



JOLLYVILLE TRANSMISSION MAIN

TECHNICAL MEMORANDUM RM 620 AND HYBRID WEST-OF-620 ROUTE ANALYSIS

Water Treatment Plant #4 – Jollyville Transmission Main
Phase B – Final Design
CIP ID: 6935.016

B&V Project 167760
B&V File D-1.2

To: Stacie Long, P.E. – Project Manager, City of Austin
From: Dennis Allen, P.E. – Project Manager, Black & Veatch
Date: September 22, 2010

Executive Summary

Black & Veatch has been asked to evaluate additional routes as part of the ongoing Jollyville Transmission Main project, part of the larger Water Treatment Plant 4 project currently being implemented by the City of Austin. These routes are being evaluated in addition to the routes studied to various degrees to date. The routes analyzed in this memorandum are as follows:

- **RM 620 Route:** A potential route generally following RM 620 from the Water Treatment Plant 4 (WTP4) plant site to Anderson Mill Road, then following City Right of Way (ROW) along Anderson Mill Road to US Highway 183, ending at the Jollyville Reservoir Site (see Appendix B).
- **Hybrid West-Of-620 Route:** A potential route following the Pedernales Electrical Cooperative (PEC) easement to Anderson Mill Road, then following City ROW along Anderson Mill Road to Pond Springs Road, then following City ROW along Pond Springs Road to the Jollyville Reservoir Site (see Appendix C). This route has been proposed by the Spicewood Springs Tunnel Coalition and is presented in detail on www.stopth shafts.com.

The methodology utilized during all route analyses consisted of a two part process:

- **Initial Threshold Screening:** Includes thresholds for Construction Cost, In-Service Schedule, Federal Permitting Limitations, and System Hydraulics, Operations, and Maintenance.
- **Criteria Based Evaluation:** Includes four (4) main equally weighted criteria of cost, potential environmental impacts, potential community impacts, and constructability issues.



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RM 620 Route Analysis

Black & Veatch provided a preliminary review of this potential route as part of the Draft Preliminary Engineering Report, and determined at that time that the additional length of this route (more than 2 miles longer than the currently proposed route) prohibited further consideration due to the excessive costs associated with this alignment – stated at that time to be in the range of an additional \$30 to \$40 million. This range of costs is greater than 25% of the budgeted construction estimates on this project (the budget for the Jollyville Transmission Main is approximately \$110 million – including engineering fees, construction fees, inflation costs, a 25% contingency, but excludes real estate costs. Approximately \$98 million is allocated for construction of the Jollyville Transmission Main).

At the request of City Staff, Black & Veatch was asked to perform additional research to further evaluate the route. The analysis determined that the RM 620 Route failed the Initial Threshold Screening in the following areas:

1. **Construction Cost:** Significant length increases over other routes, which translate to significant costs (estimated to range between \$140 million and \$150 million), which is outside the 25% threshold for consideration. Further, additional costs associated with easement acquisition are estimated to range from \$1.5 million to \$5 million.
2. **In-Service Schedule:** Unacceptable schedule delays due to design efforts and permitting requirements.

Hybrid West-Of-620 Route Analysis

Concerned citizens have provided three (3) potential alternatives associated with this route:

1. An all trench alternative along the PEC easement
2. A combination of trench and tunnel construction along the PEC easement
3. A surface pipeline along the PEC easement

Due to the presence of extremely environmentally sensitive caves on the Purcell tract, Black & Veatch did not evaluate an all trench option along the PEC route. Similarly, due to significant homeland security issues, operation and maintenance issues associated with exposed pipelines, challenges with public access and egress to communities in the area, and the fact that the foundations associated with a surface pipeline would still impact the Edwards Formation and its associated resources, Black & Veatch did not evaluate a surface pipeline along the PEC easement. Therefore, for purposes of this evaluation, Black & Veatch assumed that the first 6,800 feet will be tunneled, as a trench in this area would traverse through protected cave buffers on the Purcell tract. This will necessitate a shaft at



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the end of this tunneled section to transition from tunnel to a shallower line that can be trenched.

At the request of City Staff, Black & Veatch was asked to perform additional research to further evaluate the route. The analysis determined that the Hybrid West-Of-620 Route fails the Initial Threshold Screening in several areas:

1. **Construction Cost:** Significant length increases over other routes, which translate to significant costs (estimated to range between \$135 million to \$145 million), which is outside the 25% threshold for consideration. Further, additional costs associated with easement acquisition are estimated to range from \$20 million to \$40 million.
2. **In-Service Schedule:** Unacceptable schedule delays due to re-design efforts and permitting requirements.
3. **Federal Permitting Limitations:** Unacceptable permitting hurdles, including the need for the BCCP Coordinating Committee to evaluate any route, tunnel or trench, under or through the protected cave cluster on the Purcell tract as a potential minor or major amendment to the Section 10a permit, with that recommendation presented to the US Fish and Wildlife Service for a decision. The evaluation of a minor amendment is estimated to take between 3 and 6 months and the evaluation of a major amendment is estimated to take between 2 and 6 years. In addition, there is a potential need to acquire U.S. Army Corps of Engineers 404 permits.

Further, trenching along the majority of the Pedernales Electric Cooperative easement presents significantly more risk than all-tunnel alternatives. Environmental risks to Jollyville Plateau Salamander habitat, as well as significant disturbance of potential karst invertebrate habitat in the Edwards formation, are all evident. Although trenching activities could be scheduled outside of the Golden Cheeked Warbler and Black Capped Vireo habitat, the potential risk of impacts to these species are greater than all-tunnel alternatives. Finally, potential sediment-laden stormwater releases from the trenching activities also pose a risk to the surface water resources (and springs) near this route.



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1.0 Introduction

Black & Veatch has been asked to evaluate additional routes as part of the ongoing Jollyville Transmission Main project, part of the larger Water Treatment Plant 4 project currently being implemented by the City of Austin. These routes are being evaluated in addition to the routes studied to various degrees to date. Appendix A presents a summary of the routes evaluated to date, the documents that contains the results of the analysis, the dates of those documents, and the level of analysis undertaken to date.

The routes analyzed in this memorandum are as follows:

- **RM 620 Route:** A potential route generally following RM 620 from the Water Treatment Plant 4 (WTP4) plant site to Anderson Mill Road, then following City Right of Way (ROW) along Anderson Mill Road to US Highway 183, ending at the Jollyville Reservoir Site (see Appendix B).
- **Hybrid West-Of-620 Route:** A potential route following the Pedernales Electrical Cooperative (PEC) easement to Anderson Mill Road, then following City ROW along Anderson Mill Road to Pond Springs Road, then following City ROW along Pond Springs Road to the Jollyville Reservoir Site (see Appendix C). This route has been proposed by the Spicewood Springs Tunnel Coalition and is presented in detail on www.stopth shafts.com.

