City *of* Tigard

Tigard Business Meeting –Agenda

TIGARD CITY COUNCIL & LOCAL CONTRACT REVIEW BOARD

MEETING DATE AND TIME:	APRIL 9, 2024 - 6:30 p.m. Business Meeting
MEETING LOCATION:	Hybrid - City of Tigard - Town Hall - 13125 SW Hall Blvd., Tigard, OR 97223 - See PUBLIC NOTICE below

PUBLIC NOTICE: In accordance with Oregon House Bill 2560, this will be a hybrid meeting where some Council, staff or public will participate in person and some will participate remotely.

How to comment:

- Written public comment may be submitted electronically at www.tigard-or.gov/Comments by noon the day before the meeting date.
- If attending the meeting in person, please fill out the public comment sign-in sheet at the front of the room and come to the microphone when your name is called.
- If you prefer to call in, please call 503-966-4101 when instructed to be placed in the queue. We ask that you plan on limiting your testimony to two minutes.
- You may comment by video through the Teams app. Go to this link to learn how to participate by video: April 9, 2024 Council Meeting (https://www.tigard-or.gov/Home/Components/Calendar/Event/5698/66).

Upon request, the City will endeavor to arrange for the following services:

- Qualified sign language interpreters for persons with speech or hearing impairments; and
- Qualified bilingual interpreters.

Since these services must be scheduled with outside service providers, it is important to allow as much lead time as possible. Please notify the City of your need by 5:00 p.m. on the Thursday preceding the meeting by calling: 503-718-2419 (voice) or 503-684-2772 (TDD - Telecommunications Devices for the Deaf).

SEE ATTACHED AGENDA

VIEW LIVESTREAM ONLINE: https://www.tigard-or.gov/boxcast

CABLE VIEWERS: The City Council meeting will be shown live on Channel 21 (1st Tuesdays) and Channel 28 (2nd & 4th Tuesdays) at 6:30 p.m. The meeting will be rebroadcast at the following times on Channel 28:

Thursday 6:00 p.m. Friday 10:00 p.m. Saturday 7:30 p.m. Sunday 11:30 a.m. Monday 6:00 a.m.

City *of* Tigard

Tigard Business Meeting –Agenda

TIGARD CITY COUNCIL & LOCAL CONTRACT REVIEW BOARD

MEETING DATE AND TIME: APRIL 9, 2024 - 6:30 p.m. Business Meeting

MEETING LOCATION: Hybrid - City of Tigard - Town Hall - 13125 SW Hall Blvd., Tigard, OR 97223

6:30 PM

1. BUSINESS MEETING

   A. Call to Order

   B. Roll Call

   C. Pledge of Allegiance

   D. Call to Council and Staff for Non-Agenda Items

2. PROCLAMATIONS AND RECOGNITION

   A. NATIONAL LIBRARY WEEK PROCLAMATION **6:35 p.m. estimated time**

3. PUBLIC COMMENT **6:40 p.m. estimated time**

   A. Follow-up to Previous Public Comment

   B. Tigard Area Chamber of Commerce

   C. Tigard High School Student Envoy

   D. Police Chief/Police Department Update

E. Public Comment – Written

F. Public Comment – In Person

G. Public Comment – Phone-In

H. Public Comment – Video

4. CITY MANAGER REPORT **6:55 p.m. estimated time**

5. CONSENT AGENDA: (Local Contract Review Board) The Consent Agenda is used for routine items including approval of meeting minutes, contracts or intergovernmental agreements. Information on each item is available on the city's website in the packet for this meeting. These items may be enacted in one motion without separate discussion. Council members may request that an item be removed by motion for discussion and separate action. **7:00 p.m. estimated time**

A. TYLER TECHNOLOGIES PUBLIC SECTION SOFTWARE SOLUTION

- *Consent Agenda - Items Removed for Separate Discussion: Any items requested to be removed from the Consent Agenda for separate discussion will be considered immediately after the Council has voted on those items which do not need discussion.*

6. TIGARD HISTORICAL ASSOCIATION PRESENTATION ON CURTIS TIGARD'S BIRTHDAY **7:05 p.m. estimated time**

7. LAUNCH POD BUSINESS ACCELERATOR UPDATE **7:15 p.m.estimated time**

8. TIGARD YOUTH ADVISORY COUNCIL 2024 NATIONAL LEAGUE OF CITIES CONFERENCE REVIEW **7:35 p.m.estimated time**

9. COMMUNITY SERVICE ORGANIZATION - JUST COMPASSION **7:50 p.m. estimated time**

10. ANNUAL JOINT MEETING WITH THE LIBRARY BOARD **8:10 p.m. estimated time**

11. HEAT PUMP ADOPTION PROGRAM WITH EARTH ADVANTAGE **8:30 p.m. estimated time**

12. RED ROCK CREEK TRAIL PREFERRED ALIGNMENT **8:40 p.m. estimated time**

13. NON-AGENDA ITEMS

14. EXECUTIVE SESSION: The Tigard City Council may go into Executive Session. If an Executive Session is called to order, the appropriate ORS citation will be announced identifying the applicable statute. All discussions are confidential and those present may disclose nothing from the Session. Representatives of the news media are allowed to attend Executive Sessions, as provided by ORS 192.660(4), but must not disclose any information discussed. No Executive Session may be held for the purpose of taking any final action or making any final decision. Executive Sessions are closed to the public.

15. ADJOURNMENT **9:10 p.m. estimated time**

AIS-5484 **2. A.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 5 Minutes

Agenda Title: National Library Week Proclamation

Authored By: Halsted Bernard

Presented By: Halsted Bernard, Director of Library Services

Item Type: Proclamation

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

Library teammates request National Library Week be proclaimed in Tigard.

ACTION REQUESTED

Mayor Lueb is being asked to proclaim April 7-13, 2024 as National Library Week.

BACKGROUND INFORMATION

First sponsored in 1958, National Library Week is a national observance sponsored by the American Library Association (ALA) and libraries across the country each April. It is a time to celebrate the contributions of our nation's libraries and librarians and to promote library use and support.

ALTERNATIVES & RECOMMENDATION

Mayor Lueb could choose not to issue a proclamation for National Library Week. Library teammates recommend its issuance.

ADDITIONAL RESOURCES

N/A

Attachments

Proclamation

Proclamation

City *of* Tigard

NATIONAL LIBRARY WEEK
APRIL 7-13, 2024

WHEREAS, libraries offer the opportunity for community members to connect with others, learn new skills, and pursue their passions, no matter where they are on life's journey;

WHEREAS, libraries have long served as trusted institutions, striving to ensure equitable access to information and services regardless of race, ethnicity, creed, ability, sexual orientation, gender identity, or socio-economic status;

WHEREAS, libraries adapt to the ever-changing needs of their communities, developing and expanding collections, programs, and services that are as diverse as the populations they serve;

WHEREAS, libraries are accessible and inclusive places that promote a sense of local connection, advancing understanding, civic engagement, and shared community goals;

WHEREAS, libraries play a pivotal role in economic development by providing resources and support for job seekers, entrepreneurs, and small businesses, thus contributing to local prosperity and growth;

WHEREAS, libraries make choices that are good for the environment and make sense economically, creating thriving communities for a better tomorrow;

WHEREAS, libraries are treasured institutions that preserve our collective heritage and knowledge, safeguarding both physical and digital resources for present and future generations;

WHEREAS, libraries are an essential public good and fundamental institutions in democratic societies, working to improve society, protect the right to education and literacy, and promote the free exchange of information and ideas for all;

WHEREAS, libraries, librarians, and library workers are joining library supporters and advocates across the nation to celebrate National Library Week;

NOW, THEREFORE, be it resolved that I, Tigard Mayor Heidi Lueb, proclaim

NATIONAL LIBRARY WEEK
April 7-13, 2024

During this week, I encourage all Tigard community members to visit Tigard Public Library and celebrate the adventures and opportunities they unlock for us every day.

Dated this__ day of April 2024

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of the City of Tigard to be affixed.

_____
Heidi Lueb, Mayor
City of Tigard

Attest:

_____
Carol A. Krager, City Recorder

AIS-5481	**5. A.**
Business Meeting	
Meeting Date:	04/09/2024
Length (in minutes):	Consent Item
Agenda Title:	Tyler Technologies Public Section Software Solution
Authored By:	Rosie McGown
Presented By:	Project Director Maiya Delgoda
Item Type:	Motion Requested
Public Hearing Newspaper Legal Ad Required?:	No
Public Hearing Publication Date in Newspaper:	

Information

EXPLANATION OF ISSUE

The purpose of this action is to approve a contract amendment to Tyler Technologies for software implementation services and credit card processing fees.

ACTION REQUESTED

Staff recommends the Local Contract Review Board award a contract amendment for $4,046,000 to Tyler Technologies and to authorize the City Manager to take all steps to execute the contract.

BACKGROUND INFORMATION

The Tigard-Tyler (T2) ERP implementation project is a citywide initiative to support the council goal, modernize and improve city services. This initiative will replace the city's legacy systems, integrate departments such as Finance, Human Resource Management, Asset Management, Permitting and Licensing, and Municipal Courts into a unified platform to streamline operations, improve service delivery, and enhance decision-making capabilities.

In FY 2021, the City of Tigard signed a 10-year contract with Tyler Technologies for software licenses and implementation services to support this significant digital transformation and the council goal, modernize and improve city services.

The current technology systems supporting core business functions are fragmented and outdated, resulting in inefficient processes and siloed data. Implementing T2 will bring many benefits, including real-time data access, process automation, improved reporting capabilities, and enhanced inter-department collaboration.

In FY 2021, the board authorized $6,400,000 to execute the Tyler Technologies contract, which included $4,800,000 for software licenses for 10-years and $1,600,000 for data conversion, implementation services, project management, and travel fees. The initial approval of the contract did not take into account credit card processing fees that would be transferred to Tyler Technologies from existing vendors when revenue modules are implemented.
Total expenses, including software license and implementation services, are projected to be $2,780,000 through FY 2024.

It is anticipated we will reach the current contract authority level of $6,400,000 in expenses at the end of FY 2027. The additional amount requested will provide funds to cover the software licenses fees and credit card fees in years 7 through 10 of the contract (FY 2028 – FY 2030). During a Council update (4/6/2024), the status of the Tyler contract and amendments were presented. In this update, it was acknowledged that an increase in spending authority was necessary to cover the amendments and credit card processing fees.

The contract amendment being requested covers the following:

- $446,000 for implementing the new road map, including $230,000 contingency.
- $3,600,000 for credit card processing fees, estimated at $600,000 per year from September 2024 through September 2030, the end of the 10-year contract term.

With the implementation of Tyler Payments through Utility Billing and Tyler Cashiering, credit card processing fees will move from our existing credit card processor vendor to Tyler Technologies.

ALTERNATIVES & RECOMMENDATION

The Local Contract Review Board may choose not to amend this contract.

ADDITIONAL RESOURCES

Previous council consent for contract award AIS-4413 09/22/2020
Tigard-Tyler Presentation to Council 04/06/2024

Fiscal Impact

Cost: 4,046,000

Budgeted (yes or no): Yes

Where budgeted?: IT and UB FY25 requested budget

Additional Fiscal Notes:

Implementation expenses are included in the IT budget for FY25, central services fund; credit card fees are included in the department budget that incurs the fees and are budgeted annually based on anticipated volume. Utility Billing, central services fund, incurs most of the credit card processing fees for the City. Central services are funded through the internal cost allocation plan that charges departments proportionately for services.

Like other multiple-year contracts, expenses will also need to be budgeted in all future fiscal years for the duration of the contract.

Attachments

Tigard-Tyler Presentation to Council



City Council Goals 2023-2025 Progress Reports: Tyler & Climate

April 6, 2024

City Council

Tigard: An equitable community that is walkable, healthy, and accessible for everyone.

CITY OF Tigard

Tigard-Tyler (T2) Implementation Project

A shared platform to support city's core business systems for improved & equitable service delivery.

Overview

- Implementation Strategy
- Project Governance
- Scope of Work
- Implementation Roadmap
- Expense Categories and Budget
- 10-year Tyler Technologies Contract Budget
- Next Steps

Tigard-Tyler (T2) Implementation Strategy

- **Redefined as an organization wide initiative**
  - Prioritized T2 in the FY24, FY25 & FY 26 budgets.
  - Defined structure for project governance.

