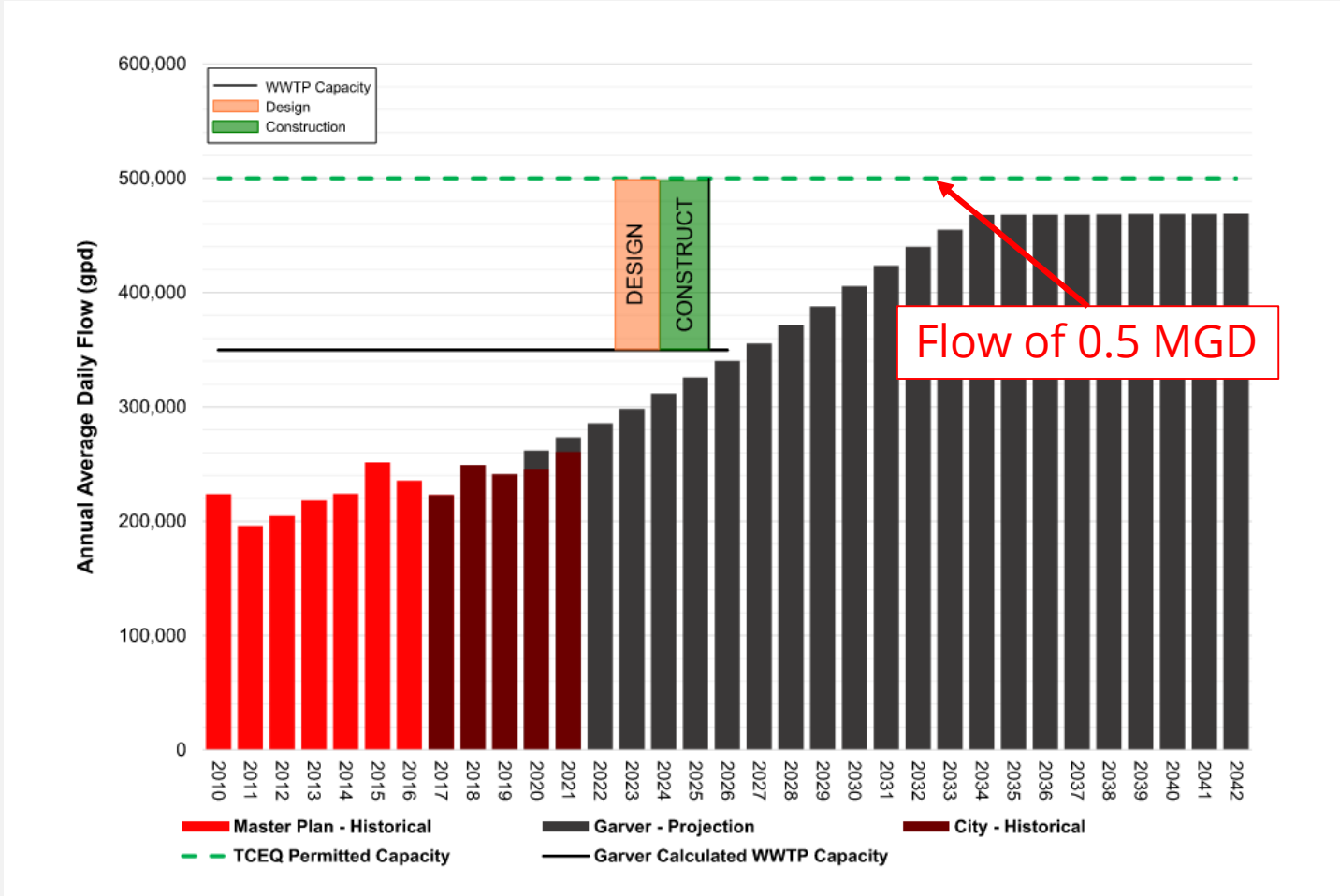
- Meet criteria the TCEQ Chapter 210 requirements
  - Coordinate with the Golf Course
    - Evaluate the Golf Course Storage infrastructure (pond liners, soil embankment, wall slope)
  - Evaluate the WWTP for compliance for TCEQ Chapter 210
- Assess Golf Course storage needs and capacity
  - Reassess the available application area
  - Assess the expected nutrient uptake of the vegetation
  - Confirm the existing soil type/depth
  - Determine the target slope to avoid oversaturation and runoff
- Coordinate with other TCEQ Depts. (ie. permitting)

Next, we will discuss project phasing alternatives and updates to the OPCC.