1.1 Evaluation Methodology

The methodology utilized during all route analyses consisted of a two part process:

1.1.1 Initial Threshold Screening

This analysis reviews the routes to identify potential issues that do not meet overall project objectives. These thresholds include (in no particular order):

- **Construction Cost:** Estimated construction costs that are greater than 25% of the budgeted construction values. The budget for the Jollyville Transmission Main is approximately \$110 million. This budget includes engineering fees, construction fees, inflation costs, a 25% contingency, but excludes real estate costs. Approximately \$98 million is allocated for construction of the Jollyville Transmission Main.
- **In-Service Schedule:** Estimated schedules that exceed the ability of the Jollyville Transmission Main to be in-service by Spring 2014.
- **Federal Permitting Limitations:** Routes that would require an amendment to the Federal Section 10a permit associated with the Balcones Canyonlands Preserve or routes that would that trigger other Federal permitting requirements.



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- **System Hydraulics, Operations, and Maintenance:** Routes that would not allow the system to function acceptably hydraulically, or would limit appropriate access to the transmission main for emergency activities or for normal operations and maintenance activities.

If any of these routes do not meet the listed project objectives, that route would not be considered for further analysis.

1.1.2 Criteria Based Evaluation

For those routes that passed the Initial Threshold Screening, additional analyses would consist of utilizing Criterium Decision Plus software of the routes based on four main criteria (and multiple subcriteria). This provides for a transparent analysis of the routes using several weighted subcriteria under each main criterion.

The four main criteria are (in no particular order):

- Potential environmental impacts
- Potential community impacts
- Constructability issues
- Construction cost

A detailed description of this evaluation methodology, criteria, and subcriteria are presented in the Draft Preliminary Engineering Report. As of the date of this memorandum, the preliminary engineering process is ongoing and, as such, the analysis is subject to change based on additional information that has been evaluated since the last update to the Preliminary Engineering Report.

2.0 RM 620 Route Analysis

Black & Veatch provided a preliminary review of this potential route following RM 620 from the Water Treatment Plant 4 (WTP4) plant site to Anderson Mill Road, then following City ROW along Anderson Mill Road to US Highway 183, ending at the Jollyville Reservoir Site (RM 620 Route). In this evaluation, Black & Veatch assumed an all tunnel alignment based on the presence of existing development in the area, the large number of potential utility conflicts, potential community impacts, and the fact that there is insufficient room in the right-of-way along RM 620 and US 183 for a trenched alternative without significant easement acquisition costs. Black & Veatch determined that the additional length of this route (more than 2 miles longer than the currently proposed route) prohibited further consideration due to the excessive costs associated with this alignment – stated to be, at that time, in the range of an additional \$30 to \$40 million. This range of costs is greater than 25% of the budgeted construction estimates on this project.



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However, at the request of City Staff, Black & Veatch was asked to perform additional research to further evaluate the route. The analysis is organized into the following four main criteria (in no particular order): Potential Environmental Impacts, Potential Community Impacts, Constructability Issues, and Construction Cost.

2.1 Potential Environmental Impact

The potential environmental impacts of the RM 620 Route are organized into four (4) main categories:

1. Groundwater/Geology
2. Surface Water
3. Flora/Fauna
4. Permitting

2.1.1 Groundwater/Geology

From a groundwater and geologic perspective, the route was evaluated based on potential impacts to the Edwards Formation, known springs, and protected caves.

As described previously, Black & Veatch assumed this route would be tunneled in its entirety; therefore, disturbance to the Edwards formation specific to this route is limited to shaft construction activities at three assumed intermediate shaft sites. Black & Veatch is estimating the cumulative depth of the Edwards formation at the intermediate shaft sites is between 200 and 250 ft. Because of the depth of the tunnel and the characteristics of the Glenrose Formation, it is not likely that the tunnel will impact local springs in the Edwards or Walnut Formation.

A tunneled route under RM 620 would proceed below approximately 8,800 linear ft of protected cave buffers – ¼ mile buffers associated with caves identified in the Balcones Canyonlands Conservation Program lying outside of the Preserve as having significant environmental value related to karst invertebrates [trenching through these buffers would present significant environmental risk and would require BCCP and U.S. Fish and Wildlife Service (USFWS) approval]. Black & Veatch has assumed that, due to the depth of the tunnel, its presence in the Glen Rose formation, and the characteristics of the Glen Rose formation, tunneling under protected caves on the Purcell tract would not pose significant threats to this habitat. Similarly, the same rationale applies for other caves along the proposed route; Black & Veatch assumes that tunneling activities in the Glen Rose formation do not pose a significant threat to caves in the Edwards Formation.



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2.1.2 Surface Water

From a surface water and watershed health perspective, the route was evaluated based on potential disturbances within Critical Water Quality Zones, the number of shafts, the surface disturbance associated with those shafts, and the proximity of any shaft construction to Bull Creek or its tributaries.

Black & Veatch has assumed that this route is tunneled; therefore, no tunneling activities will impact Critical Water Quality Zones. In addition, Black & Veatch is assuming that any intermediate shafts can be located outside of Critical Water Quality Zones. This route was assumed to have 3 intermediate shafts that could potentially impact watershed health, disturbing approximately 2 acres per shaft site (this total may be impacted by available land and the selected Contractor's means and methods, however). At its closest point, the distance between the intermediate shafts and Bull Creek (or a tributary thereof) is approximately 2,000 feet.

2.1.3 Flora/Fauna

From a flora and fauna perspective, the route was evaluated based on potential impacts to Jollyville Plateau Salamander (JPS) habitat, potential karst invertebrate habitat, and Golden Cheek Warbler (GCW) or Black Capped Vireo (BCV) habitat, along with potential vegetation or tree loss and any impacts to the existing Federal 10a permit.

It is Black & Veatch's preference to locate any potential shaft sites outside of watersheds that contribute flow to known Jollyville Plateau Salamander habitat. Therefore, Black & Veatch has assumed intermediate shafts can be located outside of any watershed containing JPS habitat. There does not appear to be appreciable disturbance to karst invertebrate habitat due to the assumption of tunneling. Tunneling activities are also not anticipated to impact GCW or BCV habitat.

Up to 2 acres of vegetation could need to be cleared for each intermediate shaft location (depending on available land).

2.1.4 Permitting

As no activity would be taking place within the Balcones Canyonlands Preserve, it is not anticipated that any amendments or modifications would need to be made to the Section 10a permit. Additionally, this route would preclude the need to hold a Chapter 26 hearing. An additional variance may need to be requested associated with clearing activities along RM 620, as it is covered under the Hill Country Roadway Ordinance, although some relief is provided under this ordinance for clearing related to utility projects.



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2.2 Potential Community Impacts

The potential community impacts of the RM 620 route take into account a wide variety of issues such as traffic, proximity to schools and daycare, impact to residents and businesses, dust, exhaust, emissions, noise, etc.