- **Transitioned to a resource-based implementation strategy**
  - Developed a new & realistic implementation roadmap.
  - Identified vendor services to support the new T2 roadmap.
  - Identified resources & estimated budget.
    1. Tyler Technologies 10-year contract
    2. Consultant support
    3. Legacy systems
    4. Internal FTE support needs

GOVERNANCE

Project Leadership

Leadership Team

Steve Rymer	James McDonald
Emily Tritsch	Kenny Asher
Kathy Nyland	Kent Wyatt
Brian Rager	Maiya Delgoda
Halsted Bernard	Shelby Rihala
Eric Kang	Jennifer Curran

Executive Sponsor

Steve Rymer

Advisory Team

Maiya Delgoda, Project Director – City of Tigard

Eric Kang, *Finance Director – City of Tigard*

<Phase Sponsor>, Department Director –City of Tigard

Project & Change Management

Project Management Team

Jonnese Kaminski –Engagement Manager, Tyler Technologies

Maiya Delgoda, Project Director – City of Tigard

Jeanne Robson – Project Manager, IT Department

Kevin Hoffmann – Project Manager, IT Department

Change Management Team

Maiya Delgoda, Project Director – City of Tigard

Kent Wyatt – Director, Design and Communications

Nicole Hendrix –Management Analyst

Jeanne Robson – Project Manager, IT Department

Kevin Hoffmann – Project Manager, , IT Department

Will Traylor – End-user Trainer, IT Department

TBD– Change Lead

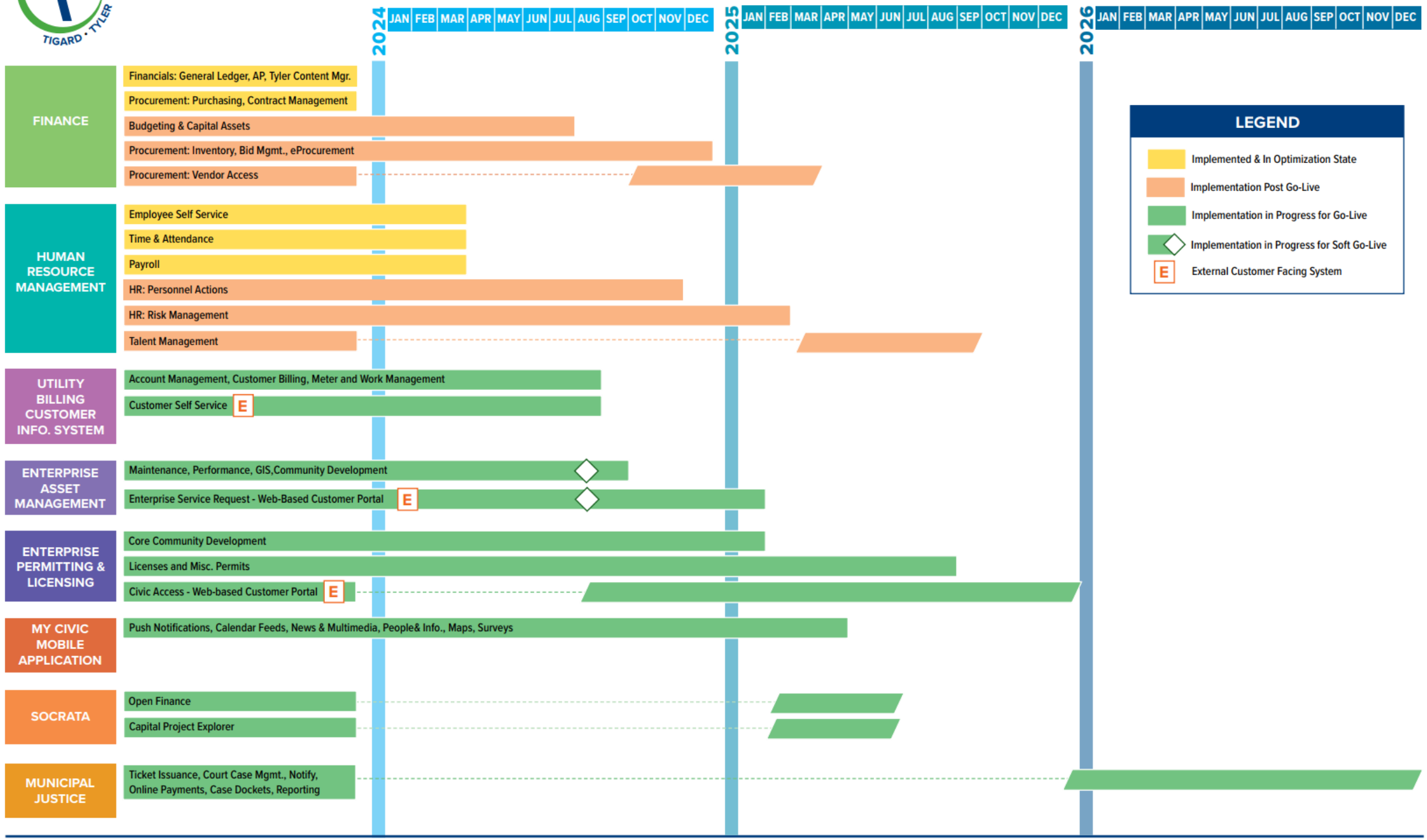
Core Team

Finance	HRM	Utility Billing	EPL	EAM	IT	Customer Portals
Eric Kang/ Lisa Yeo Jeanne Robson	Jennifer Curran Cassie Tyler Jeanne Robson	Darren Black Kevin Hoffmann Gigi Elliot	Susan Shanks Jeanne Robson	Sammy Rico Kevin Hoffmann	Ben Kearns	Nicole Hendrix TBD

SCOPE OF WORK: TYLER MODULES

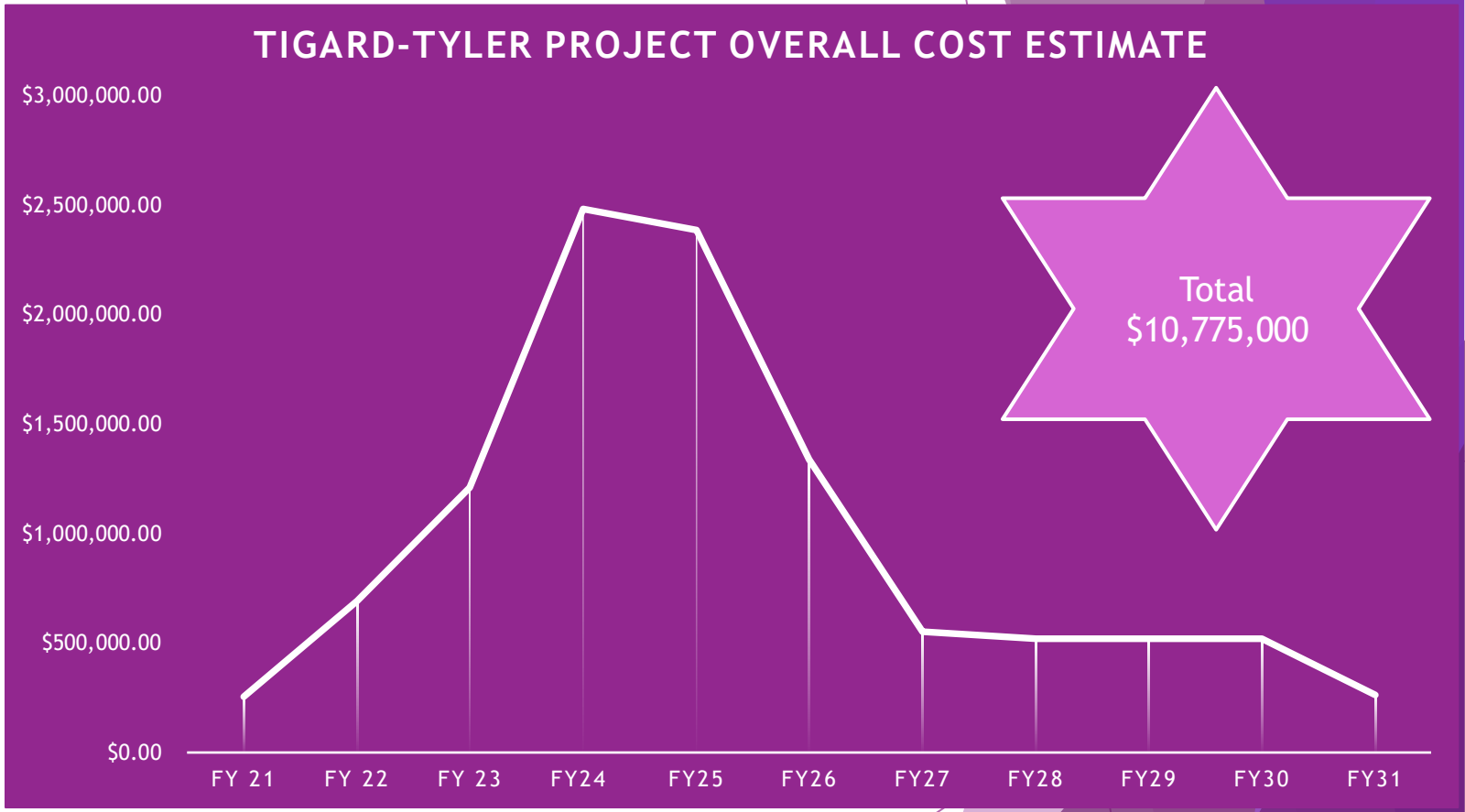


TIGARD · TYLER 2024-2026 ERP Implementation Roadmap

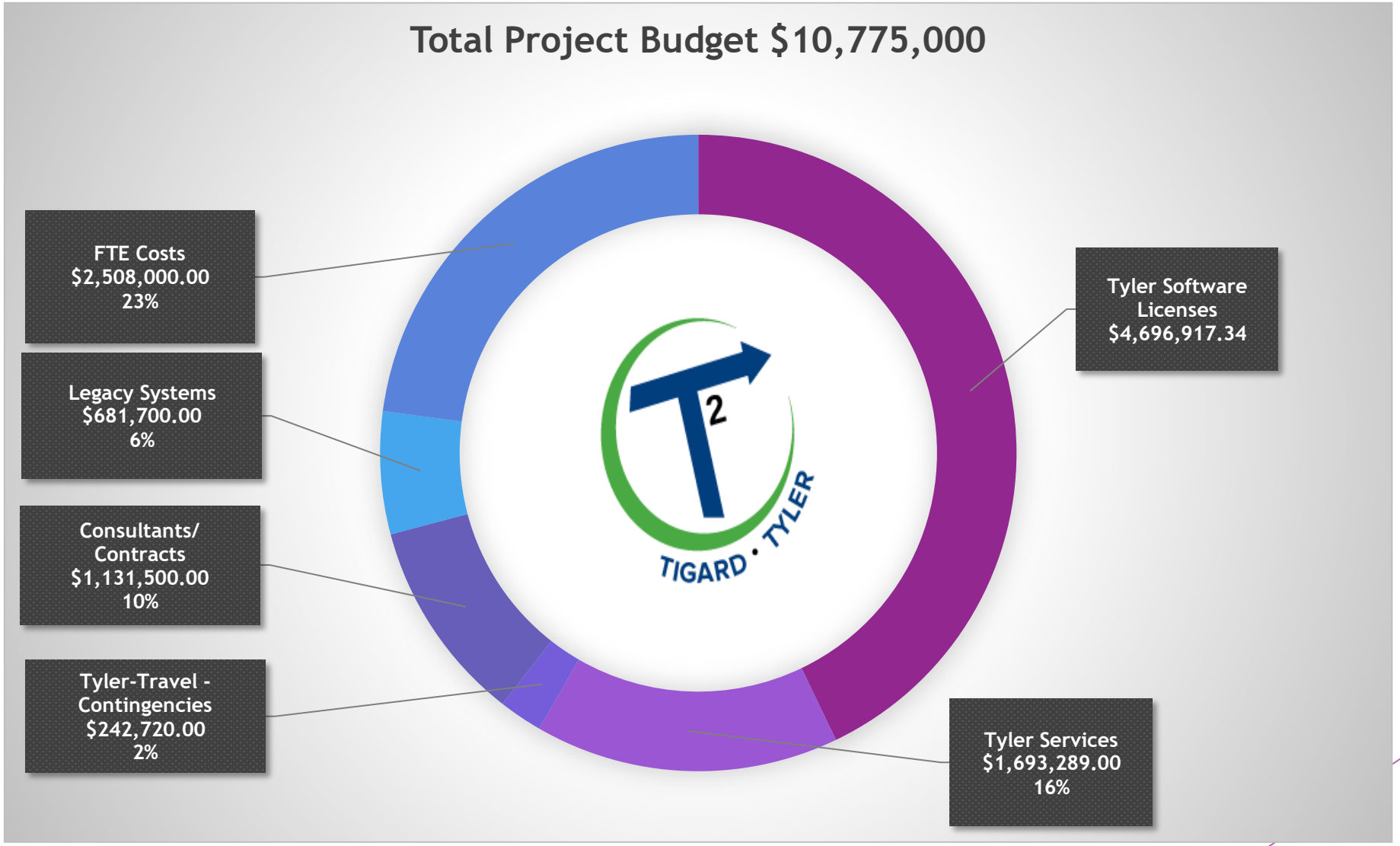


T2 BUDGET FY 21 – FY 31

1. Tyler Technologies – 10-year contract
2. Consultant Support
3. Legacy Systems
4. Internal Resources - FTE



DISTRIBUTION OF BUDGET



10-YEAR TYLER TECHNOLOGIES CONTRACT BUDGET

Execute SaaS & Services Contract

- Council authorization $6.4M for 10-year contract.
- Amendment #1 to include licensing quote for 10 years & payment schedule.
- Amendment #2 added implementation services

Extension of timelines

- Amendment #4, #5, #6 added implementation services.
- Added SaaS products, Decision Engine & Resident Access
- Assessed project performance – VIE consultants

Added Services

- Amendment #3 added project management services.

Implement new roadmap

- Amendment #7 extension of timeline
- Amendment #8 removed unused SaaS products
- Amendment #9 added services to support new T-2 implementation roadmap.

FY 21	FY 22	FY 23	FY 24

Contract amount $3,505,672	Amendment 1,2 $2,550,962	Amendment 3 $244,100	Amendment 4,5,6 $388,456	Amendment 7,8,9 $156,992	Tyler Credit Card Fees

Contract Total

$6,846,182

Authorized 10-year budget $6,400,000

Recommend to increase spending authority

FY 21

Expenses through FY 24 $2,780,000

FY 31

NEXT STEPS

- **April 9, 2024: AIS to increase spending authority**
  - $446,000 to cover previous and current amendments.
    - Includes $230,000 contingency
  - $3.6M to cover for Tyler credit card fees.
    - Change in vendor
    - Equal to current fees

AIS-5474 **6.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 10 Minutes

Agenda Title: Tigard Historical Association Presentation on Curtis Tigard's Birthday

Authored By: Carol Krager

Presented By: Margaret Doherty

Item Type: Update, Discussion, Direct Staff

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

Members of the Tigard Historical Association will give a short presentation about Curtis Tigard.

