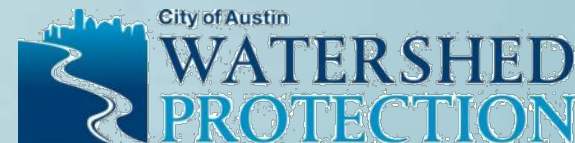


Environmental Mitigation and Action Plan Related to WTP4 Jollyville Transmission Main

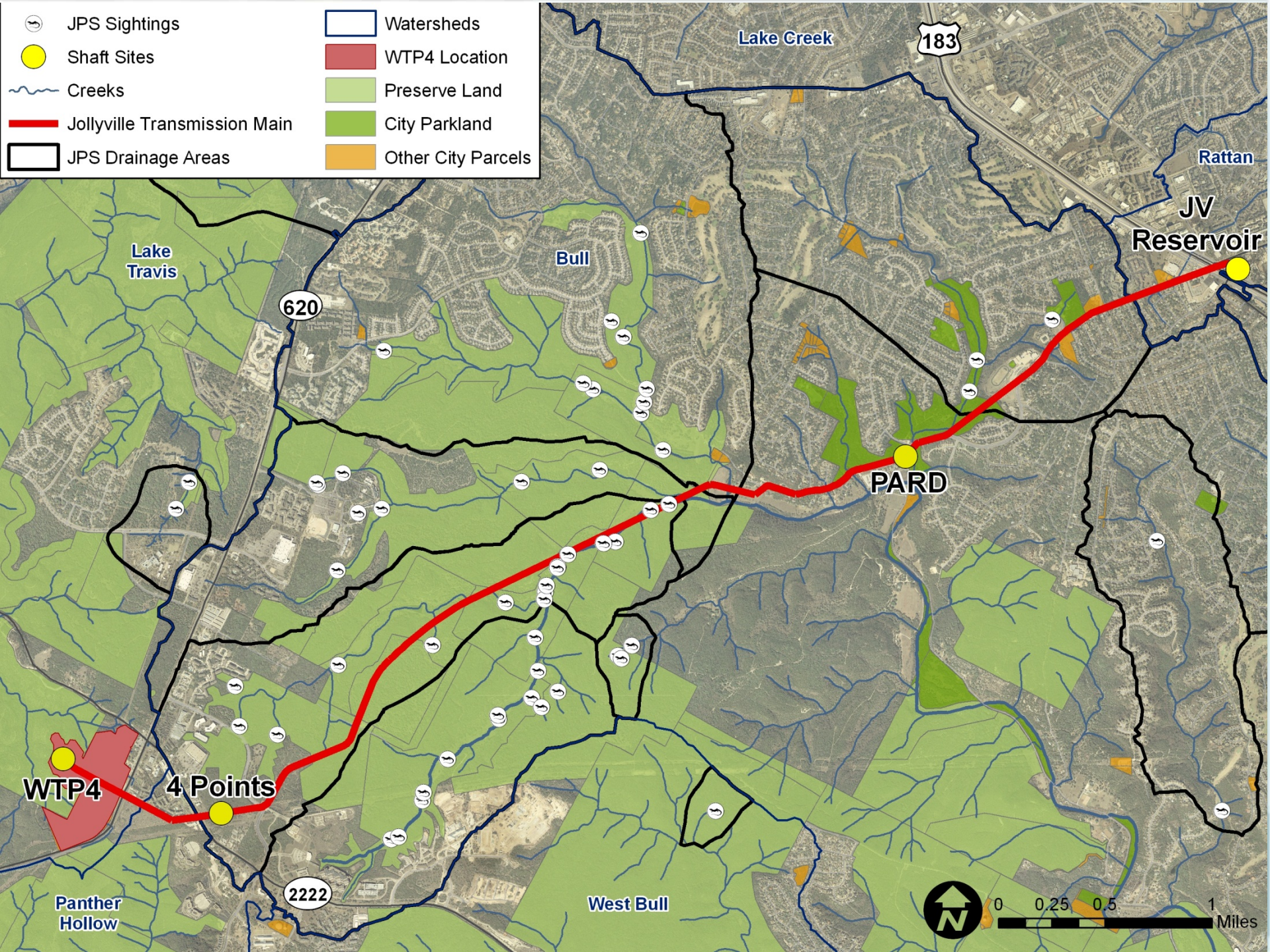
Briefing to Austin City Council
November 8, 2011