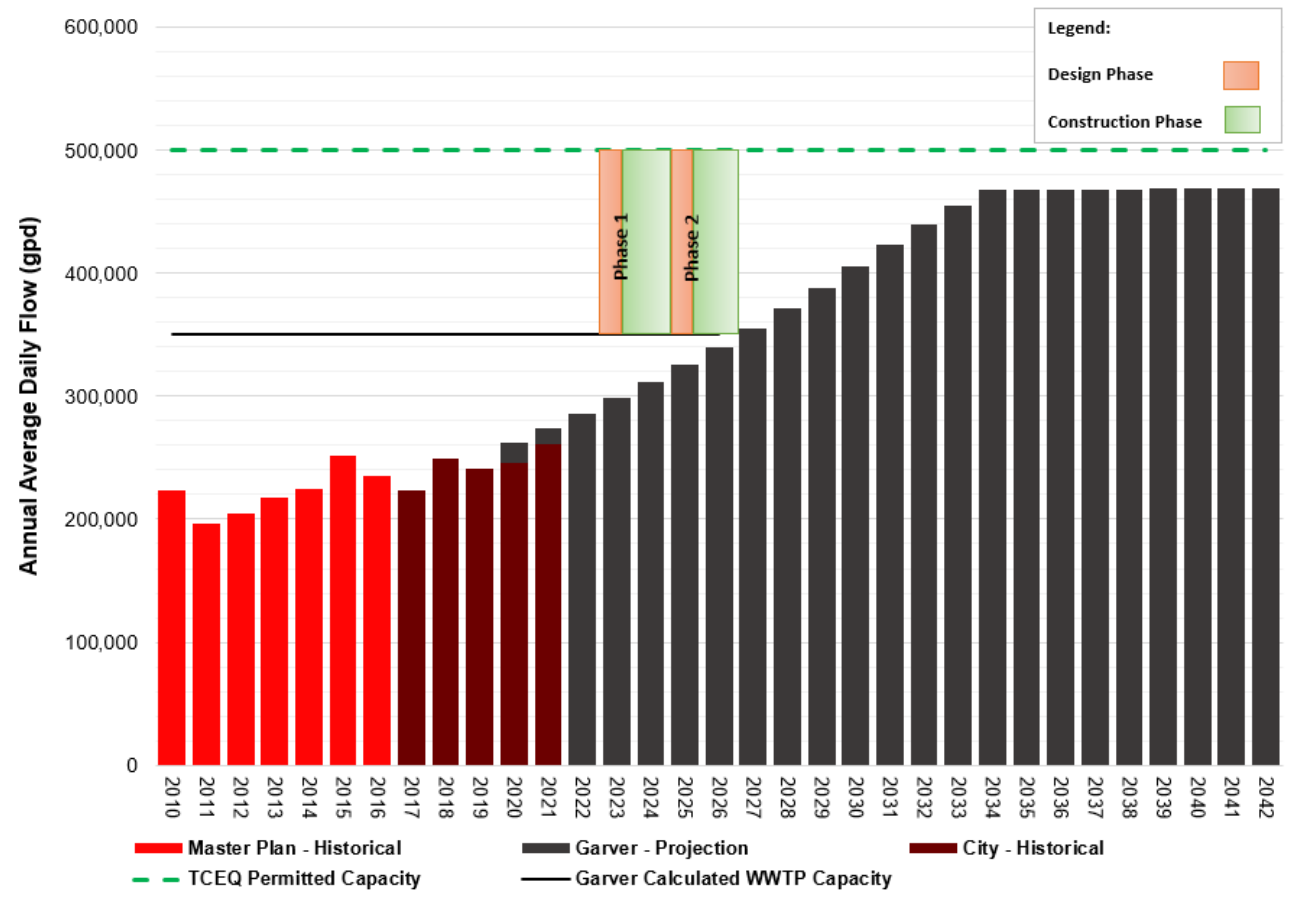
Two project phasing alternatives were considered in TM 3. The figure below shows the **single-phase** alternative

This alternative includes all the proposed improvements:

- Oxidation Ditch to Aeration Basin Retrofit
  - Diffuser installation
  - Blower installation
- Headworks Grit System
  - Classifier/Conveyor
  - Roll-off Bin
- Intermediate LS Improvements
- Bottom of the Hill LS Improvements
- Aerated Sludge Holding Tank
  - WAS Pump Station
  - Tank Blowers
- Effluent Pump Station and Conveyance Improvements
  - Effluent Pump Station Improvements
  - Pipeline conveyance improvements to the golf course
  - Golf Course Reuse Study (if necessary)



The **multi-phase** alternative was developed that included two phases which address short- and long-term needs



This alternative includes the following:

Phase 1:

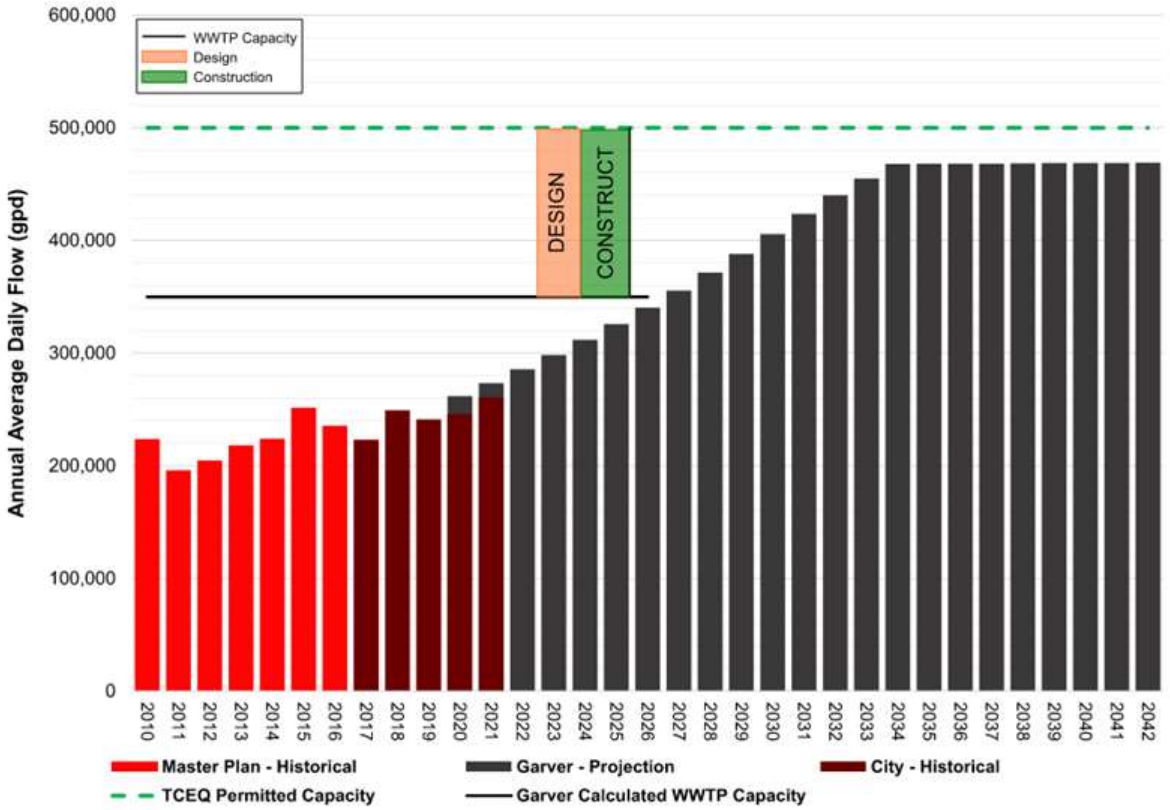
- Effluent Pump Station and Conveyance Improvements
  - Effluent Pump Station Improvements
  - Pipeline conveyance improvements to the golf course
  - Golf Course Reuse Study (if necessary)
- Intermediate LS Improvements
- Bottom of the Hill LS Improvements

Phase 2:

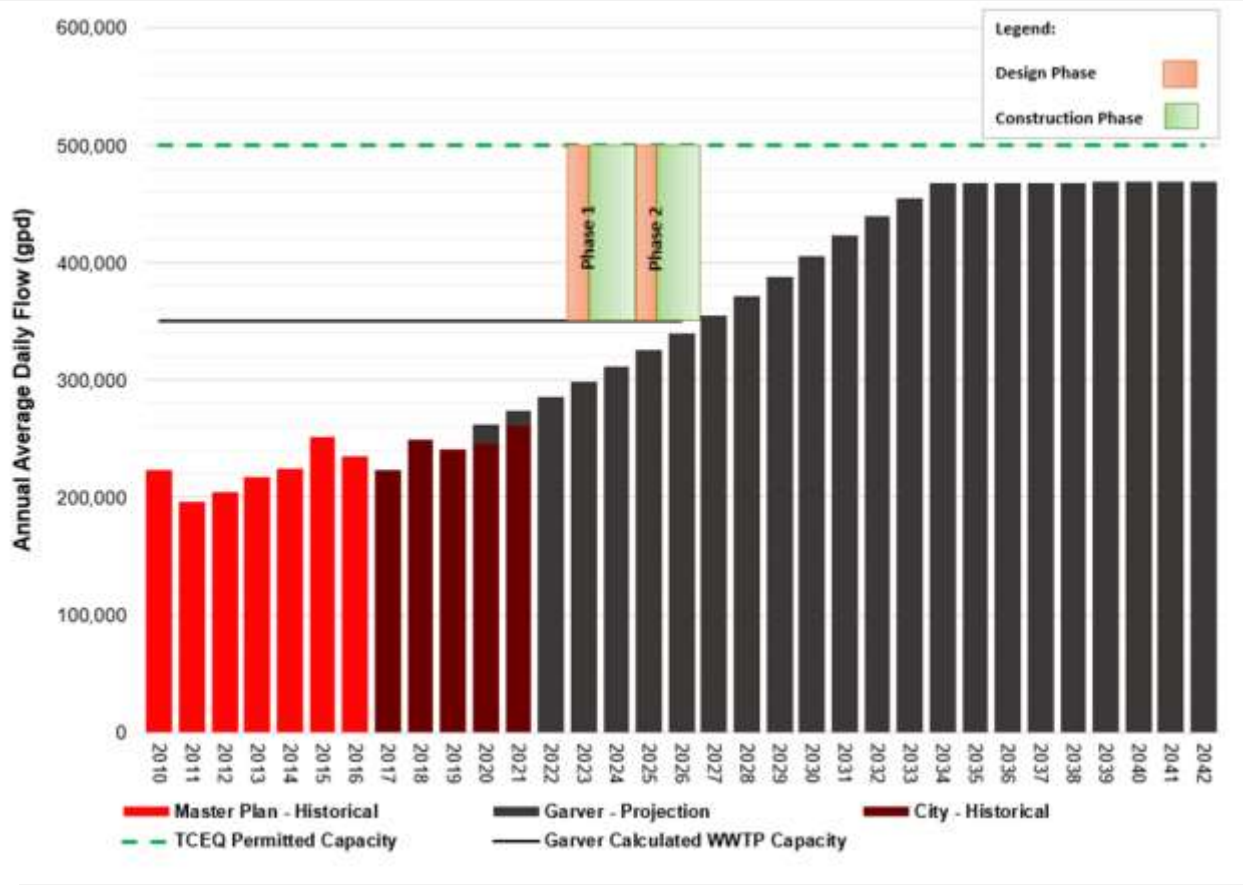
- Oxidation Ditch to Aeration Basin Retrofit
  - Diffuser installation
  - Blower installation
- Aerated Sludge Holding Tank
  - WAS Pump station
  - Tank Blowers
- Headworks Grit Removal
  - Classifier/Conveyor
  - Roll-off Bin