ACTION REQUESTED

No action requested.

BACKGROUND INFORMATION

Curtis Tigard was the grandson of Tigard's founder and died at the age of 109 in 2018. Mr. Tigard served on many boards, including the Tigard School District, Tigard Water District and the Chamber of Commerce. He enjoyed sharing the early history of Tigard, participating in Tigard Historical Association and city events. His birthdays were often public celebrations, with cake served at the library and the community invited to attend.

ALTERNATIVES & RECOMMENDATION

N/A

ADDITIONAL RESOURCES

N/A

Attachments

Presentation

Curtis Tigard

A presentation by

the

Tigard Historical

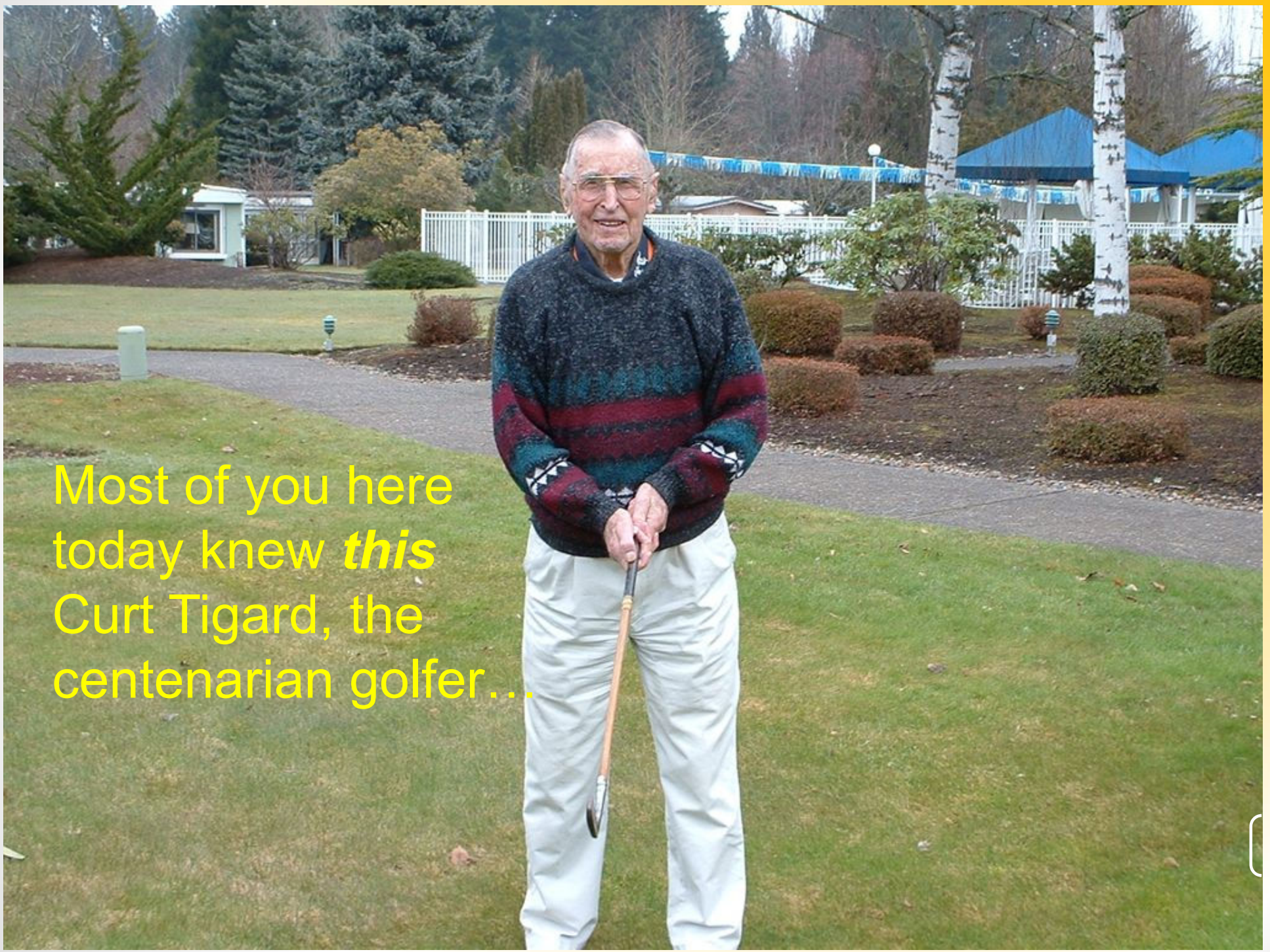
Association

To the

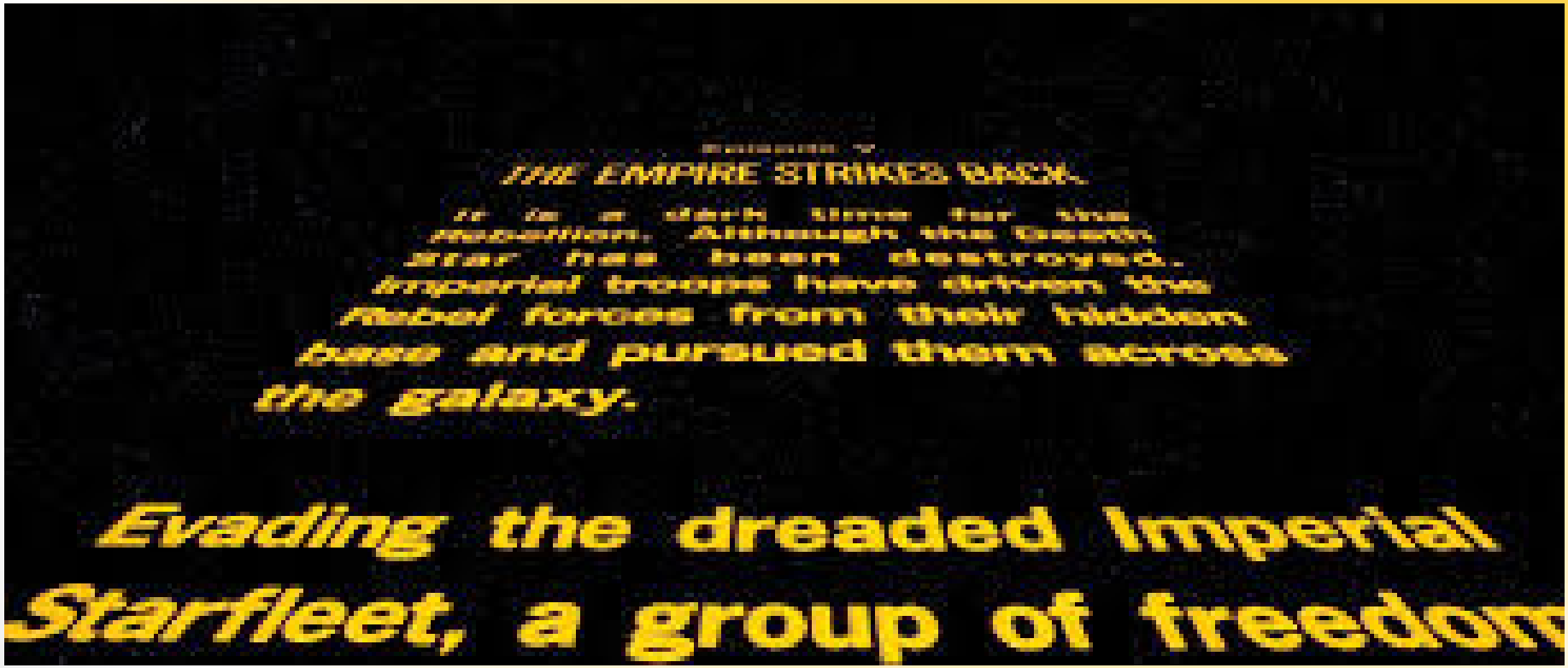
Tigard City Council

April 9, 2024




Most of you here today knew *this* Curt Tigard, the centenarian golfer…

But, A Long Time Ago...





Curtis Tigard was born on April 13, 1909





Curt's parents, Rosa Hohman and Charles Fremont Tigard

Charles was born in 1860, Rosa in 1870

Married on May 22nd, 1892





Charles F. Tigard served two terms in the Oregon Legislature and was the first postmaster for Tigard.

The post office was located in his General Store, which was located on the northeast corner of McDonald Street & Hwy 99, near the current Goodwill store.



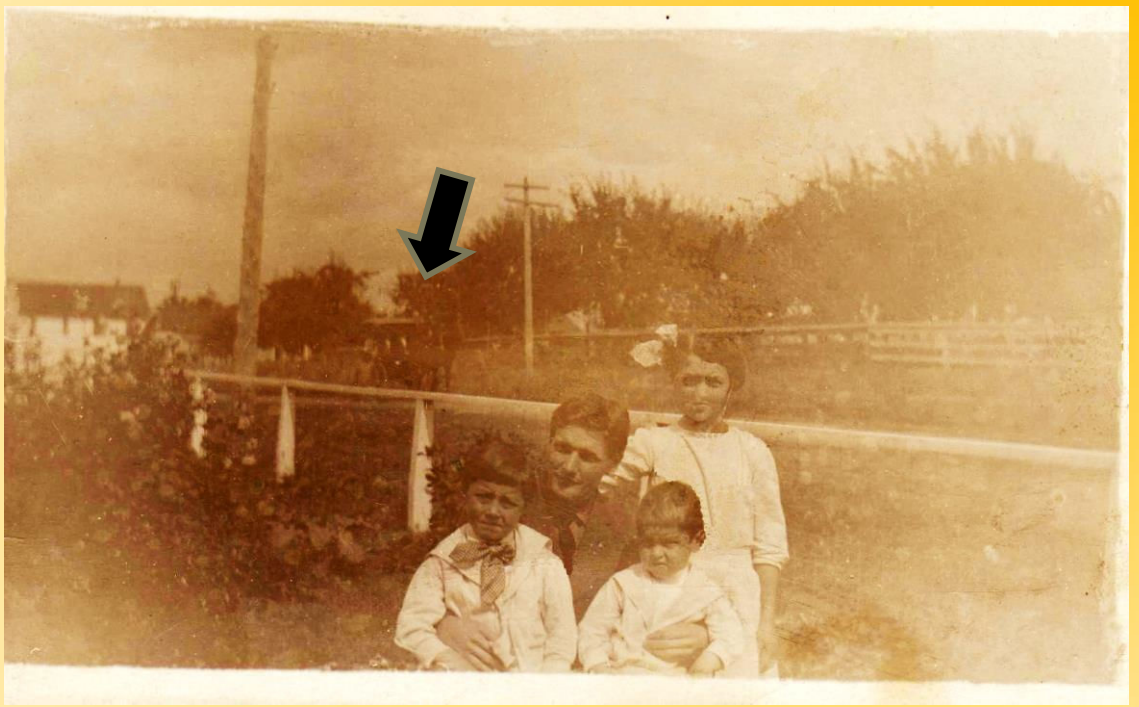
The Tigard Family in their garden. Charles, Rosa, Grace, Curtis and George

Curtis, George and Trixie



George, Curtis, and Grace pose for a photograph with Mr. Tonkin, a family friend.

Notice the horse and buggy in the background?





Marvin Gaarde, Curt, and Leonard Thomas relax in the grass in front of the house.

On Armistice Day, Curt and his friends rang the church bells to announce the end of WWI.