Truck traffic through residential neighborhoods during construction is expected to be less than other routes, as the majority of this route lies along more major roads. There is 1 fire station within $\frac{1}{4}$ mile of an intermediate shaft site, but no streets are anticipated to be closed during construction due to the assumption of tunneling as a construction method. There is also 1 daycare center within $\frac{1}{4}$ mile of an intermediate shaft site.

Traffic disruption is quantified by the number of truck trips generated as a percentage of the traffic capacity of the roads expected to carry the truck traffic. The RM 620 Route is estimated to generate, at its busiest time, 25-35 truck loads per day (or 50-70 truck trips per day), and Anderson Mill Road has a total capacity of 28,000 vehicles per day based on 2010 CAMPO estimates at its most restricted location. This equates to an impact of 0.25% of the rated capacity for Anderson Mill Road. It should be noted that, as of the date of this memorandum, Anderson Mill Road is over capacity, as more vehicle trips per day have been estimated than the total capacity of the road.

The number of residents and business impacted was determined by a count of residential and commercial structures within $\frac{1}{4}$ mile of the shaft sites. The number of residential structures within this area is estimated between 450 and 500, and the number of commercial structures within this area is estimated between 150 and 200.

Dust, exhaust, and emissions are expected to be moderate and directly related to the number of shafts utilized for the route.

Noise impacts will be generally limited to construction activities at the shaft sites. Hauling hours at the shaft sites are estimated to be 10 hours per day. A Chapter 26 hearing is not expected to be required as part of the RM 620 Route.

2.3 Constructability Issues

Constructability issues evaluated include potential impacts to schedule, shaft siting constraints, the ease of permit approvals, available ROW, the volume of utility relocations necessary, future access and maintenance issues, and turning radii necessary for tunnel construction.

At this point, the RM 620 Route would have significant schedule impacts of up 1 year due to the necessity to obtain detailed geologic information as well as additional time to perform



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detailed design on this route. Black & Veatch has largely completed preliminary engineering, as well as some final design tasks, associated with the preferred alternative. If a new route were to be recommended, new geotechnical information would need to be acquired, and that information rolled into a revised preliminary engineering design as well as the final design tasks completed to date.

At this level of study, there does not appear to be other significant shaft site constraints, but a detailed analysis has not been performed.

Additional permit approvals (beyond those associated with the other routes studied) include seeking an exception to the TXDOT Utility Accommodation Rules. If an exception were to be granted, the City's access to the utility could be impacted, as TXDOT could not close travel lanes down during business commute times to allow work on the transmission main.

In the event of a stopped TBM, this route appears about equal to the routes under the BCP, as the distance along RM 620 governed by TXDOT's Utility Accommodation Rules is similar to the distance between the proposed shaft sites along the BCP routes.

Utility relocations would be necessary in the vicinity of the intermediate shaft sites. Tunnel turning radii appear to be adequate for this route at this level of analysis given additional shaft sites, and are not expected to be a significant impediment to any route. Additional shaft sites are necessary not only to improve tunneling efficiency, but also to provide ventilation, access for pipe installation and grouting to meet schedule, and to provide access for future operation and maintenance.

2.4 Cost

The costs associated with this route are detailed in the table below. They are comprised of estimated construction costs and the cost to acquire easements.

2.4.1 Construction Cost

Item No.	Item Description	Cost(\$M)
1	JR Working Shaft (320 ft x \$6.5K/ft)	\$2.08
2	Anderson Mill Road/183 Retrieval Shaft (200 ft x \$5.9K/ft)	\$1.18
3	RM 620/Anderson Mill Road Working Shaft (200 ft x \$6.5K/ft)	\$1.30
4	Intermediate Working/Retrieval Shaft along RM 620 (200 ft x \$6.5K/ft)	\$1.30
5	WTP4 Retrieval Shaft (200 ft x \$5.9K/ft)	\$1.18
6	Tunnel, Pipe Installation & Grouting (45,600 ft x \$1.955K/ft) *	\$89.15



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Item No.	Item Description	Cost(\$M)
7	Shaft Pipe Installation & Backfill (520 ft x \$5.5K/ft + 600 ft x \$1.6K/ft)	\$3.82
8	Access Structure (3 x \$50K/ea + 2 x \$150K/ea)	\$0.45
9	Surface Restoration	\$0.25
10	Additional Re-engineering Fees	\$5.50
	Subtotal	\$106.21
	Contingency (35%)	\$37.17
	Cost Estimate Range**	\$140 - \$150

* Increased pipe cost by \$30/LF to allow for 6-inch increase in diameter required to deliver equivalent flow to the current proposed alignment

** A cost estimate range (low-high) is used to account for variables, including market conditions and prices of materials at the time of bidding, contract bonds, insurance, availability of skilled local labor and labor productivity factors, power delivery to job site, miscellaneous contract requirements, and implementation of various environmental protection controls and risk management strategies.

2.4.2 Easement Costs

It is assumed that a subterranean easement would be necessary along the RM 620 corridor due to the available ROW associated with RM 620. A portion of this subterranean easement would fall within the RM 620 ROW, but a portion of the easement would have to be obtained (between 20 and 40 feet) from adjacent private property owners adjacent to RM 620. Black & Veatch has assumed that the transmission main could be tunneled within the ROW of Anderson Mill Road. The US 183 Corridor would also require the purchase of a subterranean easement. Up to 2-acres is estimated to be required for shaft construction only and would require an access easement. In perpetuity, a small permanent access shaft would require a limited area of surface easement. In addition, a subterranean easement would be required to and from the access shaft across the remainder of the shaft site.

Black & Veatch has estimated that a subterranean easement would cost between \$3 and \$5 per square foot, which would result in a potential impact of \$1.5 million to \$5 million based on the length of the proposed route and the width of easement necessary along RM 620 and US Hwy. 183. This added further impact to the costs estimated during the Initial Threshold Screening analysis of this route.

2.5 Results

The RM 620 Route fails the Initial Threshold Screening in the following areas:

1. **Construction Cost:** Significant length increases over other routes, which translate to significant costs (estimated to range between \$140 million and \$150 million), which



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is outside the 25% threshold for consideration. Further, additional costs associated with easement acquisition are estimated to range from \$1.5 million to \$5 million.

2. **In-Service Schedule:** Unacceptable schedule delays due to design efforts and permitting requirements.

3.0 Hybrid West-Of-620 Route

At the request of City Staff, Black & Veatch was asked to perform additional research to further evaluate the route known as the Hybrid West-Of-620 Route, a potential route generally following the Pedernales Electrical Cooperative (PEC) easement to Anderson Mill Road, then following City ROW along Anderson Mill Road to Pond Springs Road, then following City ROW along Pond Springs Road to the Jollyville Reservoir Site.