Overview

- Environmental Commissioning
- JTM area environmental assessment
- Environmental design features
- Monitoring and construction oversight
- Additional studies

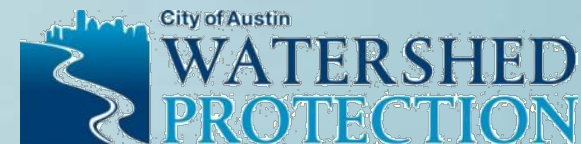




Environmental Commissioning

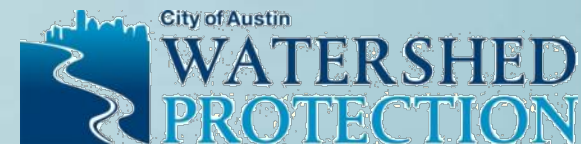
Independent effort using WPD staff and separate consultant team

- EC Team involved in all phases of JTM design
 - Groundwater assessment and other environmental analyses
 - Route and shaft location selection
 - Development of environmental protection design elements
 - Construction phase oversight
- Designed and implementing environmental impact monitoring program
- Funding provided by AWU



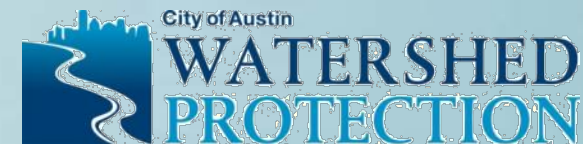
Key Issues & Questions

- Potential for tunnel to drain sensitive groundwater
- Potential for shafts to intersect groundwater flow paths
- Impacts to JPS habitat and Bull Creek
 - What do we need to know about geology and groundwater flow to assess these issues?
 - Is there an adequate data set to assess potential environmental impacts?
 - How can the JTM be designed to avoid and minimize environmental impacts?
 - How do we monitor for environmental effects?



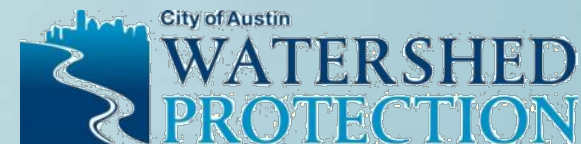
Environmental Team

Project Team	EC Team
<p>Austin Water Utility</p> <ul style="list-style-type: none">• Joe Hoepken, P.E.• Bill Stauber, P.E. <p>Public Works</p> <ul style="list-style-type: none">• Jason Bybel, P.E.• Stacie Long, P.E.• Robyn Smith <p>Black & Veatch</p> <ul style="list-style-type: none">• Dave Anderson, P.E.• Ray Brainard <p>Daniel B. Stephens & Assoc.</p>	<p>Watershed Protection Dept.</p> <ul style="list-style-type: none">• Chuck Lesniak• David Johns• Ed Peacock, P.E.• Tom Ennis, P.E.• Nancy McClintock <p>BCCP</p> <ul style="list-style-type: none">• Willy Conrad <p>Intera Consultant Team</p> <ul style="list-style-type: none">• Rick Scadden, P.E.• John Pickens, P.E.• Lauren Ross, P.E.