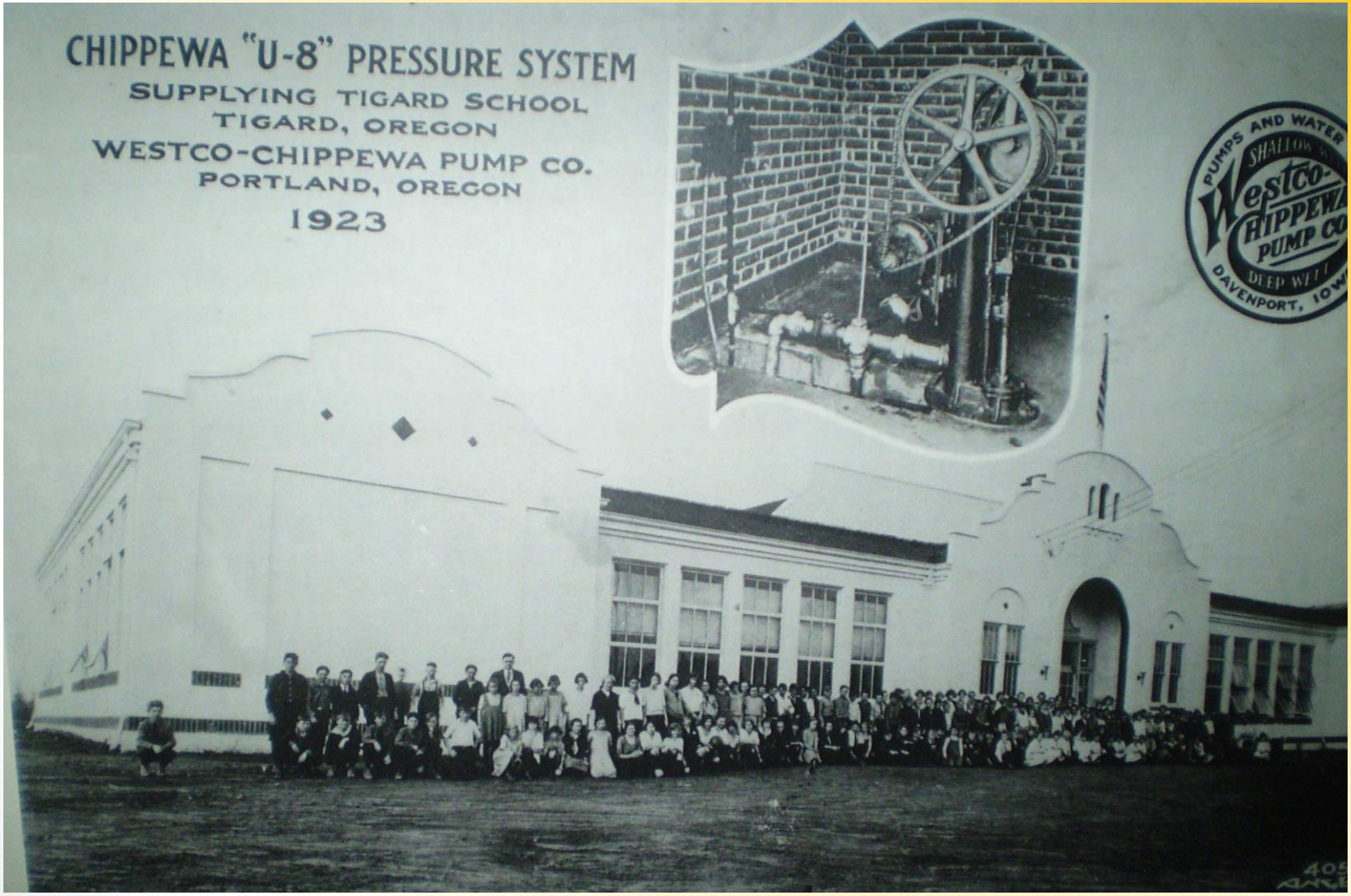
This was the East Butte Grade School. It was built around 1898.

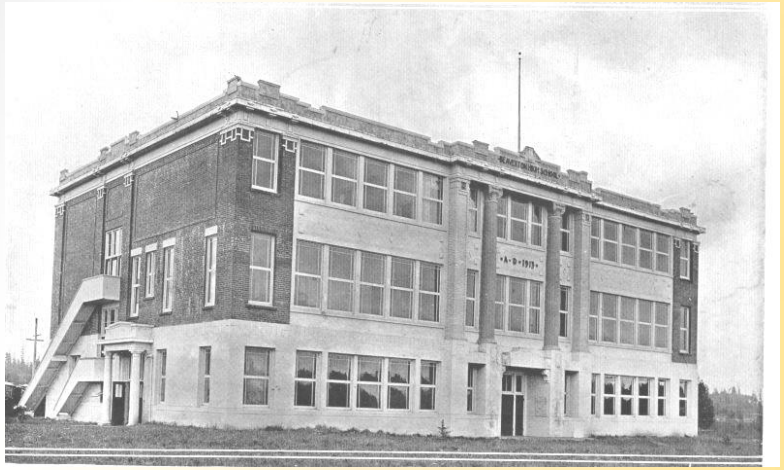


In 1918 Curt and Marvin Gaarde rescued books from their school as it burned.

Curt was 9 years old!

The new Tigard Grade School, completed in 1923





As a teenager, Curt attended Beaverton High School because Tigard hadn't built one yet.

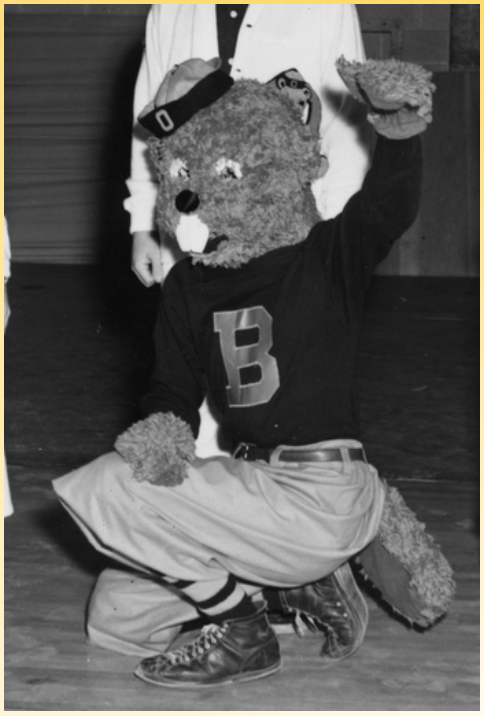


Curt lived with friends in Beaverton during the week and came home on weekends to help on the farm.

After graduating from high school, Curt attended Oregon Agricultural College (now OSU), graduating in 1930.



Tuition was $12 per term then and is currently $8,538 per year.



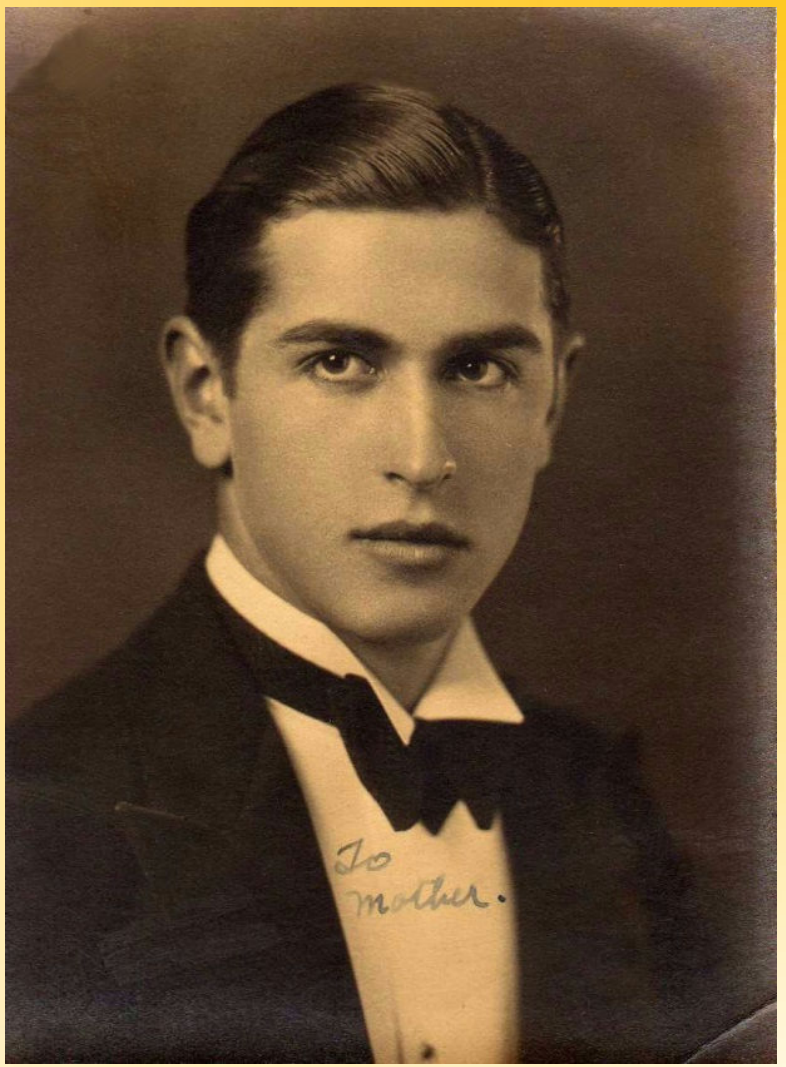
In his freshman year, Curt and five friends rented a house; sharing cooking and laundry duties.

He also joined the Army ROTC program which paid him $57 per quarter. By the time he graduated, Curt was a 2nd Lieutenant.



1929 brought the stock market crash and the beginning of the great depression.

Here is Curt's OAC graduation picture from 1930.



In 1935, Curt went to work for US National Bank in Albany, Oregon.

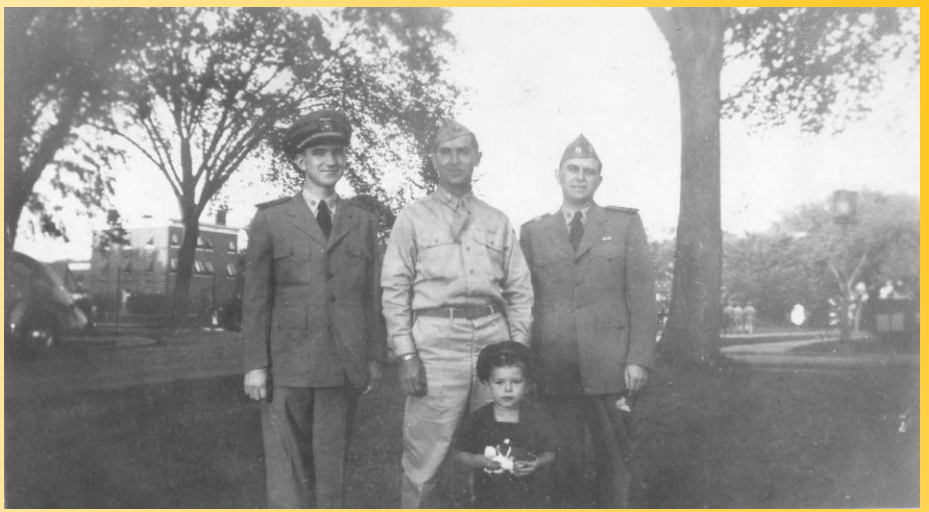
He was also a member of the Army Reserves and was stationed at Ft. Vancouver Barracks.





Then came December 7th, 1941…





Like so many Americans during that time, Curt joined the war effort to help achieve victory over enemy forces.

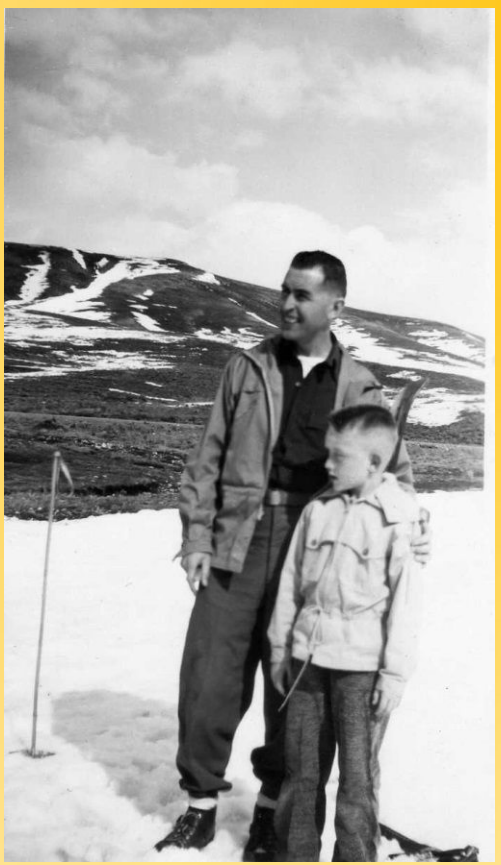
He served initially in North Africa, working to drive the Nazis out of Casablanca. He later served in Italy as the German army retreated.

In 1944, Curt transferred to Washington DC where he worked at The Pentagon.

His assignment was to scour military records for officers who were qualified to lead the invasion of Japan, an event he says thankfully never happened.









The end of the war brought time for family activities and fun.

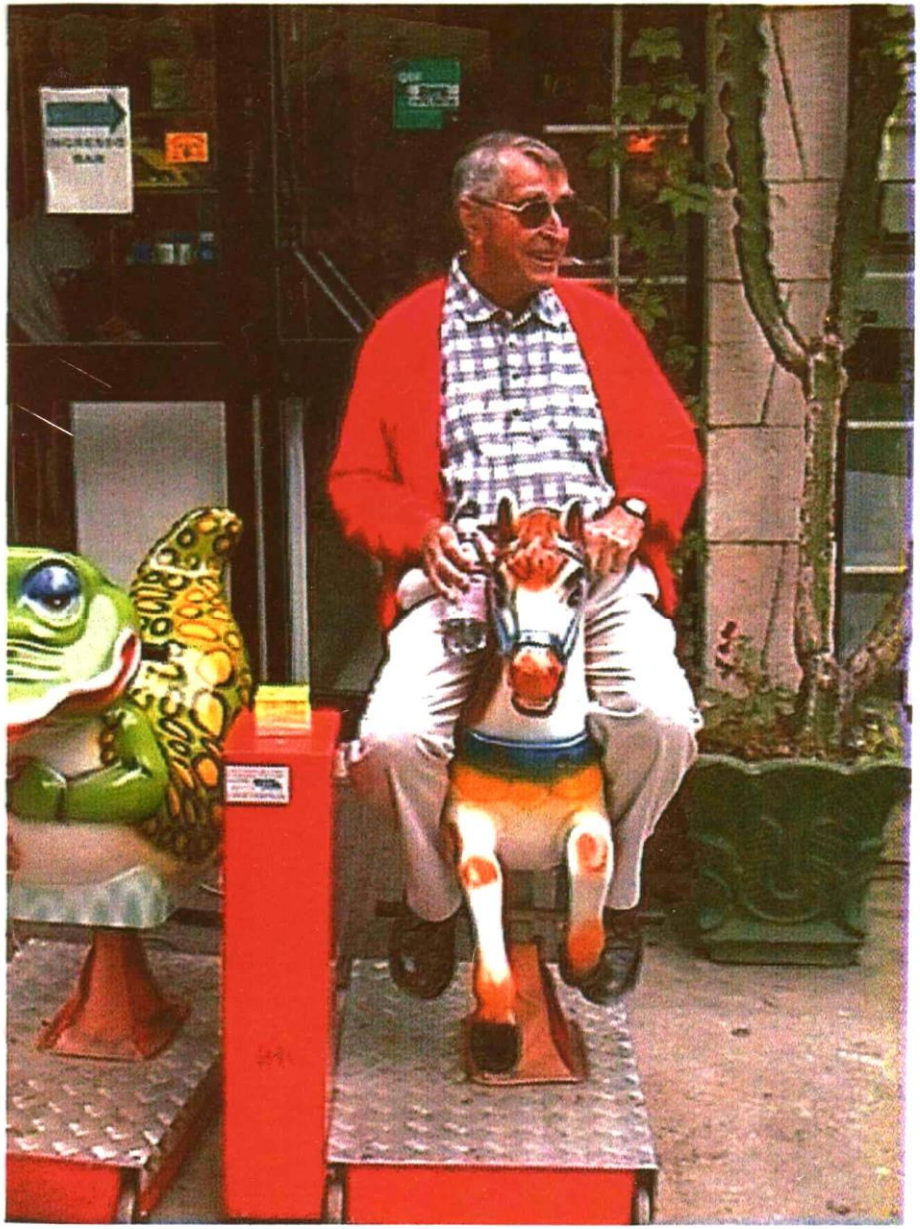
Back in civilian life, Curt went to work for US Bank, serving as the Tigard Branch Manager for eighteen years.