Concerned citizens have provided three (3) potential alternatives associated with this route:

1. An all trench alternative along the PEC easement
2. A combination of trench and tunnel construction along the PEC easement
3. A surface pipeline along the PEC easement

Due to the presence of extremely environmentally sensitive caves on the Purcell tract, Black & Veatch did not evaluate an all trench option along the PEC route. Similarly, due to significant homeland security issues, operation and maintenance issues associated with exposed pipelines, challenges with public access and egress to communities in the area, and the fact that the foundations associated with a surface pipeline would still impact the Edwards Formation and its associated resources, Black & Veatch did not evaluate a surface pipeline along the PEC easement. Therefore, for purposes of this evaluation, Black & Veatch assumed that the first 6,800 feet of this route would be tunneled, as a trench in this area would traverse through protected cave buffers on the Purcell tract. This would necessitate a shaft at the end of this tunneled section to transition from tunnel to a shallower line that can be trenched.

The analysis is organized into the following four main criteria (in no particular order): Potential Environmental Impacts, Potential Community Impacts, Constructability Issues, and Cost.

3.1 Potential Environmental Impact

The potential environmental impacts of the Hybrid West-Of-620 Route are organized into four (4) main categories:

1. Groundwater/Geology
2. Surface Water



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3. Flora/Fauna
4. Permitting

3.1.1 Groundwater/Geology

From a groundwater and geologic perspective, the route was evaluated based on potential impacts to the Edwards Formation, known springs, and protected caves.

Concerned citizens have correctly determined that the first 6,800 feet of this route would be tunneled – however, left out of this analysis is the fact that a shaft would be required at the end of this tunneled section to transition from tunnel to a shallower line that can be trenched. This would disturb an estimated 200 and 250 feet of Edwards formation. Trenching activities would impact an additional approximately 15,500 feet of Edwards formation.

There is also one known spring between 300 and 450 feet west of the PEC easement, located north of Wilson Parke Ave. Black & Veatch has estimated that gradient of flows to this spring roughly follow surface flows – from the southwest to the northeast. The potential impacts referenced are primarily related to sediment-laden stormwater releases from surface trenching activities and the construction of an intermediate shaft site in this location, as well as the potential to intercept subsurface conduits potentially contributing flow to the spring.

A tunneled route under the Purcell tract would proceed below approximately 6,800 ft of protected cave buffer – ¼ mile buffers associated with caves identified in the Balcones Canyonlands Conservation Program lying outside of the Preserve as having significant environmental value related to karst invertebrates. Black & Veatch has assumed that, due to the depth of the tunnel, its presence in the Glen Rose formation, and the characteristics of the Glen Rose formation, tunneling under protected caves on the Purcell tract would not pose significant threats to this habitat. Similarly, the same rationale applies for other caves along the proposed route; Black & Veatch assumes that tunneling activities in the Glen Rose formation do not pose a significant threat to caves in the Edwards Formation

3.1.2 Surface Water

From a surface water and watershed health perspective, the route was evaluated based on potential disturbances within Critical Water Quality Zones, the number of shafts, the surface disturbance associated with those shafts, and the proximity of any shaft construction to Bull Creek or its tributaries.

The trenched portion of the Hybrid West-Of-620 Route does not appear to impact Critical Water Quality Zones, but it is anticipated to cross up to seven (7) streams. These streams are too small to have associated CWQZs, but trenching activities could pose a risk to the water quality of these waterways. The shaft necessary to transition from tunnel to trench has been



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assumed to be located outside of any Critical Water Quality Zone. This route has 3 intermediate shafts (located at the tunnel/trench transition, at the Alternate WTP4 site, and near Pond Springs Road and US Hwy. 183) that could potentially impact watershed health, disturbing approximately 2 acres per shaft site (this total may be impacted by available land and the selected Contractor's means and methods, however).

3.1.3 Flora/Fauna

From a flora and fauna perspective, the route was evaluated based on potential impacts to the Jollyville Plateau Salamander (JPS) habitat, karst invertebrate habitat, Golden Cheek Warbler (GCW) or Black Capped Vireo (BCV) habitat, along with potential vegetation or tree loss and any impacts to the existing Federal 10a permit.

Black & Veatch estimates that more than 4,000 feet of trenching activities would impact drainage areas that feed known Jollyville Plateau Salamander habitat, which may pose risks to the water quality and quantity associated with that habitat. In addition, Black & Veatch has determined that a large portion of the intermediate shaft location at the Alternative WTP4 site lies within the boundaries of a watershed that contains known Jollyville Plateau Salamander habitat. It is possible that a shaft could be located on the portion of the site that is outside of this watershed, however.

There is an extremely high potential for the trenched portion of the line to disturb potential karst invertebrate habitat, as this activity takes place in the karstic Edwards Formation. Approximately 15,500 linear feet of this route would be trenched in the Edwards Formation, with more than 60% of the trenched portion estimated to be in Karst Zone 1 and 20% of the trenched portion estimated to be in Karst Zone 2.

Tunneling activities are not anticipated to impact GCW or BCV habitat; however, the trenched portion of the line would impact up to 20 acres of Golden Cheeked Warbler or Black Capped Vireo habitat.

Between 5 and 10 acres of vegetation may need to be cleared along trenched portions of the PEC easement. Similarly, up to 2 acres of vegetation would need to be cleared for the tunnel/trench transition shaft and the Alternate WTP4 shaft location (depending on available land).

3.1.4 Permitting

The PEC easement currently traverses approximately 3,000 feet of the Balcones Canyonlands Preserve, including the cave cluster on the Purcell tract – a tract that is explicitly defined in the Balcones Canyonlands Preserve Section 10a Permit. As configured, the Hybrid West of 620 Route would tunnel underneath the protected caves on the Purcell Tract, with a transition



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shaft to the trench outside (north) of the BCP. The BCCP Coordinating Committee Secretary has stated that any route, tunnel or trench, under or through that cave cluster would have to be evaluated by the BCCP Coordinating Committee as a potential minor or major amendment to the 10a Permit, and their recommendation presented to the US Fish and Wildlife Service for a decision. The evaluation of a minor amendment is estimated to take between 3 and 6 months. The evaluation of a major amendment is estimated to take between 2 and 6 years.

Additionally, trenching across up to seven (7) streams, if classified as Waters of the United States, would potentially require a U.S. Army Corps of Engineers Section 404 permit. Under Nationwide Permit 12 (the Nationwide Permit for Utility Crossings), it states that “*No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which will destroy or adversely modify the critical habitat of such species.*” The presence of Jollyville Plateau Salamander in the general vicinity, and the lack of complete mapping of JPS habitat in the area, provides the “potential” for the proposed trenching activities to trigger the need for a U.S. Army Corps of Engineers Section 404 Individual Permit(s). If an Individual Permit were required, this would add significant schedule impacts to this route.

This route does not appear to require a Chapter 26 hearing.

An additional variance may need to be requested associated with clearing activities along the PEC easement, as it is covered under the Hill Country Roadway Ordinance, although some relief is provided under this ordinance for clearing related to utility projects.