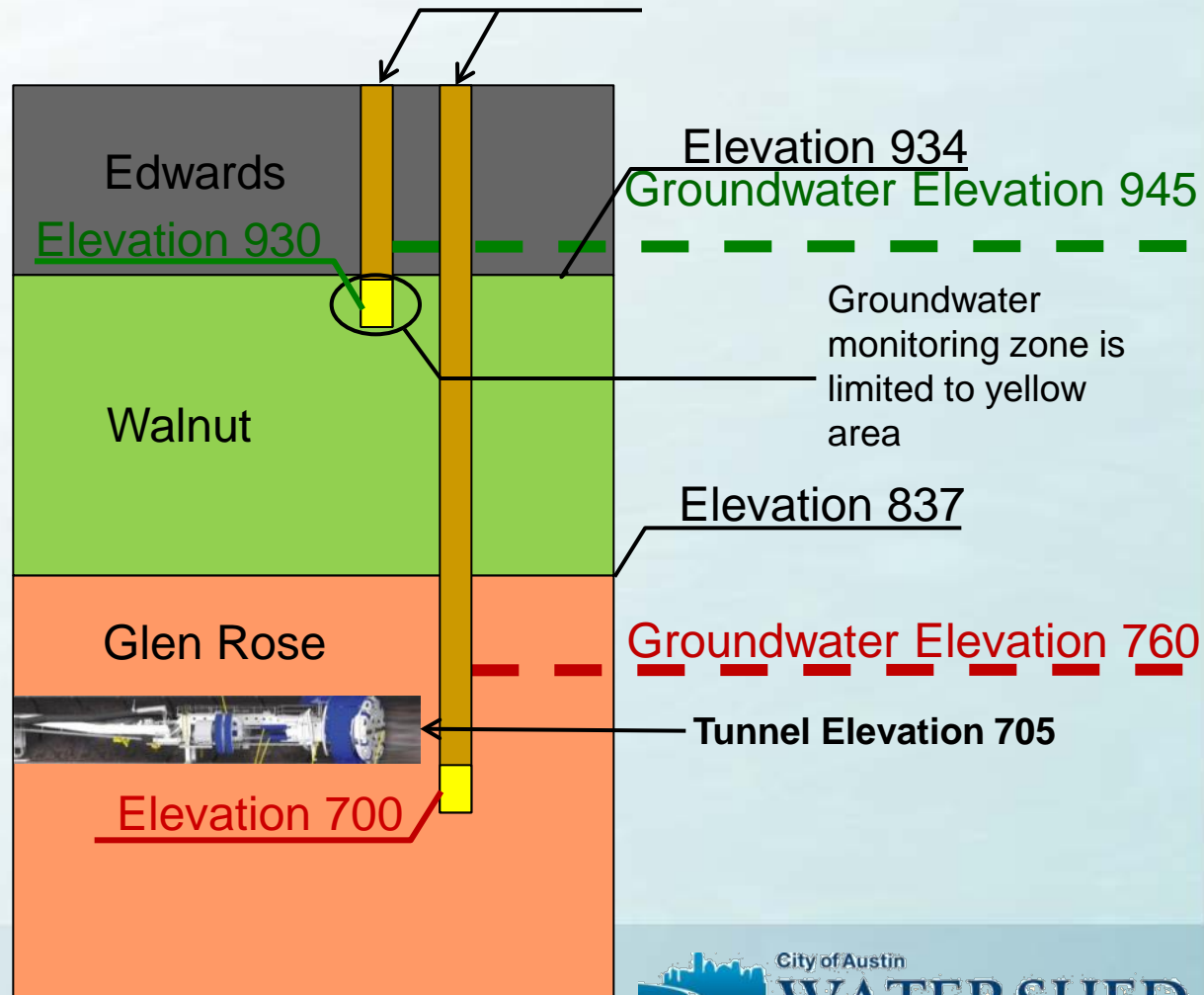
Data and Analysis

- 35 years of Bull Creek data for wells, springs, and streams (344 sites, 12,000+ unique samples)
- 38 geotechnical borings along JTM route
- 276 packer tests of hydrologic conductivity
- 22 monitoring wells for design phase assessment and construction phase monitoring
- Geological field mapping and core analysis
- Dye tracing (6 traces)
- Information from previous Glen Rose tunnels (2)