After retiring from US Bank, Curt had time for more fun activities, like golf with his buddies in Palm Springs. Curt is on the far right.

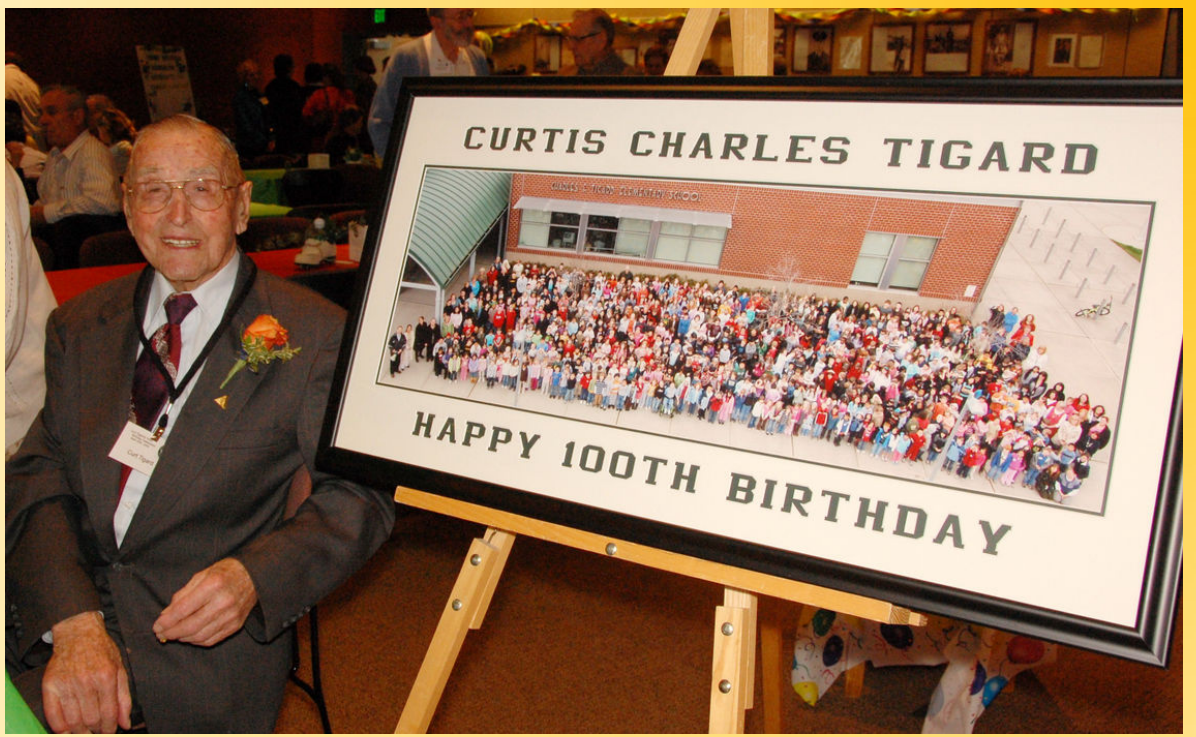


... and attempts to make a clean getaway on a horse of a different color in Sicily.



Three-digit birthdays!









Distinguished 1926 Beaverton High School Graduate!









Curt shows his flair for style with his sporty red Oldsmobile.



Curtis left us on July 25, 2018



He was one of "The Greatest Generation" even though he was shy about the title. Curtis was a man of great character and served all the citizens of Tigard.

www.tigardhistorical.org

AIS-5268 **7.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 20 Minutes

Agenda Title: Launch Pod Business Accelerator Update

Authored By: Lloyd Purdy

Presented By: Lloyd Purdy

Item Type: Update, Discussion, Direct Staff

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

Modeled after the City's *Opportunity Café* business incubator at the Tigard Public Library, Tigard's *Launch Pod Business Accelerator* is the city's second business incubator supporting minority entrepreneurs. The goal of this program is to remove barriers-to-entry for new entrepreneurs, provide a food amenity at Universal Plaza, and add to the diversity of food offerings in downtown Tigard.

Initially, entrepreneurs renting one of two city-owned food carts pay reduced rent in exchange for use of the cart. Upon leasing the space, entrepreneurs have 18 to 24 months to perfect their business operation. Rent gradually increases over the course of the lease. As a requirement of their lease, entrepreneurs also benefit from ongoing business advising from a business coaching program. At the end of the lease, entrepreneurs graduate from the *Launch Pod*. Then, new entrepreneurs are invited into the business incubator to begin the process anew.

ACTION REQUESTED

No Council action requested. This is an opportunity to meet the entrepreneurs in the Launch Pod business accelerator.

Juliana Mosely, owner of *Harvest Moon Experience*, has launched from the green cart and is opening Harvest Moon Sangria Bar at 12553 Main Street in the building next to Fanno Creek. She expects to be open in March 2024. Brothers Joshua & Alfredo Carreon, owners of *West Coast Torta*, will continue operating out of the city-owned orange cart for the remainder of their lease, which will continue through summer 2024.

In March 2024, two new entrepreneurs will start their business at the Launch Pod. Jay Kwon will open *Wow Cow* serving cheesesteak sandwiches with a Korean influence. Jay will furnish his own cart in the three-cart lineup. Mia Selders will open *Nunny & Pheebs* ice cream in the city-owned green cart. Her menu will include ice cream as well as sandwiches, coffee and teas.

The addition of a third (privately owned) cart into the Launch Pod lineup will attract more visitors to the plaza and to the carts with a balanced mix of food offerings.

BACKGROUND INFORMATION

This initiative is one way Tigard's economic development programs advance the city's strategic vision "Tigard: An equitable community that is walkable, healthy and accessible for everyone." Relevant economic development objectives from the City's Strategic Vision include:

- Ensure all businesses can easily connect to resources that help them grow and add value to the community.
- Build a resilient local economy in which residents' health and the health of local businesses increase together.
- Support a balanced, diverse mix of business sectors and employment opportunities. Advance equitable economic opportunity.

This business incubator innovates by utilizing two city-owned food carts as low-cost startup locations for entrepreneurs at Universal Plaza in downtown Tigard. The carts were constructed for the City of Tigard by Portland-based Pacific Northwest Food Trucks and Trailers in 2022 to provide a versatile platform for a range of food-focused entrepreneurs. The two city-owned food carts are outfitted as Class IV commercial kitchens. The City of Tigard received $70,000 in funding from Washington County to support this new business assistance program. The city also received a $12,000 grant award from the AARP Community Challenge to support the Launch Pod's initial startup expense. The balance of funding (about $30,000) came from the City of Tigard's ARPA allocation.

The entrepreneurs hosted at the Launch Pod were selected from an intensive interview process and clearly articulated their entrepreneurial spirit through the selection process, submitting the following:

- Sample menu with products and pricing.
- Business model summary.
- Eighteen-month marketing plan with actions and expenses by week or month.
- Eighteen-month financial forecast by month.
- Startup cost analysis. Break-even analysis.

The rigorous, but fundamental, business preparation requirements for these first-time entrepreneurs, and the continuing business coaching provided is one way this business incubator helps the participating entrepreneurs succeed in launching their business.

ALTERNATIVES & RECOMMENDATION

Welcome the new Launch Pod entrepreneurs to Tigard and encourage their growth as business owners.

ADDITIONAL RESOURCES

N/A

Attachments

Presentation Slide

Meet the Entrepreneurs



AIS-5444	**8.**
Business Meeting	
Meeting Date:	04/09/2024
Length (in minutes):	15 Minutes
Agenda Title:	Tigard Youth Advisory Council 2024 National League of Cities Conference Review
Authored By:	Alexandra Richardson
Presented By:	Alex Richardson, Management Analyst; TYAC President Areana Mann, TYAC Vice President Shriya Myneni, and Youth Councilor Madi Vogel
Item Type:	Update, Discussion, Direct Staff
Public Hearing Legal Ad Required?:	No
Publication Date:	

Information

EXPLANATION OF ISSUE

The purpose of this item is to debrief the Council on the experiences of the three Tigard Youth Advisory Council (TYAC) Delegates at the National League of Cities Congressional Cities Conference, March 10-13, 2024 in Washington, D.C. Management Analyst Alex Richardson chaperoned Youth Councilor Madi Vogel, TYAC President Areana Mann, and TYAC Vice President Shriya Myneni on this trip.

ACTION REQUESTED

Informational only; no action requested.

BACKGROUND INFORMATION

Each youth delegate will highlight their most memorable experiences of the trip, what they learned, and how the conference sessions affected their view of government.

Each year, the Washington, D.C. Congressional Cities Conference includes a Youth Delegation track with sessions for youth advisory council members. This portion of the conference allows youth council members to network with other youth delegates, observe how their councils work, and appreciate the benefits youth bring to city hall in their own towns. Youth sessions this year included such topics as city ordinances, park lands, and political polarization.

Standout general conference speakers included President Biden, Transportation Secretary Pete Buttigieg, Senior Advisor and Assistant to the President Tom Perez, U.S. Representatives Don Bacon and Salud Carbajal, and Presidential Historian and Pulitzer Prize-winning Author Doris Kearns Goodwin.

In addition to attending conference sessions, the three students visited the Smithsonian National Museum of American History, the Lincoln Memorial, and the U.S. Capitol.

Dates of Previous and Potential Future Considerations

None of the students attending this year attended in previous years. Tigard sent three students to the conference in 2023 and has sent students annually (missing a handful of conferences during the pandemic). Management Analyst Richardson reported on the 2023 TYAC NLC trip on April 25, 2023.

Public Involvement
N/A

Impacts (Community, Budget, Policies and Plans/Strategic Connection)
A 2023-2024 budget request was approved to fund the attendance of TYAC members. In addition, Portland General Electric provided funding to support the attendance of youth delegates. This allows two TYAC members, the Youth City Councilor, and one Tigard teammate to go as a chaperone.

ALTERNATIVES & RECOMMENDATION

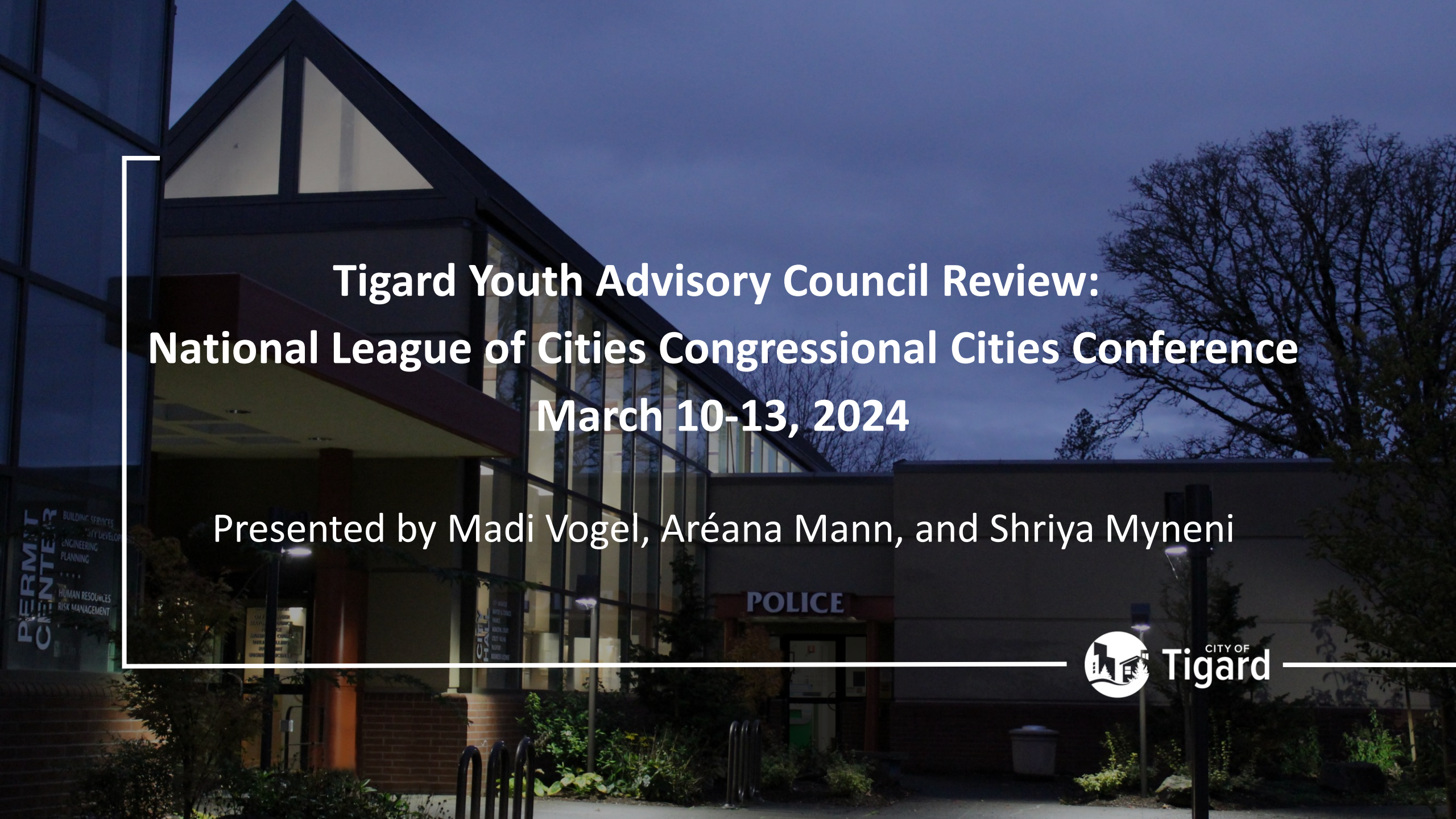
N/A

ADDITIONAL RESOURCES

N/A

Attachments

Presentation



Tigard Youth Advisory Council Review:
National League of Cities Congressional Cities Conference
March 10-13, 2024