Both alternatives were developed with the capacity triggers in mind

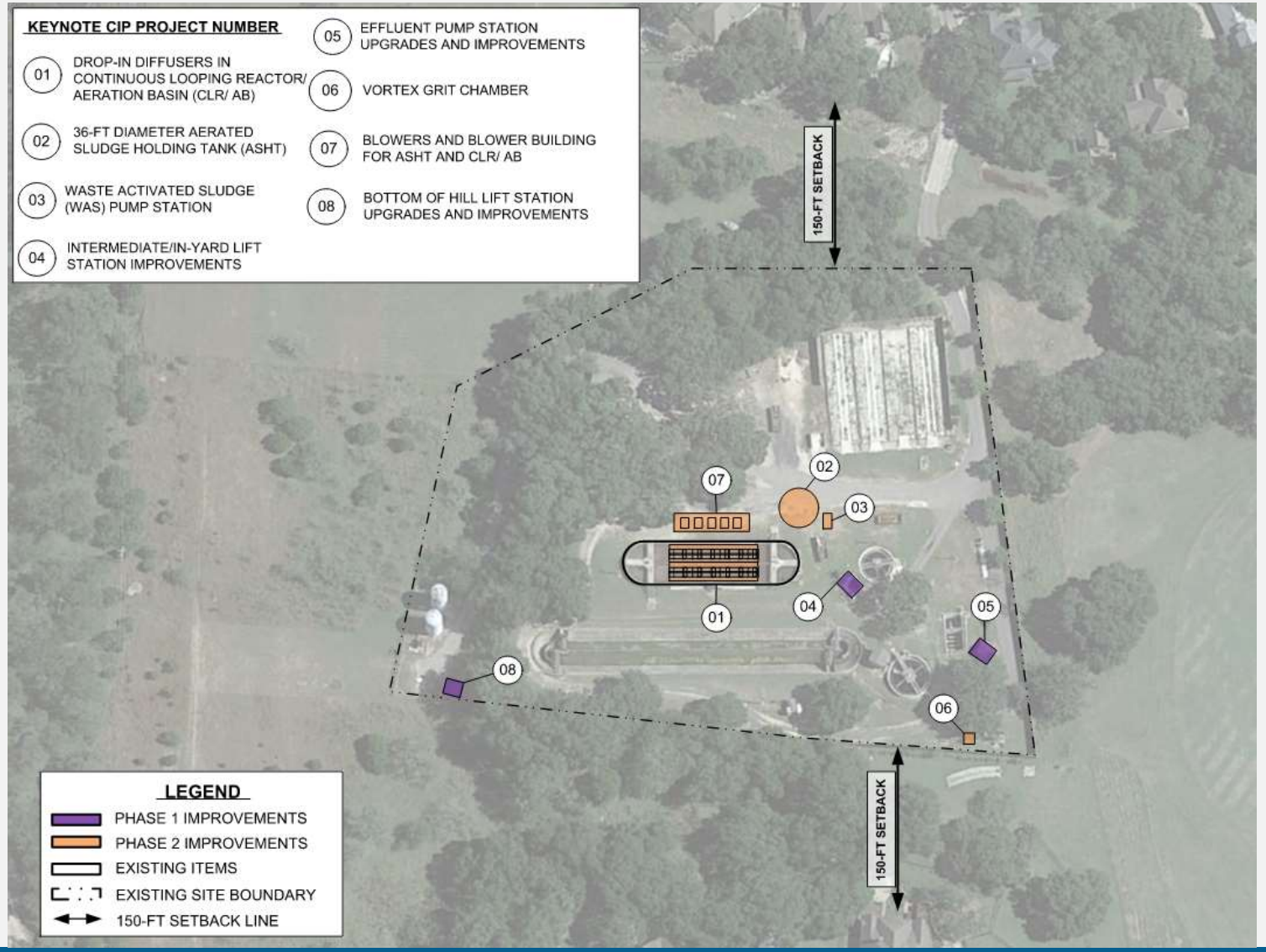
Single-Phase Alternative



Multi-Phase Alternative



The site plan below shows all proposed improvements



As a reminder, Cost estimates for this study utilized Class 4 estimates

Class 4 estimates are typically prepared for strategic business planning purposes such as strategic planning, technical feasibility, preliminary budget approval, etc.

Unknown Site Conditions Percentage Ranges

Unknown	Standard (%)	Potential Range (%)
Miscellaneous Piping and Utilities	15	0 to 15
Other Sitework	15	0 to 15
Electrical and Instrumentation	30	0 to 50

Project Contingencies and Markups

Category	% Contingency	Applied to:
Market Pricing Contingency	10%	Raw OPCC
Construction Contingency	30%	Raw OPCC + Marketing Pricing Contingency
Mobilization Markup	5%	Raw OPCC + Marketing Pricing Contingency + Construction Contingency
Contractor Overhead and Profit Markup	20%	Raw OPCC + Marketing Pricing Contingency + Construction Contingency +Mobilization
Total Contingency (Project Cost)	(1.10 * 1.30 * 1.05 * 1.2) =1.80%	180% of Raw OPCC
Professional Engineering Services	20%	Total Project Cost

Garver reviewed the cost estimate for Option 1 developed in TM 2 and updated the cost information

- In TM 2, the improvement/expansion alternatives were investigated to determine which option(s) would best serve the City's needs.
- High level cost estimates were developed as a tool to evaluate and compare the capital cost required to improve the treatment capacity.
- The capital costs shown in the table to the right has been revised to incorporate the updated vendor/manufacturer input as well as costs associated with the effluent conveyance piping and easements and incorporated the effluent flow metering and golf course storage study.

Description	Units	Quantity	Total
Site Civil	LS	1	$144,000
Bottom of the Hill Lift Station Modifications	LS	1	$65,000
Intermediate Lift Station Modifications	LS	1	$104,000
Grit Removal System	LS	1	$320,000
Aeration Basins Improvements	LS	1	$1,155,000
Process Blowers	LS	1	$747,000
Aerated Sludge Holding Tank	LS	1	$273,000
Effluent Pump Station and Pipeline Modifications	LS	1	$1,635,000
		Raw Subtotal	**$4,443,000**

Conducting the improvements in a **single-phase** would streamline the implementation

- The historical annual average flow rates have currently not reached the treatment capacity limit of 0.35 MGD on an annual average basis and are not projected to cross the threshold until the years 2026-2027
- Design phase in 2023 to implement the capacity and optimization improvements and complete construction before the years 2026-2027

Single-Phase Alternative Opinion of Probable Construction Cost

Description	Total
WWTP Improvements to 0.5 MGD Infrastructure Cost	**$5,183,000**
Raw Subtotal	**$5,183,000**
Miscellaneous Piping and Utilities (15%)	$492,000
Sitework (15%)	$778,000
Electrical and Instrumentation (30%)	$1,174,000
Raw OPCC	**$7,625,000**
Construction Contingency (80%)	$6,100,000
Total Project Cost	**$13,724,000**
Engineering Services (20%)	$2,745,000
Total Programmed Cost	**$16,469,000**

*This alternative assumes that the City will be able to obtain easements and permits within 6-9 months for the pipeline and conveyance improvements

The **Multi-Phase** Alternative features a two-phase approach for the proposed improvements

- The improvements packaged in the first phase (Phase 1) are intended to help the City meet the immediate needs of the WWTP in order to maintain adequate effluent pumping capacity.
- It's recommended that the City move forward with the design of Phase 1 in 2023 to address rehabilitation needs and complete the improvements by the end of 2024.