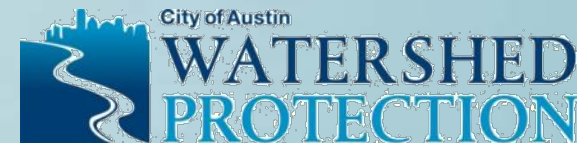


Groundwater Assessment

- Two groundwater flow systems:
 - Upper: Edwards, Walnut and uppermost Glen Rose
 - Lower: Glen Rose
- Poor connectivity between the 2 flow systems
- Tunnel in lower flow system
- Shafts will go through upper flow system



Drawing provided by Black & Veatch

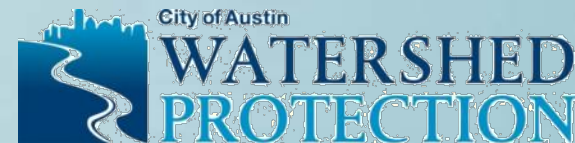


Environmental Risk Analysis

Tunnel

Low risk

- Fractures infrequent and tight
- Tunnel in low permeability zone
- **Poor connection** to shallow groundwater
- **Conservative** design approach warranted by proximity to Bull Creek and springs



Environmental Risk Analysis

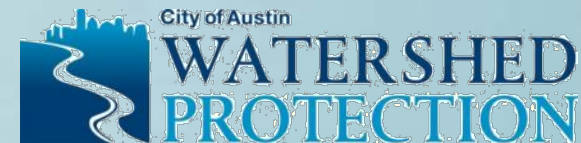
Shafts

Plant – Low risk as data indicates unlikely connection to Bull Creek area

Four Points – Moderate to high risk due to location over sensitive Edwards groundwater

PARD – Very low groundwater risk, low surface water risk due to proximity to Bull Creek