3.2 Potential Community Impact

The potential community impacts of the Hybrid West-Of-620 Route take into account a wide variety of issues such as traffic, proximity to schools and daycare, impact to residents and businesses, dust, exhaust, emissions, noise, etc.

Truck traffic through neighborhoods during construction is expected to be less than other routes, as the majority of this route lies along more major roads. There is 1 fire station within ¼ mile of an intermediate shaft site and the trenched portion of the route. There is also 1 school and 2 daycare centers within ¼ mile of intermediate shaft sites and the trenched portion of the route. Several streets would require closure during trenching activities associated with this route, further impacting the community.

Traffic disruption is quantified by the number of truck trips generated as a percentage of the traffic capacity of the roads expected to carry the truck traffic. The Hybrid West-Of-620 Route is estimated to generate, at its busiest time, 25-35 truck loads per day (or 50-70 truck



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trips per day), and Anderson Mill Road has a total capacity of 28,000 vehicles per day based on 2010 CAMPO estimates. This equates to an impact of 0.25% of the rated capacity for Anderson Mill Road. It should be noted that, as of the date of this memorandum, Anderson Mill Road is over capacity, as more vehicle trips per day have been estimated than the total capacity of the road.

The number of residents and business impacted was determined by a count of residential and commercial structures within ¼ mile of the shaft sites and the trenched portion of the line. The number of residential structures within this area is estimated to be between 350 and 400, and the number of commercial structures within this area is estimated to be between 200 and 250.

Dust, exhaust, and emissions are expected to be moderate, and are directly related to the number of shaft sites.

Noise impacts will be limited to construction activities at the shaft sites. Hauling hours at the shaft sites are estimated to be 10 hours per day. A Chapter 26 hearing is not expected to be required as part of the Hybrid West-Of-620 Route.

3.3 Constructability Issues

Constructability issues evaluated include potential impacts to schedule, shaft siting constraints, the ease of permit approvals, available ROW, the volume of utility relocations necessary, future access and maintenance issues, and turning radii necessary for tunnel construction.

The Hybrid West-Of-620 Route would have significant schedule impacts of up 1 year due to the necessity to obtain detailed geologic information and design this route.

The possibility of trenching within the PEC easement is also a constructability issue, as PEC has explicitly stated that they are not interested in making their ROW available for trenching.

At this level of study, there does not appear to be significant shaft site constraints, except for the majority of the alternate WTP4 site being located in a watershed that contributes flow to a known location of the Jollyville Plateau Salamander, but a detailed analysis has not been performed.

Future access and maintenance may be impacted by the easements that would need to be acquired for trenching from PEC (or the private entities who own each parcel of land). A typical trenching operation is shown in the figure on the following page.

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PEC has explicitly stated, however, that they are not interested in discussing a trenched alternative along this alignment, as there is limited space within the existing easement for additional construction activities, and trenching could put the electric transmission line foundations at risk. In addition, construction under these high voltage lines is not safe and could be avoided with the all-tunnel routes.

Utility relocations would be necessary in the vicinity of the intermediate shaft sites, and all along the trenched portion of the line, as the PEC easement crosses several roadways and a limited number of developments. It is not known at this time what type of utilities exist in these areas, but it is reasonable to assume some level of utility relocation would be necessary in these areas, which would be another expense as compared to the all-tunnel alternatives.

In the event of a stopped TBM, this route appears better than the routes through the BCP, as it would theoretically be easier to access the TBM from the surface in areas outside of the BCP.

Tunnel turning radii appear to be adequate for this route at this level of analysis given additional shaft sites, and are not expected to be a significant impediment to any route. Additional shaft sites are necessary not only to improve tunneling efficiency, but also to provide ventilation, access for pipe installation and grouting to meet schedule, and to provide access for future operation and maintenance.

3.4 Cost

The costs associated with this route are detailed in the table below. They are comprised of estimated construction costs and the cost to acquire easements.

3.4.1 Construction Cost

Item No.	Item Description	Cost(\$M)
1	JR Retrieval Shaft (250 ft x \$5.9K/ft)	\$1.48
2	Pond Springs Road Working/Retrieval Shaft (200 ft x \$5.9K/ft)	\$1.18
3	Alt WTP4 Working Shaft (200 ft x \$6.5K/ft)	\$1.30
4	Tunnel/Trench Transition Shaft Working Shaft (200 ft x \$6.5K/ft)	\$1.30
5	WTP4 Retrieval Shaft (200 ft x \$5.9K/ft)	\$1.18
6	Tunnel, Pipe Installation & Grouting (6,800 + 25,900 ft x \$1.955K/ft)	\$63.93



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Item No.	Item Description	Cost(\$M)
7	Trenching (15,500 ft x \$1.5K/ft)	\$23.25
8	Shaft Pipe Installation & Backfill (850 ft x \$5.5K/ft + 200 ft x \$1.6K/ft)	\$5.00
9	Access Structure (3 x \$50K/ea + 2 x \$150K/ea)	\$0.45
10	Surface Restoration	\$0.50
11	Additional Re-engineering Fees	\$5.50
	Subtotal	\$105.07
	Contingency (35%)	\$36.77
	Cost Estimate Range**	\$135 - \$145

* Increased pipe cost by \$30/LF to allow for 6-inch increase in diameter required to deliver equivalent flow to the current proposed alignment

** A cost estimate range (low-high) is used to account for variables, including market conditions and prices of materials at the time of bidding, contract bonds, insurance, availability of skilled local labor and labor productivity factors, power delivery to job site, miscellaneous contract requirements, and implementation of various environmental protection controls and risk management strategies.

3.4.2 Easement Costs

It is assumed that a subterranean easement would be necessary along the tunneled portion of the PEC alignment, as well as permanent easements along the remainder of the trenched portion within the PEC easement. Black & Veatch has assumed that the transmission main could be tunneled within the ROW of Anderson Mill Road and along Pond Springs Road. Up to 2-acre sites for the tunnel/trench transition shaft, the Alternate WTP4 shaft, and the shaft along Pond Springs Road are estimated to require both subterranean easements and permanent surface easements.

Black & Veatch has estimated that a permanent easement for trenching, if it could be acquired along the PEC easement, would cost between \$30 and \$50 per square foot (a 50' wide permanent easement is assumed to be required per Austin Water Utility standards), which would result in a potential impact of \$20 million to \$40 million based on the length of the open-cut portion of the proposed route. Additionally, a subterranean easement would be required along the tunneled portion of the line along the PEC easement, which is estimated to cost between \$3 and \$5 per square foot, which would result in an additional potential impact of \$1 million to \$2 million based on the length of this portion of the route. This adds further impacts to the costs associated with this route.