Presented by Madi Vogel, Aréana Mann, and Shriya Myneni

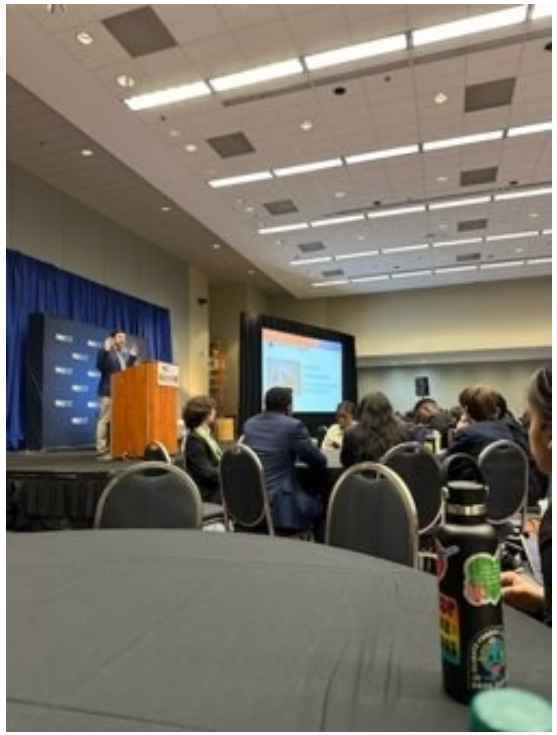
CITY OF Tigard

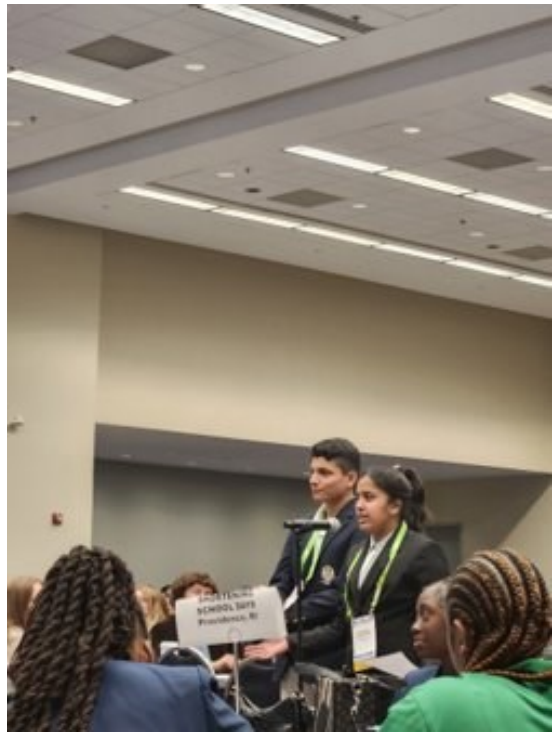
2024 Congressional Cities Conference
Tigard Youth Delegation



Youth Sessions







General Conference Sessions













Hill Day









Sightseeing













Thank you!

AIS-5485 **9.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 20 Minutes

Agenda Title: Community Organization Update - Just Compassion

Authored By: Carol Krager

Presented By: Strategic Initiatives Program Manager Ezell

Item Type: Update, Discussion, Direct Staff

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

Each month the City of Tigard invites a community service organization to present at a City Council meeting and share information about their programs. Just Compassion is the organization presenting in April.

ACTION REQUESTED

This is an informational presentation. No action is requested.

BACKGROUND INFORMATION

Just Compassion of East Washington County is a registered 501(c)3 non-profit organization supporting those in our community experiencing houselessness. Since their inception in 2010, their mission has been to provide a community-centered response to address the needs of unhoused and marginalized individuals. Their objective is to understand issues by evaluating needs, actively listening to community voices, and turning those insights into action.

ALTERNATIVES & RECOMMENDATION

N/A

ADDITIONAL RESOURCES

N/A

Attachments

No file(s) attached.

AIS-5448 **10.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 20 Minutes

Agenda Title: Annual Joint Meeting with the Library Board

Authored By: Halsted Bernard

Presented By: Halsted Bernard, Director of Library Services; Members of the Tigard Public Library Board

Item Type: Joint Meeting-Board or Other Juris.

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

The Tigard Public Library Board will meet with the Tigard City Council for their annual joint meeting. The Board will provide its annual report on library services and operations.

Presenters include:
Library Board Chair Kate Ristau
Library Board Member Candice Coleman
Library Board Member Jenny Stoffel
Library Board Member Bart Hawkins

ACTION REQUESTED

This is an update. No action is requested.

BACKGROUND INFORMATION

Dates of Previous and Potential Future Considerations

The Tigard Public Library Board last met with the Tigard City Council for a joint meeting on May 16, 2023.

Public Involvement

Tigard Public Library Board members are members of the public who attend monthly meetings and receive reports on library services and operations.

Impacts (Community, Budget, Policies and Plans/Strategic Connection)

The annual report informs the Council and community members of the library's key accomplishments over the past year.

ALTERNATIVES & RECOMMENDATION

Not applicable.

ADDITIONAL RESOURCES

The 2021-2026 Library Strategic Plan is available on our website: https://www.tigard-or.gov/your-government/departments/library/about-your-library/strategic-plan

Attachments

2024 Library Board Presentation to Council



Library Board Annual Report to City Council

Prepared by the Tigard Public Library Board

Calculating the value of libraries



AVG RETAIL COST OF BOOK
$22.18

NUMBER OF FIRST TIME CHECKOUTS 2023
463,198

VALUE OF COLLECTION
$5.13M



AVG RETAIL COST OF EBOOK
$33.54

NUMBER OF EBOOK CHECKOUTS TPL 2023
293,126

EBOOK CIRCULATION
$9.8M



COST OF REFERENCE QUESTION
$7.00

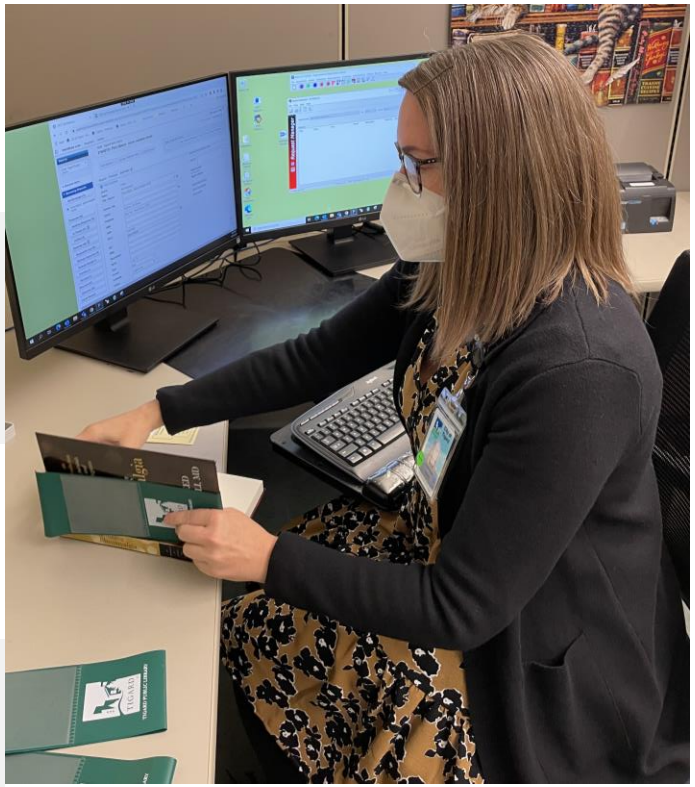
ALL REFERENCE TRANSATIONS 2023
18,758

VALUE OF REFERENCE QUESTIONS
$131,306

- But what about …

Calculating the value of libraries, part two

ILL COST PER TRANSACTION	**INTERLIBRARY LOAN PATRONS 2023**	**TOTAL VALUE 2023**
$31.83 →	1815 →	$24,264
COST PER HOUR OF STUDY ROOM USAGE	**HOURS OF USAGE 2023**	**TOTAL VALUE 2023**
$50.00 →	6058 →	$302,900
COST PER HOUR OF COMPUTER USAGE	**HOURS OF USAGE 2023**	**TOTAL VALUE 2023**
$15.00 →	20,987 →	$314,805
COST PER FILING	**NUMBER OF APPOINTMENTS**	**TOTAL VALUE 2024**
$89.00 →	987 →	87,843



Groups, Large and Small

Meeting spaces like study rooms, the new flexible technology space, the Teen Scene & Teen Alcove

Burgess Community Room

Children's Room and Puett Room

Quiet spaces like the Local History Room and Houghton Room



Groups, Large and Small



Meeting Spaces



Teens-only spaces



Opportunity Café in the lobby

Groups, Large and Small



Houghton Room



Puett Room



Burgess Community Room

Connecting with Our Community



English Conversation Group for Adults 7+ Countries/Languages represented

*An attendee of the English Conversation Group told the facilitator: "**During this time, you have taught us more about humanity through your behavior than English.**"*

Connecting with Our Community

*A community member who often visits the library said he always wants to "clean things up because Library teammates are always good to me, talk to me and don't treat me any differently because I'm homeless". He touched his heart and said "**...it's hard being homeless but you make it easier for me because you're kind, and I appreciate it very much.**"*



Connecting with Our Community



"Thanks again for your monthly 'Coffee and Conversation', the party- like food and atmosphere is truly ***an invaluable resource and DEPARTURE for some of these less than perfect times!****"*

Connecting with Our Community



Teen Alcove

A patron stopped by the Circ Desk and asked how often the Teen Area is used. I explained that it's well-used when they are out of school. She also said, "That's really cool that you have a place just for teens."

*A community member said she was **able to be more successful in high school even though her family couldn't afford private tutoring because of library access to virtual, on-demand tutoring**.*

Connecting with Our Community



2023 Tigard Pride Parade & Festival

*Library presence was the **most requested feature** for 2024 Juneteenth and Pride celebrations, according to City of Tigard planning surveys.*

Connecting with Our Community



Bilingual Storytime

In 2023 **7,782** children and their grownups attended **278** sessions of Storytime at Tigard Public Library.

E-Learning / Online Learning

- Libby
- Kanopy
- LinkedIn Learning
- Press Reader & NY Times
- Mango & Brainfuse

Libby eBooks & eAudiobooks

Average cost per eBook:

$33.54

Total number of eBook checkouts by TPL patrons in 2023

293,126

Value per eBook circulation in 2023

$9.8 M



LinkedIn Learning

- Access to thousands of online courses

Annual subscription cost

$239.88

Total logins for 2022-2023

4,009



During a visit to the Family Promise Bridge to Home Shelter, we restored library access to a mother and her child who are staying there. The mother was overwhelmed with excitement at getting to log in to ***LinkedIn Learning to refresh her graphic design skills for future employment.***

Kanopy

Access to ad-free streaming media with your library card



Annual cost of six popular streaming sites for ad-free programming:

HULU	**NETFLIX**
215.88	185.88
DISNEY+	**AMAZON PRIME**
167.88	139.00
MAX	**APPLE TV**
119.88	119.88

Digital Magazines & Newspapers

- New York Times and PressReader





Annual Digital NYT subscription

$325.00

2022-23 Total Sessions

47,570

Number of magazines

7,000+

2022-23 Total PressReader Sessions

8,740

Language Learning

- Mango & BrainFuse

MANGO

LANGUAGE IS AN ADVENTURE

brainfuse HelpNow™ Free online tutoring a-z

WORLD LANGUAGES

70+

TOTAL SESSIONS 2022-2023

18,233

LIVE TUTORING

LANGUAGE GAMES

SPOKEN PRONUNCIATIONS

Exciting projects around the library

- In response to community feedback, we are starting our first seed library this summer!