Reservoir – Low risk based on distance to sensitive springs



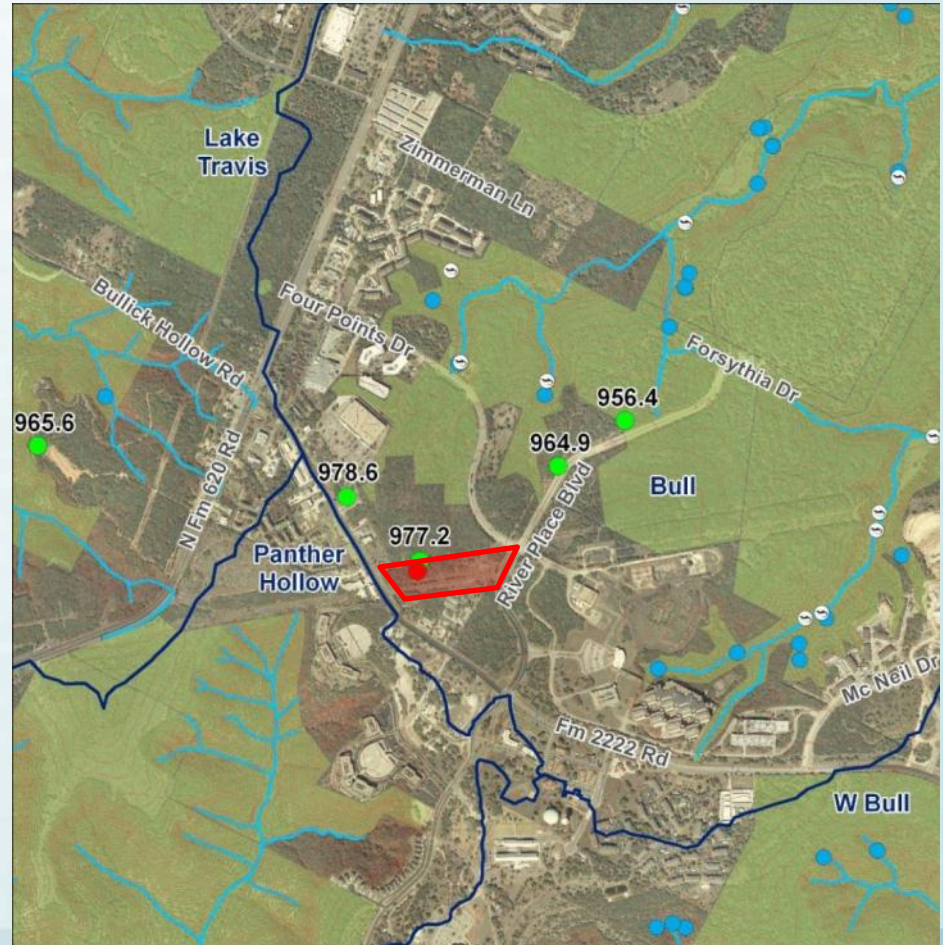
Env. Protection – Tunnel

- Tunnel risk minimized by depth and inflow mitigation
 - Tunnel below shallow groundwater and in less permeable portion of Glen Rose formation
 - Proactive mitigation of inflow above trigger levels