3.5 Results

The Hybrid West-Of-620 Route fails the Initial Threshold Screening in several areas:



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4. **Construction Cost:** Significant length increases over other routes, which translate to significant costs (estimated to range between \$135 million to \$145 million), which is outside the 25% threshold for consideration. Further, additional costs associated with permanent easement acquisition are estimated to range from \$20 million to \$40 million, with an additional \$1 million to \$2 million estimated for subterranean easements.
5. **In-Service Schedule:** Unacceptable schedule delays due to re-design efforts and permitting requirements.
6. **Federal Permitting Limitations:** Unacceptable permitting hurdles, including the need for the BCCP Coordinating Committee to evaluate any route, tunnel or trench, under or through the protected cave cluster on the Purcell tract as a potential minor or major amendment to the Section 10a permit, with that recommendation presented to the US Fish and Wildlife Service for a decision. The evaluation of a minor amendment is estimated to take between 3 and 6 months and the evaluation of a major amendment is estimated to take between 2 and 6 years. In addition, there is a potential need to acquire U.S. Army Corps of Engineers 404 permits.

Further, trenching along the majority of the Pedernales Electric Cooperative easement presents significantly more risk than all-tunnel alternatives. Environmental risks to Jollyville Plateau Salamander habitat, as well as significant disturbance of potential karst invertebrate habitat in the Edwards formation, are all evident. Although trenching activities could be scheduled outside of the Golden Cheeked Warbler and Black Capped Vireo habitat, the potential risk of impacts to these species are greater than all-tunnel alternatives. Finally, potential sediment-laden stormwater releases from the trenching activities also pose a risk to the surface water resources (and springs) adjacent to this route.



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Appendix A

Summary of Jollyville Transmission Main Routes Analyzed to Date



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Table A-1. Summary of Route Evaluations to Date

Route	Document	Date	Threshold Screening	Further Analysis	This Memo
RM 620	Draft Preliminary Engineering Report	5/27/10*	X		X
PER – Alt 1	Draft Preliminary Engineering Report	5/27/10*		X	
PER – Alt 2	Draft Preliminary Engineering Report	5/27/10*		X	
PER – Alt 3	Draft Preliminary Engineering Report	5/27/10*		X	
PER – Alt 4	Draft Preliminary Engineering Report	5/27/10*		X	
Hybrid West of 620	The True Cost of a Hybrid West-Of-620 Route Presentation – Spicewood Springs Tunnel Coalition	8/5/10			X
ATC – Alt 1	Draft Evaluation of Alternative Tunneling Concepts Technical Memo	8/23/10		X	
ATC – Alt 2	Draft Evaluation of Alternative Tunneling Concepts Technical Memo	8/23/10		X	
ATC – Alt 3	Draft Evaluation of Alternative Tunneling Concepts Technical Memo	8/23/10		X	
ATC – Alt 4	Draft Evaluation of Alternative Tunneling Concepts Technical Memo	8/23/10		X	
ATC – Alt 5	Draft Evaluation of Alternative Tunneling Concepts Technical Memo	8/23/10		X	

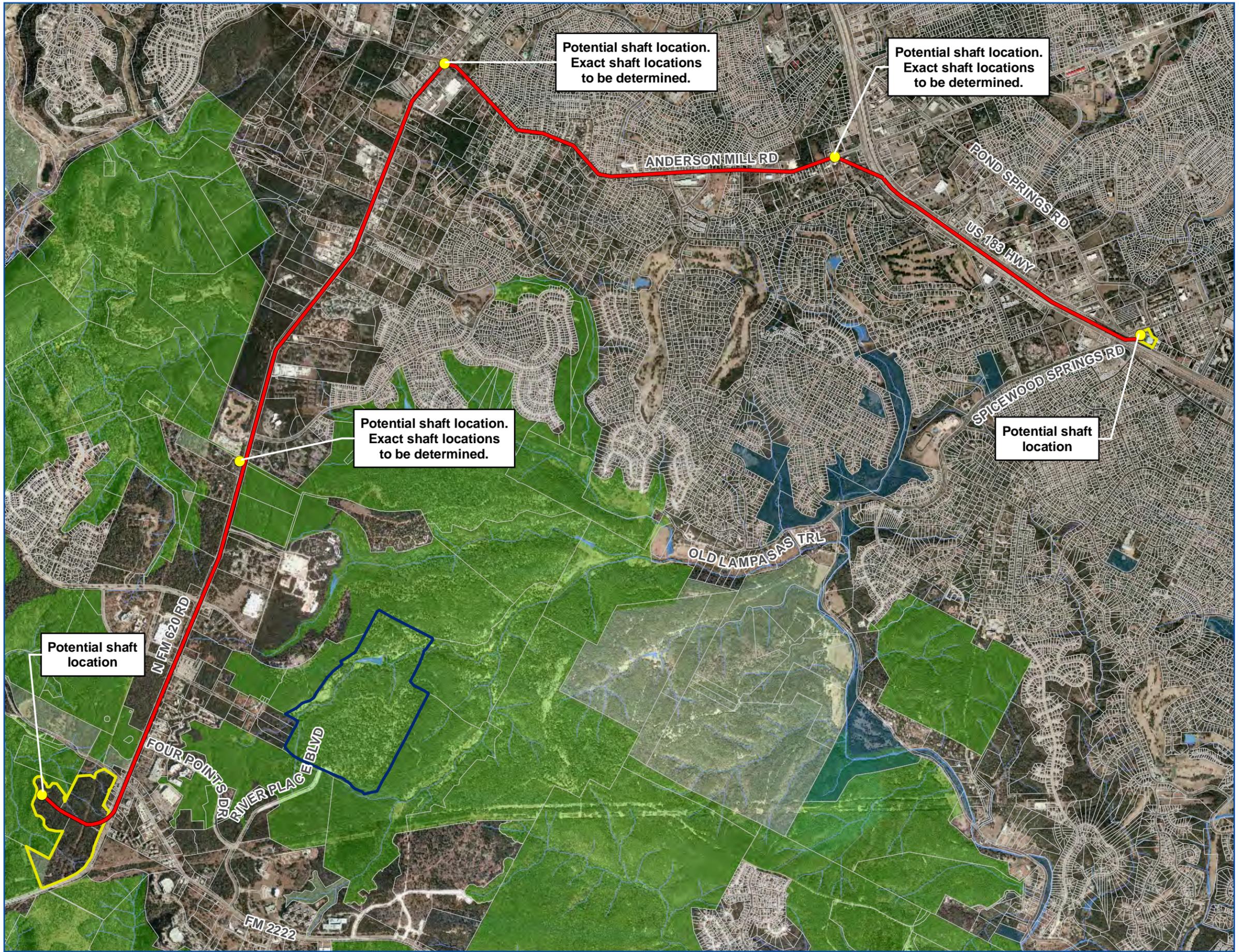
* Initial submittal of the Draft Preliminary Engineering Report (PER) was in November 2009. As preliminary engineering activities progressed, a revised Draft PER was submitted in May 2010.