Multi-Phase Alternative (Phase 1) Opinion of Probable Construction Cost

Description	Total
WWTP Improvements to 0.5 MGD **Infrastructure Cost (Phase 1)** • **Effluent Pump Station and Conveyance Improvements** • **Bottom of The Hill Lift Station Improvements** • **In Yard Lift Station Improvements**	**$2,108,000**
Raw Subtotal	**$2,108,000**
Miscellaneous Piping and Utilities (15%)	$121,000
Sitework (15%)	$317,000
Electrical and Instrumentation (30%)	$241,000
Raw OPCC	**$2,785,000**
Construction Contingency (80%)	$2,228,000
Total Project Cost	**$5,012,000**
Engineering Services (20%)	$1,003,000
Total Programmed Cost	**$6,014,000**

*This alternative assumes that the City will be able to obtain easements and permits within 6-9 months for the pipeline and conveyance improvements

The **Multi-Phase** Alternative Phase 2 focuses on the enhancement of the biological treatment system and sludge processing

- As noted in TM 1 and TM 2, the bottleneck of the WWTP was calculated to be limited to 0.35 MGD.
- The conversion of the oxidation ditch to an aeration basin through the implementation of retrievable diffusers and process blowers will increase the capacity of this process area to the permitted flow of 0.5 MGD.
- The Phase 2 improvements would likely begin design in early-2025 with the goal of completing construction by early 2027.

Multi-Phase Alternative (Phase 2) Opinion of Probable Construction Cost

Description	Total
WWTP Improvements to 0.5 MGD Infrastructure Cost (Phase 2) • Oxidation Ditch to Aeration Basin Retrofit • Aerated Sludge Holding Tank • Headworks Grit Removal	**$3,234,000**
Raw Subtotal	**$3,234,000**
Miscellaneous Piping and Utilities (15%)	$486,000
Sitework (15%)	$486,000
Electrical and Instrumentation (30%)	$971,000
Raw OPCC	**$5,174,000**
Construction Contingency (80%)	$4,140,000
Total Project Cost	**$9,314,000**
Engineering Services (20%)	$1,863,000
Total Programmed Cost	**$11,176,000**

When comparing the two alternatives the single-phase approach was more cost effective. However, if development plans or the number of connections needed changes, a multi-phase approach should be considered.

As a reminder:

- **Single Phase** Alternative
  - Construction costs were escalated (8%) to the midpoint of construction (early 2025)
- **Multi Phase** Alternative
  - Phase 1 - Construction costs were escalated (8%) to the midpoint of construction (mid 2024)
  - Phase 2 – Construction costs were escalated (8%) to the midpoint of construction (early 2026)
- The calculated cost savings of doing the improvements in a single phase versus multiple phases resulted in a difference of approximately $721,000 dollars

Phase	Single-Phase Alternative	Multi- Phase Alternative
Phase 1 (Total Programmed Cost	$16.5 Million	$6.0 Million
Phase 2 (Total Programmed Cost	N/a	$11.2 Million
Total	**$16.5 Million**	**$17.2 million**