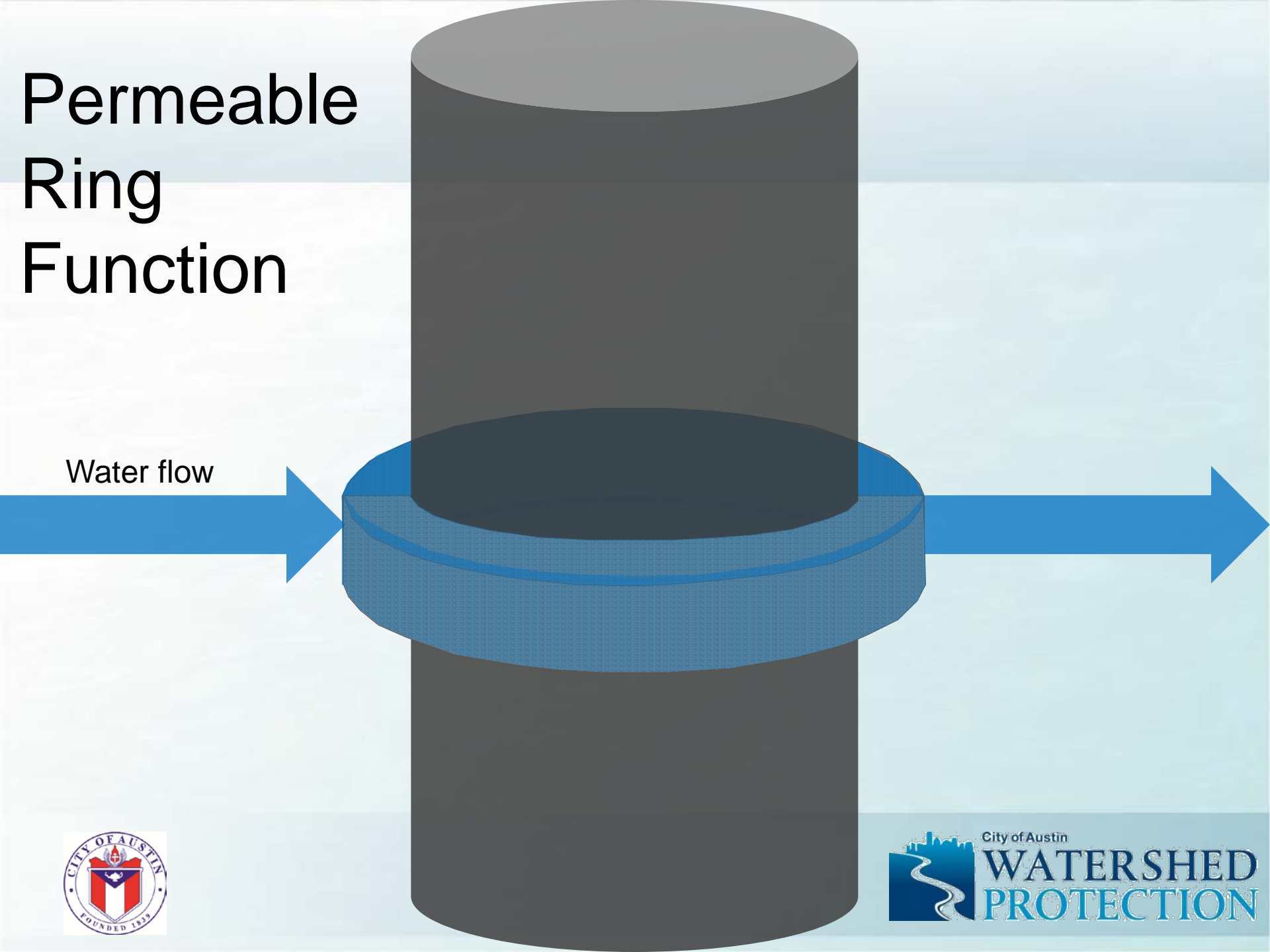
Env. Protection – Four Points

- Near groundwater divide and upper end of Bull Ck. watershed
- Springs in likely flow direction relatively distant ($> 2,300'$)
- Permeable rings to route water around shaft
- Any interrupted groundwater flow more likely to reach springs
- WPD geologists determine location of rings



Permeable Ring Function

Water flow

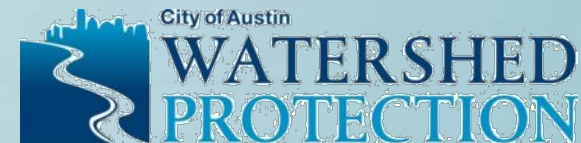


Permeable Ring 1 (26-30 ft)



Monitoring and Adaptive Management

- Monitoring of groundwater (wells) and surface water (springs, Bull Creek) for quality and quantity.
- Data compared to baseline and background sites
- Extensive environmental oversight during construction
- Adaptive management process to address possible impacts or respond to changes at construction sites



Upcoming Work

- Dye trace of permeable rings at 4 Points shaft to verify function and connectivity to nearby wells
- Age dating of groundwater in Edwards and Glen Rose to confirm groundwater model



Key Issues & Questions

Issue	Response
Potential for tunnel to drain sensitive groundwater	Low risk due to placement below shallow groundwater with poor connection to tunnel elevation
Potential for shafts to intersect groundwater flow paths	Low risk at 3 of 4 shafts, 4 Points shaft of most concern
Impacts to JPS habitat and Bull Creek	Risk to JPS and Bull Creek directly related to protection of groundwater



Key Issues & Questions

Question

Response

What do we need to know about geology and groundwater flow to assess these issues?

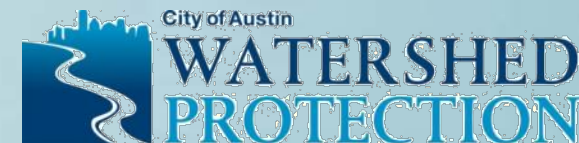
Developed groundwater model showing 2 poorly connected groundwater systems

Is there an adequate data set to assess potential environmental impacts?

Yes, extensive historical data available plus data developed specifically for this project

How can the JTM be designed to avoid and minimize environmental impacts?

Potential impacts addressed by tunnel placement and inflow mitigation and 4 Points shaft location and permeable rings



Conclusion

The EC Team, as a group, has concluded that the project design is well founded on robust data and analysis and that design is conservative and protective of springs, streams, and the Jollyville Plateau Salamander