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Appendix B

Map of Proposed RM 620 Route



City of Austin, Texas
Water Treatment Plant 4

Jollyville Transmission Main

September 26, 2010

LEGEND

-  Shafts
-  Tunnel
-  Reservoir and WTP 4
-  Old WTP 4 Site
-  BCP
-  Potential Future BCP
-  City of Austin Parks
-  Creeks
-  Water
-  ROW/Property Lines



0 1,250 2,500
 Feet
 1 inch = 2,500 feet

Alignment Alternative:
 RM 620 Route





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Appendix C

Map of Proposed Hybrid West-Of-RM 620 Route

City of Austin, Texas
Water Treatment Plant 4
 Jollyville Transmission Main

September 24, 2010

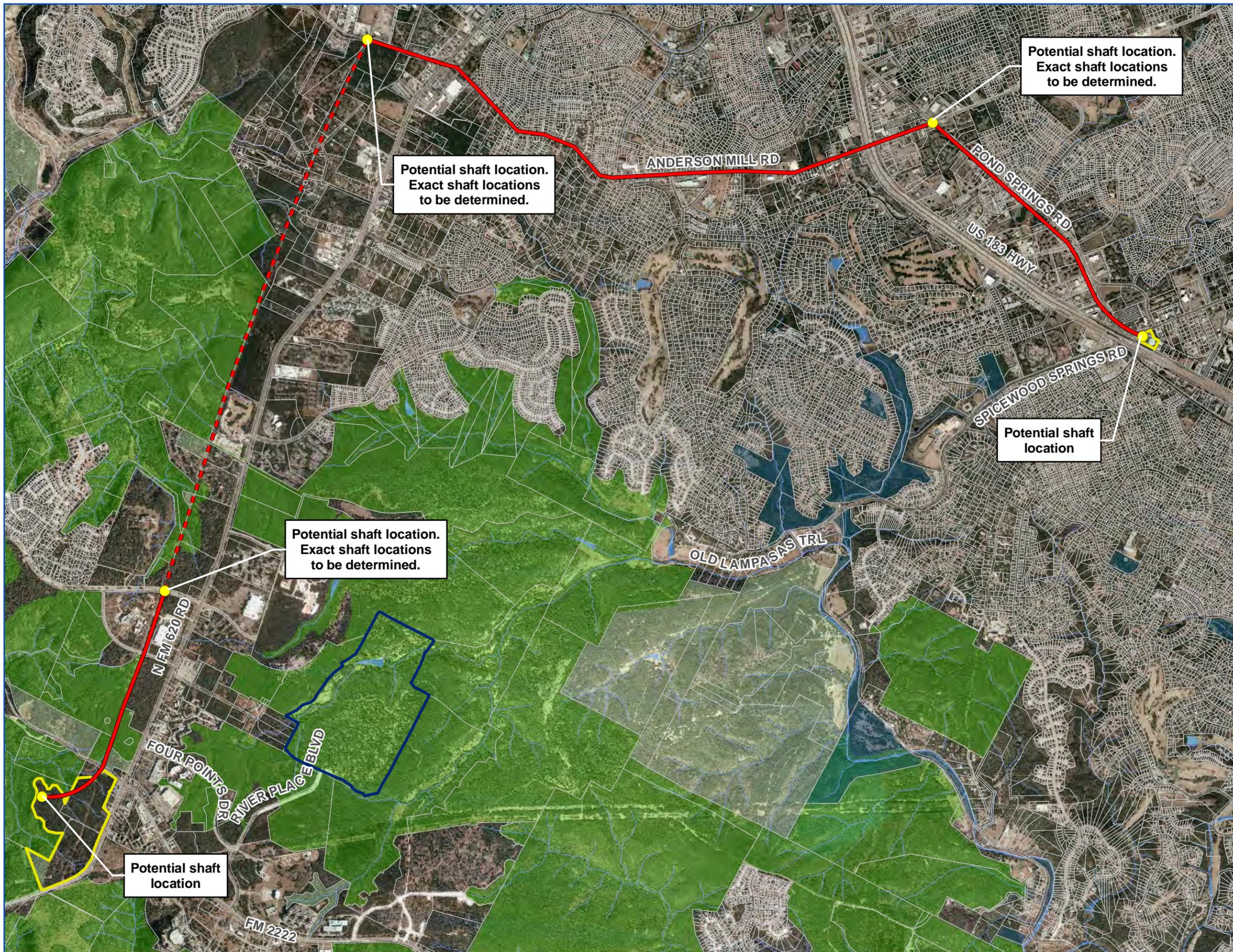
LEGEND

-  Shafts
-  Tunnel
-  Open Cut
-  Reservoir and WTP 4
-  Old WTP 4 Site
-  BCP
-  Potential Future BCP
-  City of Austin Parks
-  Creeks
-  Water
-  ROW/Property Lines