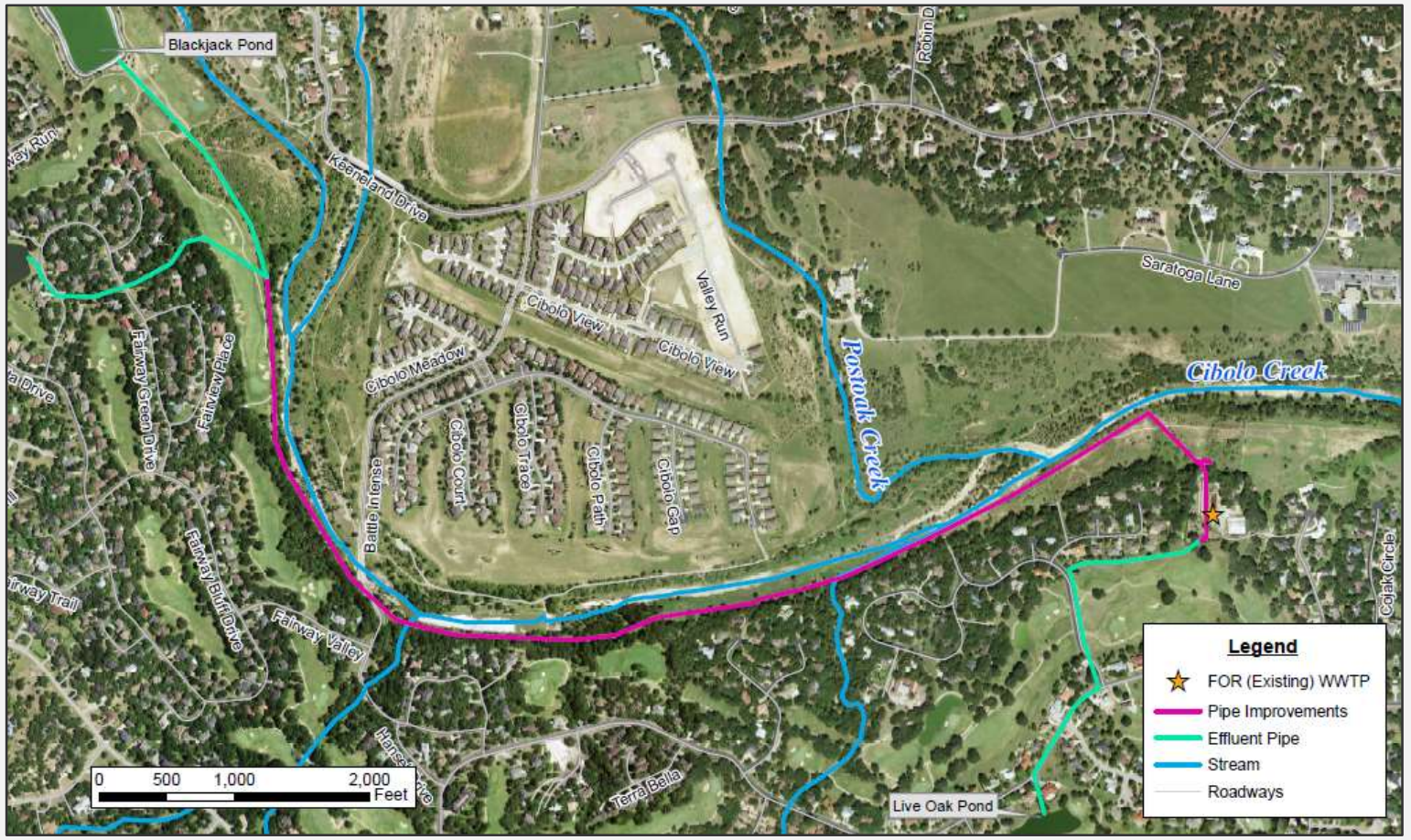
Next, we will discuss the Environmental Desktop Review Findings.

The environmental evaluation of the project (pipe) site noted the close proximity to Cibolo Creek, a potentially jurisdictional Water of the U.S. (WOUS)

If the proposed project impacts more than 0.10-acre of jurisdictional waters within the project, a Nationwide Permit 58 with Pre-Construction Notification (PCN) would be required from the USACE