"Hi! Does the library have a seed library? If not, any chance you can see if you can start one? I know Tualatin, Beaverton main, and Cedar Mill libraries have seed libraries they put on in the spring. I think it would be a really big hit at the library!"

"Do we have a seed sharing program at the Tigard Library? I saw this seed sharing program in Clackamas County but I don't remember seeing anything here or at Beaverton/Murrayhill."





"Coming to the library has always been an adventure…the lockers make it more so! Very fun."

"I love having the books already checked out and waiting for me in the lobby! The little door popping open just makes me smile. I appreciate having expanded hours to pick up my books too."

Holds Lockers Pilot Project

Tigard Public Library opened the Tigard Lockers location October 1st and it's been received well!

UNIQUE PATRONS	ITEMS CHECKED OUT
148	1,937



The 5 E's – Tigard's Community Promise:
Equity • Environment • Economy • Engagement • Excellence

CITY OF Tigard

Adventure Passes

Some recent additions:

- Five Oaks Museum
- Japanese American Museum of Oregon
- Portland Art Museum
- Portland Japanese Garden
- Portland Opera




Thank you!

AIS-5449 **11.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 10 Minutes

Agenda Title: Heat Pump Adoption Program with Earth Advantage

Authored By: Lloyd Purdy

Presented By: Lloyd Purdy and Tina Escalera

Item Type: Update, Discussion, Direct Staff

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

The City of Tigard's economic development team is launching a new program to encourage homeowners in the city to install new energy efficient heat pumps. Funding for this program comes from Earth Advantage, with more than $1.5 million available to reimburse homeowners across the region. This program builds upon the economic development team's focus on economic mobility, workforce cultivation, and equitable economic development. Up to $11,000 in reimbursement for heat pump purchase and installation will be available to Tigard homeowners.

ACTION REQUESTED

No Council action needed.

BACKGROUND INFORMATION

This climate friendly energy efficiency program encourages homeowners in Tigard to install heat pumps by removing the cost barrier -- with up to $11,000 in reimbursement.

Tigard's heat pump adoption program originates from Oregon Department of Energy funding allocated to encourage investment in climate-friendly infrastructure. It pairs Tigard with Earth Advantage – a nonprofit with more than 20 years of experience in home-focused sustainability and energy efficiency programming. Earth Advantage, headquartered in Portland, serves a multi-state region with a focus on carbon reduction strategies for single-family and multi-family residential. More than 17,000+ people have participated in Earth Advantage's energy efficiency training, approximately 4,000 residential units certified each year by their green building team, more than 30,000 homes verified with a Home Energy Score through Earth Advantage, and over 2 million homes included in the nonprofit's Green Building Registry.

<u>Economic Mobility</u>

Helping residents build family wealth (often called intergenerational wealth) is a key component of local economic development. Intergenerational wealth uses a resident's most valuable asset - in most cases their home – to build wealth for future generations. This heat pump adoption program reduces home operating costs, saves energy, and adds a climate friendly asset to Tigard residences. This approach to economic mobility is especially powerful for low and moderate income homeowners who don't have the financial capacity to make a $11,000 investment in their home. This work is one way the economic development team can advance Tigard City Council's sustainability goal.

Equitable Economic Development & Workforce Development

Adding an energy efficient heat pump adoption incentive to the city's economic development program portfolio creates the opportunity to expand equitable workforce programs. Increased green infrastructure and investments, even at the residential scale, increases demand for people trained in the green trades. More green infrastructure and investment will require more skilled talent to meet this demand. Cultivating a local business sector of trades people and firms qualified to serve the expanding green economy aligns with the economic development team's strategy of equitable economic development and workforce development -- especially when focusing on BIPOC and minority entrepreneurs interested in expanding into the green trades. This work is one way the economic development team can align and advance the city's equity goals.

The economic development team's work on the Tigard heat pump adoption program includes working with training partners to help skill up local talent in the green trades, communicating this reimbursement for climate friendly investment to Tigard homeowners, reserving funds from Earth Advantage's $1.5 million pool of funding when a homeowner expresses interest in the program, confirming successful installation of a certified heat pump by a certified contractor, and reimbursing contractors for up to $11,000 in eligible expenses.

ALTERNATIVES & RECOMMENDATION

This heat pump adoption program advances the Tigard City Council's sustainability goals. No alternative policy action needed.

ADDITIONAL RESOURCES

N/A

Fiscal Impact

Fiscal Information:

When a homeowner in the City of Tigard expresses interest in a heat pump installation rebate, funds will be reserved from Earth Advantages pool of $1.5M. After payment is made to the contractor upon successful installation, the City of Tigard will be reimbursed by Earth Advantage. There is no net loss to the City of Tigard to administer this program.

The program will be launched and administered through Economic Development. Specialist Tina Escalara will promote this program during her visits with Tigard-based contractors in the green trades. Funding for this program will come from Economic Development, within their existing budget.

This program works well as an economic development program in Community Development because of our focus on economic mobility for residents, the work we're trying to do to build a larger workforce and business sector focused on the green economy, and our experience with grant administration – especially the TIF grants.

Attachments

Presentation Slide

Heat Pump Adoption Program



earthadvantage®

CITY OF Tigard

AIS-5437 **12.**

Business Meeting

Meeting Date: 04/09/2024

Length (in minutes): 30 Minutes

Agenda Title: Red Rock Creek Trail Preferred Alignment

Authored By: Gary Pagenstecher

Presented By: Gary Pagenstecher

Item Type: Update, Discussion, Direct Staff

Public Hearing Legal Ad Required?: No

Publication Date:

Information

EXPLANATION OF ISSUE

This Council briefing presents the results of the Red Rock Creek Trail (RRCT) Alignment Study establishing the preferred trail alignment. No action is required.

The preferred alignment of the proposed two-mile RRCT begins at a connection with the Fanno Creek Trail (under construction in 2024) just east of the Tigard Public Library, provides grade-separated crossings at high-volume/high-risk locations at Portland & Western railroad and Highway 217, expands existing sidewalks in constrained areas, travels through natural spaces adjacent to the Red Rock Creek resource, and terminates at the intersection of Highway 99W at the SW 64th Ave crossing and Interstate 5 southbound on-ramp. The trail is planned to be accessible, hard-surfaced for its entirety, designed for a 12-ft width with shoulders, handrails, or fencing to clearly define the edge of the trail.

ACTION REQUESTED

No action requested.

BACKGROUND INFORMATION

The city applied for a Regional Flexible Funds Allocation (RFFA) grant in June 2019 to refine the alignment of the RRCT along its two-mile length, determine cross-sections, identify necessary easements, and develop an implementation plan. The grant was awarded by Metro Council in January 2020 and was delivered by ODOT on contract with OTAK between January 2023 and March 2024.

The attached RRCT Alignment Study Report details the process, engagement, alternative analysis, and an implementation strategy for the preferred alignment.

Dates of Previous and Potential Future Considerations

On September 3, 2019, staff presented the RRCT Conceptual Alignment to City Council after the RFFA grant had been awarded.

Public Involvement

The RRCT alignment study project included a robust engagement process to narrow and refine the alignment segments. The project team created a stakeholder working group (SWG) of 25 representatives from public agencies, private property owners, and local residents. Utilizing a series of meetings, online

surveys, focus groups, individual interviews, and public workshops, the engagement process provided multiple opportunities to gather comments regarding the trail and scoring of the alignment segments. (See Section Four of the attached Report).

In addition, city advisory bodies were briefed, including the Parks and Recreation Advisory Board, Tigard Transportation Advisory Committee, and the Town Center Advisory Commission. A final presentation of the study and preferred alignment will be given to the Metro Quarterly Trails Forum on April 10th.

Impacts (Community, Budget, Policies and Plans/Strategic Connection)

Community

Tigard is working to become an inclusive community that is pedestrian-friendly, healthy, and accessible to all. Red Rock Creek Trail is crucial in establishing a well-connected, attractive, and easily accessible pedestrian network in the urbanizing heart of the city.

Budget

The Preferred Alignment recommended in the report is poised for implementation through prioritization of the discreet alignment segments. Ongoing staff support is necessary to fully implement the trail through grant awards, developer improvements and future capital projects. A number of funding opportunities identified in the report are available for trail design and construction projects, beginning this year. Budget implications will be developed as implementation projects arise.

Policies, Plans, Strategic Connections

The RRCT is consistent with and implements the Strategic Plan and Council Goals:

Strategic Plan - An equitable community that is walkable, healthy, and accessible for everyone.

- Strategic Priority Two - Create a well-connected, attractive, and accessible pedestrian network.
    - Objective 2.1C Identify and pursue new funding sources to build the pedestrian network.
    - Objective 2.2B Design the trail system to serve both recreational and active transportation purposes.
- Strategic Priority Three - Ensure development and growth support the vision.
    - Objective 3.1G Invest in public spaces that equitably serve the city's diverse residents, workers, and visitors.

2023-2025 City Council Goals

- Address Climate Change:
    - Strategy 2.1 Prioritize carbon responsibility in the City of Tigard operations, projects, and policies.
- Enhance Community Safety and Accessibility:
    - Strategy 4.3 Increase funding to expand connectivity and support an active, healthy, accessible community.

ALTERNATIVES & RECOMMENDATION

Staff Recommendation

This briefing is to update City Council on the developing status of a major active transportation facility serving the Metro-designated Tigard Town Center, comprised of two of the city's urbanizing districts - Downtown Tigard and the Tigard Triangle. No action is required.

The preferred alternative trail alignment refines the conceptual trail alignment already identified in the Tigard Triangle Transportation Network Map and in the Tigard 2040 TSP (outside the Triangle in the

Hunziker Core area). A revised Network Map codifying the preferred alignment is included in the MADE omnibus code amendment package scheduled soon for Council review and adoption. TSP 2040 Updates may come later this year or next.

Future trail segment projects will provide final design services and more fully detailed amenities, such as plaza spaces, benches, trail lighting, and wayfinding signage. Alignments that were not selected as preferred will remain as candidates for future recreation loops.

ADDITIONAL RESOURCES

Attachments

RRCT Alignment Study PowerPoint

RRCT Trail Report with Appendix



City *of* Tigard Respect and Care | Do the Right Thing | Get it Done

Red Rock Creek Trail Alignment Study Council Briefing

Tigard City Council
April 9, 2024

The Red Rock Creek Watershed is a happening place:

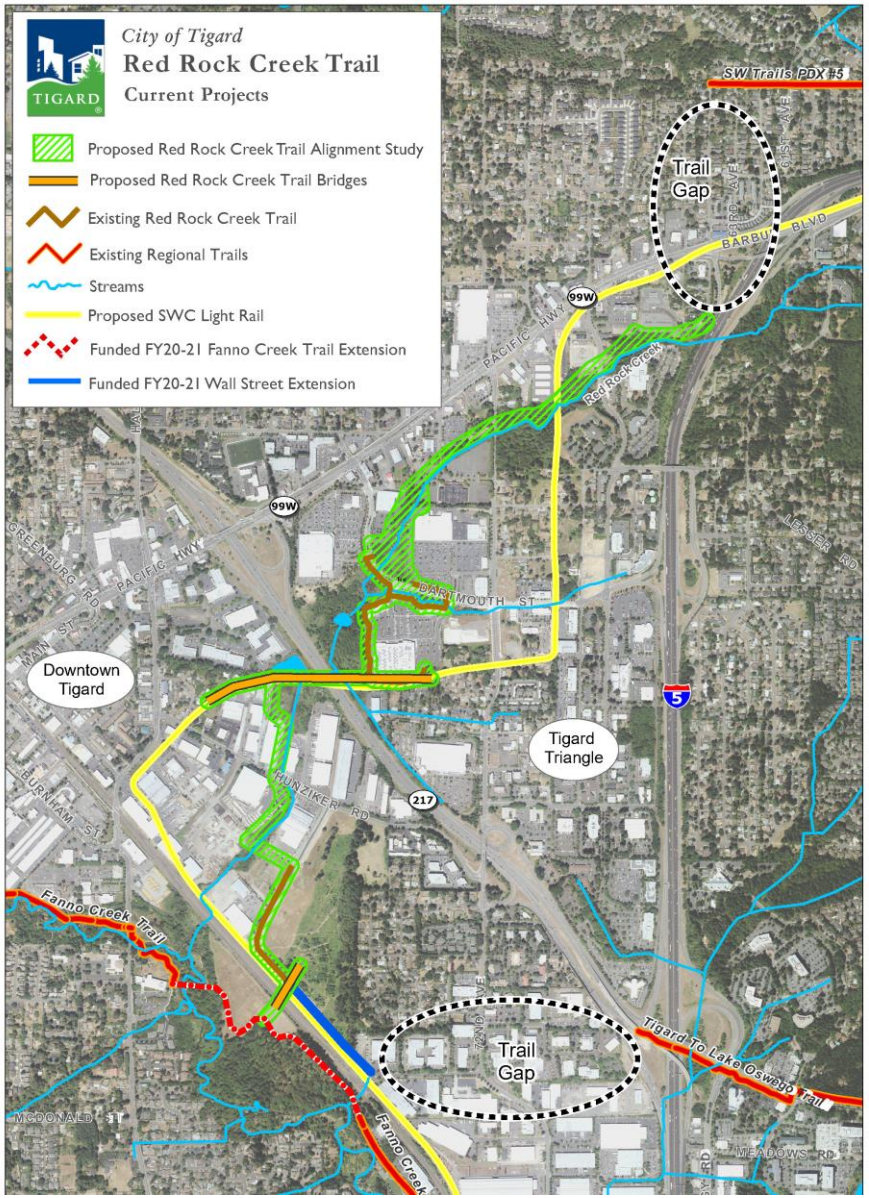
- Tigard Triangle Equitable Urban Renewal Implementation Strategy
- Southwest Corridor Light Rail Transit
- Private Development Investment
- RRC Stream Stabilization and Enhancement
- Tigard Parks Master Plan Update