0 1,250 2,500
 Feet
 1 inch = 2,500 feet

**Alignment Alternative:
 Hybrid West-of-RM620
 Route**

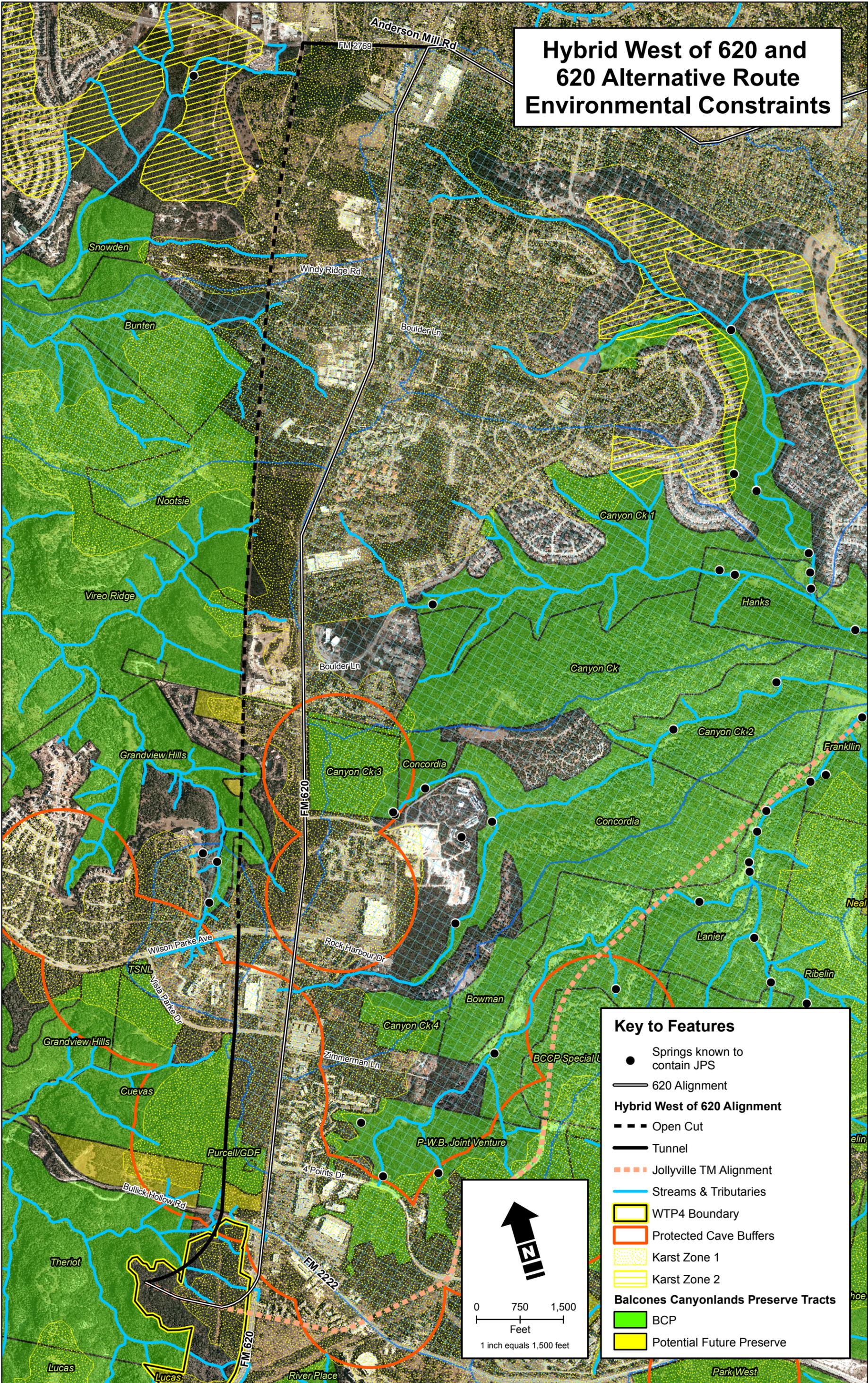




JOLLYVILLE TRANSMISSION MAIN

Appendix D
Environmental Constraints Maps

Hybrid West of 620 and 620 Alternative Route Environmental Constraints

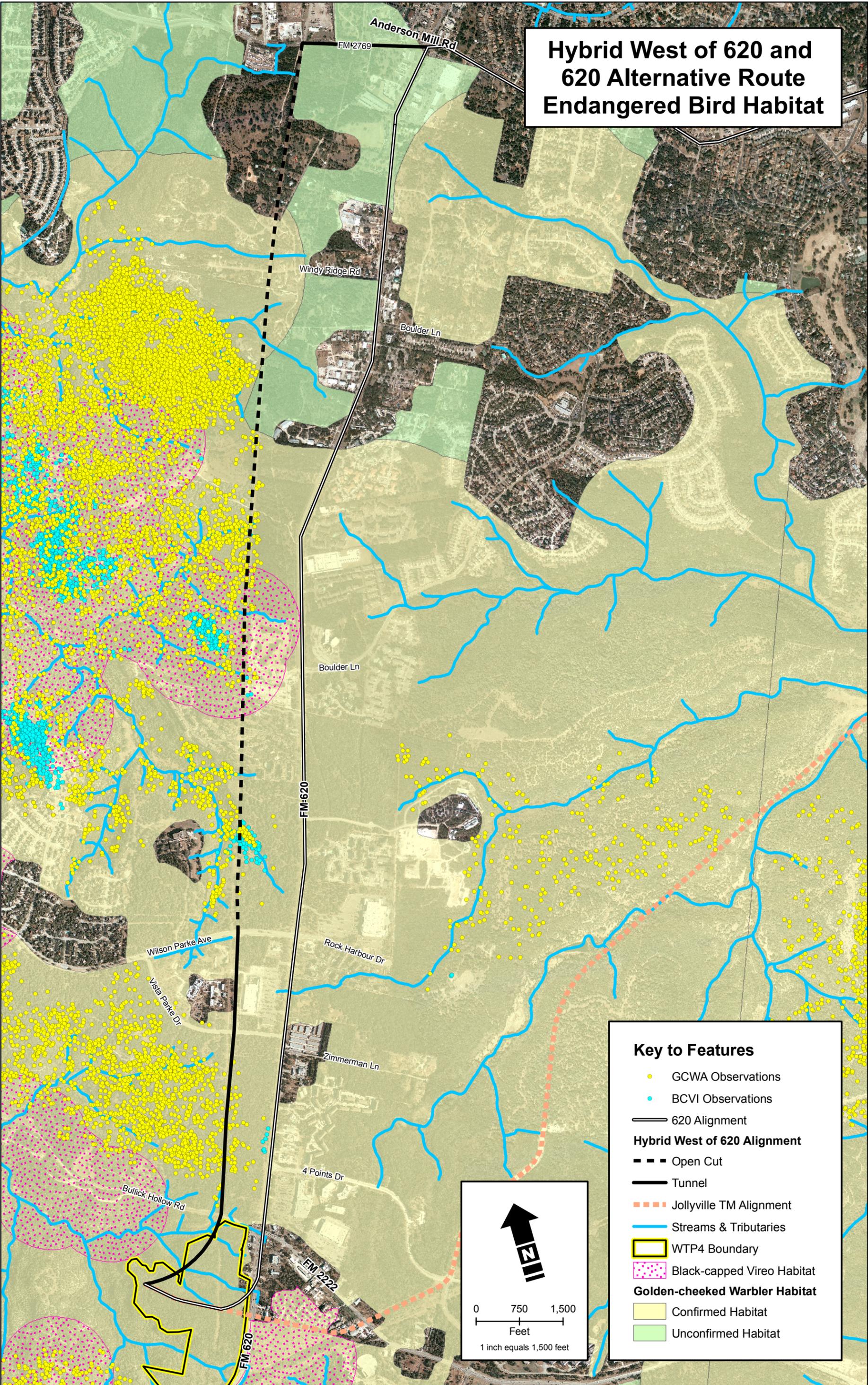


Key to Features

- Springs known to contain JPS
- 620 Alignment
- Hybrid West of 620 Alignment**
- - - Open Cut
- Tunnel
- - - Jollyville TM Alignment
- Streams & Tributaries
- ▨ WTP4 Boundary
- Protected Cave Buffers
- ▨ Karst Zone 1
- ▨ Karst Zone 2
- Balcones Canyonlands Preserve Tracts**
- BCP
- ▨ Potential Future Preserve

0 750 1,500
Feet
1 inch equals 1,500 feet

Hybrid West of 620 and 620 Alternative Route Endangered Bird Habitat



Key to Features

- GCWA Observations
- BCVI Observations
- 620 Alignment
- Hybrid West of 620 Alignment**
- Open Cut
- Tunnel
- Jollyville TM Alignment
- Streams & Tributaries
- WTP4 Boundary
- Black-capped Vireo Habitat
- Golden-cheeked Warbler Habitat**
- Confirmed Habitat
- Unconfirmed Habitat