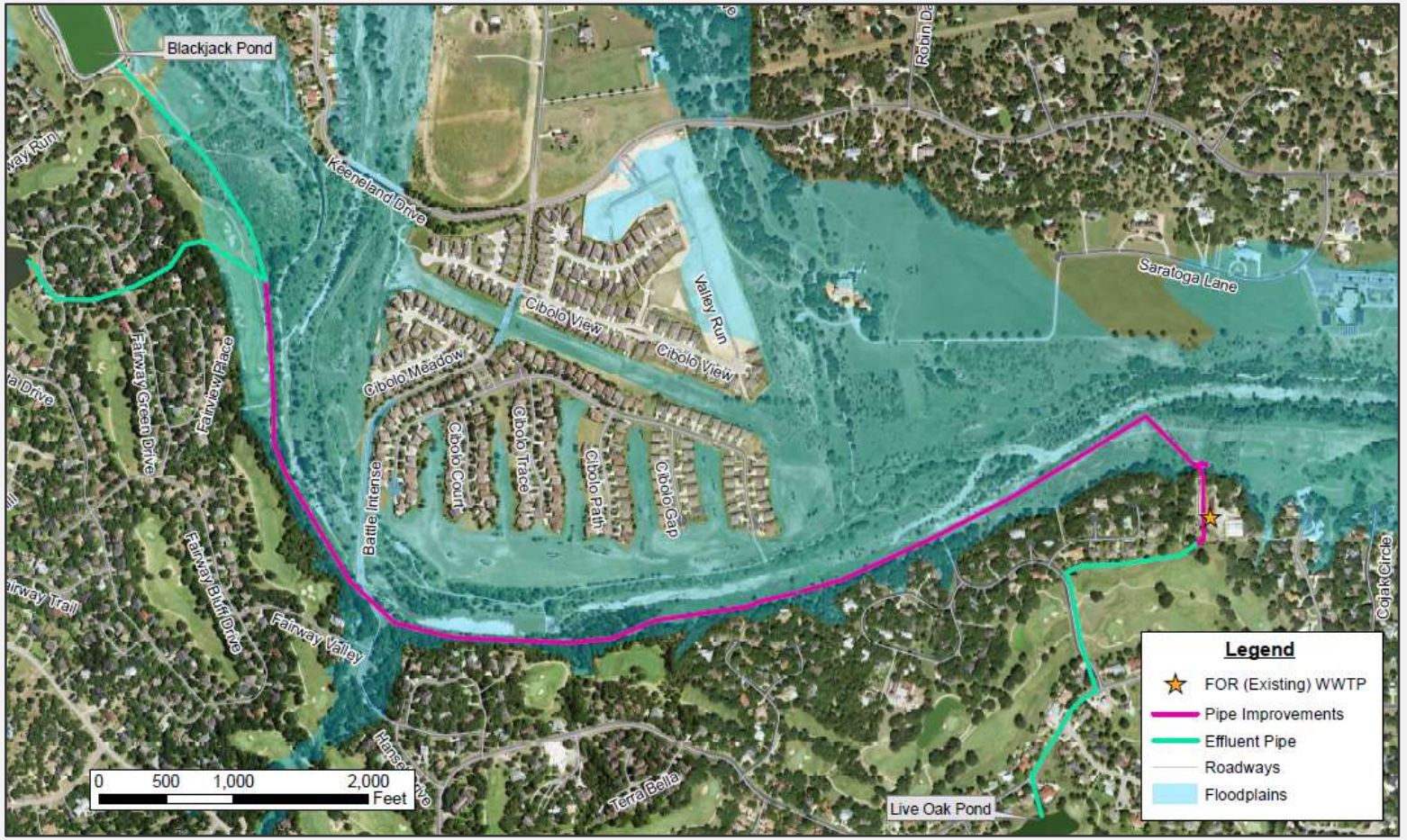
- This typically takes 90 days

If impacts exceed 0.5-acre, the project will require an Individual Permit per the USACE.



The alignment of the pipeline improvements from the Wastewater Treatment Plant to the Blackjack Pond is located within the floodplain, coordination with the floodplain administrator will be required.

Additionally, a Water Pollution Abatement Plan (WPAP) will need to be submitted and approved by the Texas Commission on Environmental Quality (TCEQ) to show compliance with the Edwards Aquifer Rules.



The evaluation of the threatened and endangered species in the area found that there should not be any impacts to federally listed species

- Further investigation will be required to determine if there could be impacts to state-listed species.
- If further investigation identifies impacts to state-listed species, coordination with TPWD would be required, resulting in a list of suggested Best Management Practices (BMPs) to be used during construction.
  - TPWD review typically takes 45 days

The evaluation of cultural and historical sites found that there was one archeological site located within the study area.

- Trinomial 41BX1614 is a burned rock midden consisting of points, scrappers, and bone study area that also intersects approximately 50 meters of a linear archaeological project survey conducted for the Federal Energy Regulatory Commission in 2006 (Atlas Number 8500011647).
- There were no other sites or surveyed locations identified.

The proposed project will also require coordination with the THC to comply with Section 106 of the National Historic Preservation Act (NHPA).

- The THC may require an archaeological background study to determine if a survey is required.
  - If a survey is required, then a qualified archaeologist will need to obtain an Antiquities Code of Texas permit from the THC for the investigation.
  - Once the investigation is complete and a report of findings is prepared and coordinated with the THC, the permit will be closed by the archaeologist.
  - If an archaeological survey is required, coordination could take 90-120 days.

Environmental Desktop Review Summary

Based on Desktop Environmental review, there does not appear to be major environmental concerns. Some concerns/risks are:

- Conducting all permitting, authorizations, and environmental evaluations to maintain the project schedule
- The alignment of the pipe to the golf course and the proximity of the cultural/historical site
  - Existing pipeline is already constructed along the route
  - However, there is a potential to uncover more sites when excavating along the route that has not been previously disturbed

Next, we will discuss the next steps.

Next steps

1) Staff provides additional info or analysis (if requested by Council)

2) Council approves single-phase or multi-phase expansion alternative (future agenda item)

3) Staff selects design consultant and prepares PS&E (FY23)

4) Bid advertisement and construction award (FY24)

Questions?