City *of* Tigard

Regional Context, Concept Alignment & Major Elements

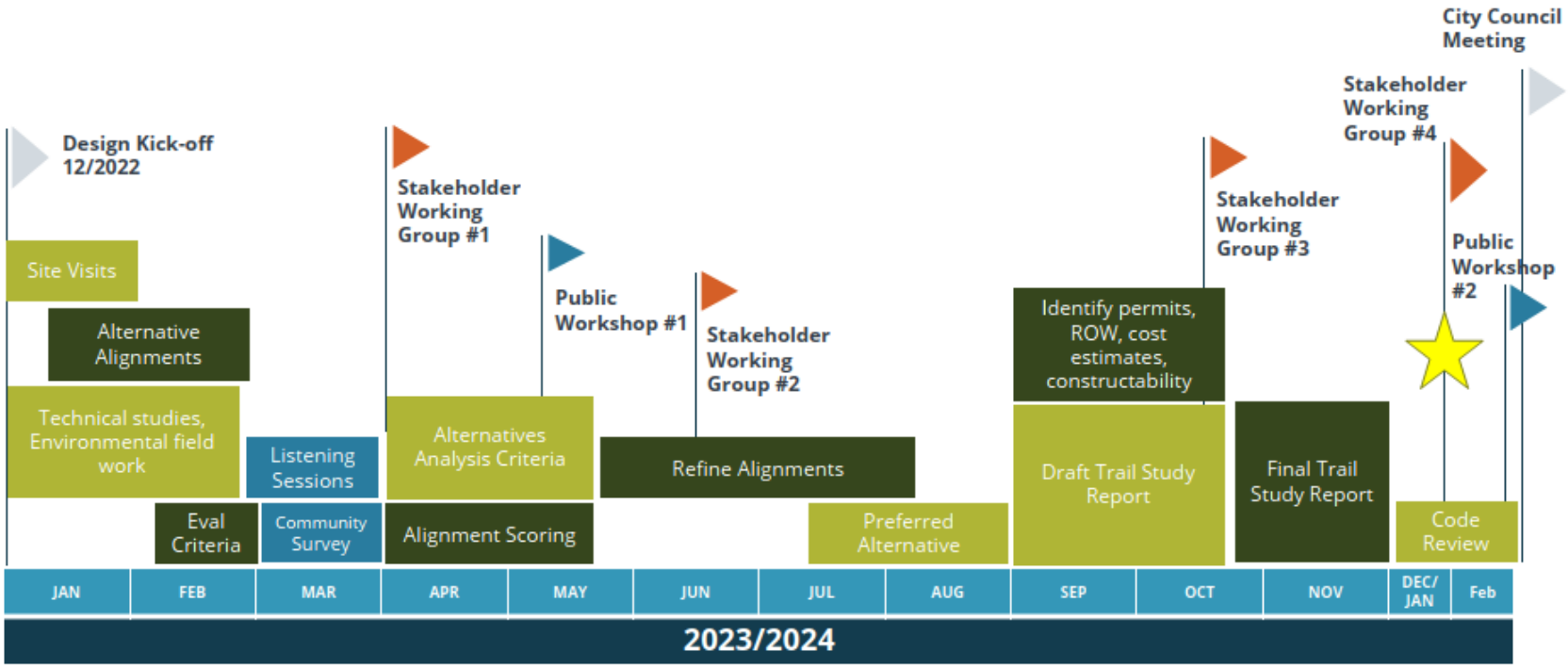
- Tigard Triangle
- Hwy 217 Bridge
- Hunziker Core
- RR Bridge



Project Timeline

Otak

Timeline



City *of* Tigard

Explore Alternatives

Segment A: Fanno Creek Trail to Potso Dog Park

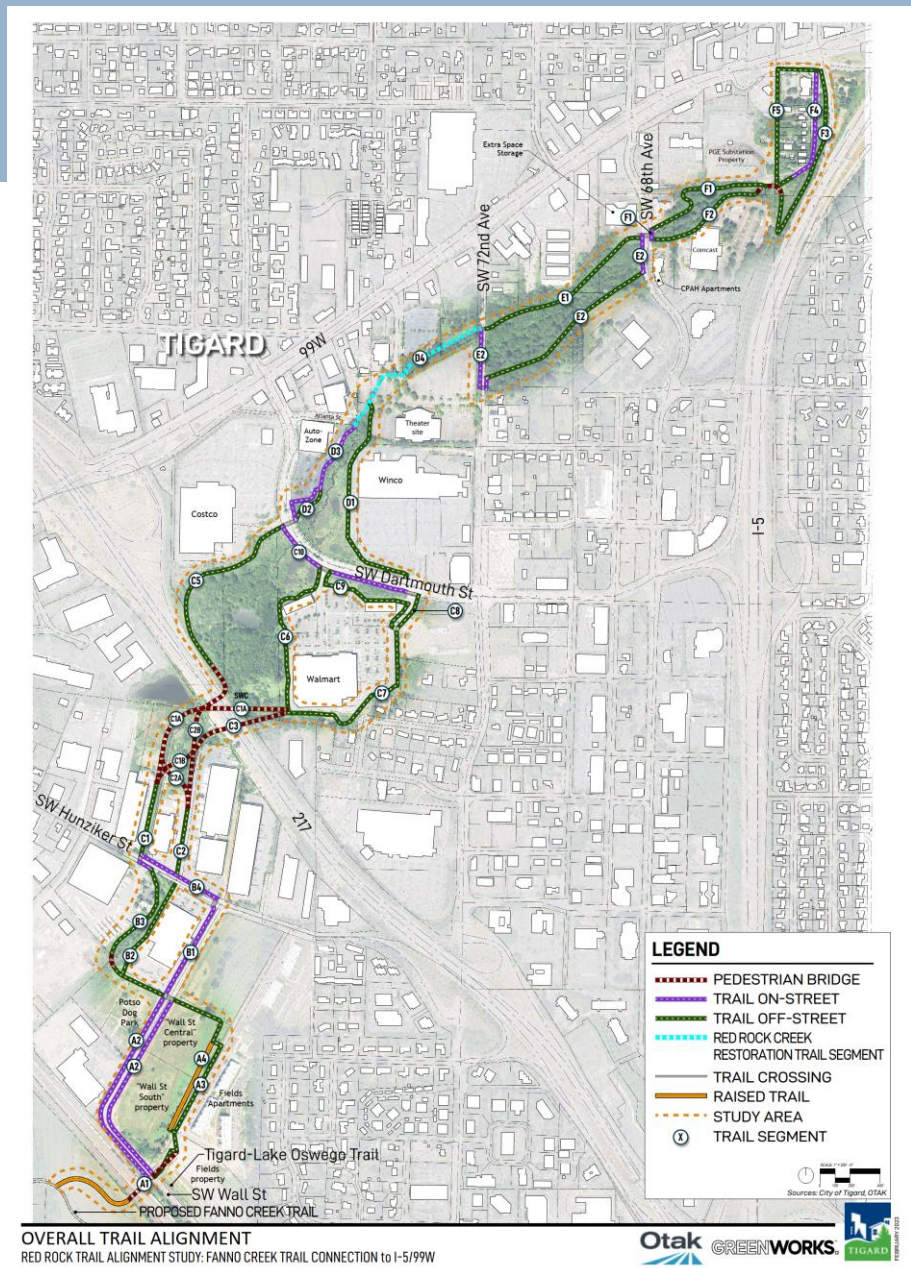
Segment B: Potso Dog Park to Hunziker Rd

Segment C: Hunziker to Dartmouth

Segment D: Dartmouth to 72nd Ave

Segment E: 72nd Ave to 68th Ave

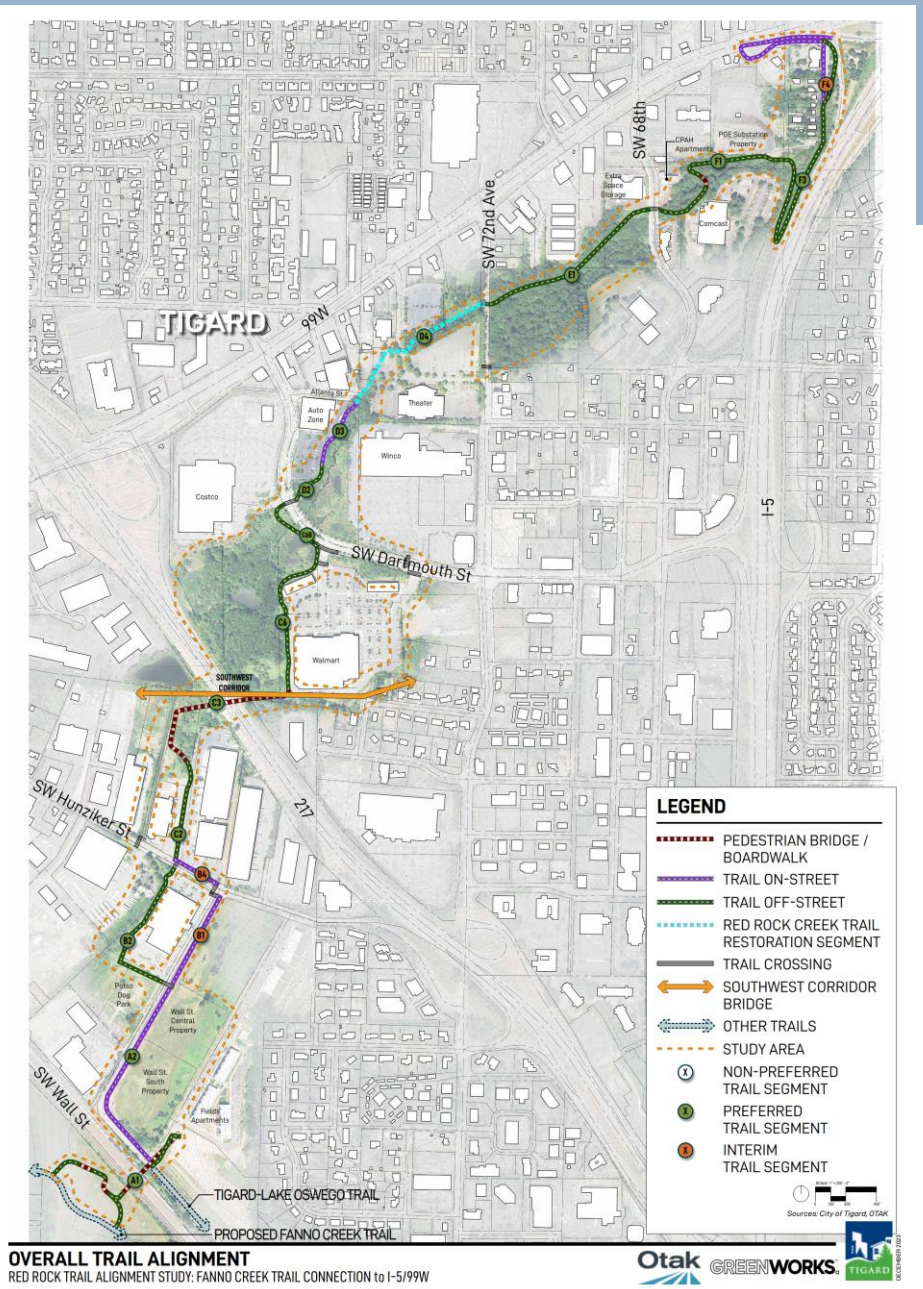
Segment F: 68th Ave to OR99W at 64th Ave/I5 SB Onramp



Preferred Alignment

Balances Design Criteria:

- User Experience
- Connectivity / Continuity
- Environmental Impacts
- Ease Of Permitting
- Cost, Constructability & Funding
- Property Ownership
- Safety & Security
- Community Support



Implementation

Otak

Prioritization of segments

Short-term 0-5 years	Medium-term 5-10 years	Long-term 10+ years	Ongoing Efforts
A1 A2 B1+B4 D2 D4	B2 C2 C3 E1	C6B F1 F3	• Coordinate with SW Corridor • Establish "friends" group • ROW Dedication, Purchase • Grant Applications

Otak

Estimated costs

ITEM	BASIC CONSTRUCTION ITEM	UNIT COST	UNIT
1	MOBILIZATION, SURVEY, EROSION CONTROL	20%	%
2	CLEARING & GRUBBING	$8,000.00	AC
3	TREE REMOVAL	$25,000.00	AC
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	$150.00	SY
5	EXCAVATION/EMBANKMENT	$100.00	CY
6	DRAINAGE PIPE	$50.00	LF
7	TRAIL SURFACING (CONCRETE)	$16.00	SF
8	TRAIL SURFACING (ASPHALT)	$6.00	SF
9	GRAVEL SHOULDERS	$4.00	SF
10	ACCESSIBLE RAMPS	$15,000.00	EA
11	ROAD CROSSING - SIGNALIZED	$40,000.00	EA
12	ROAD CROSSING - SIGN & STRIPE	$5,000.00	EA
13	BRIDGE STRUCTURE	$425.00	SF
14	BOARDWALK or VIADUCT STRUCTURE	$300.00	SF
15	RETAINING WALL	$150.00	SF
16	PEDESTRIAN RAILING	$175.00	LF
17	TRAIL LIGHTING	$50.00	LF
18	STREET LIGHTING	$8,000.00	EA
19	BOLLARDS	$1,000.00	EA
20	CHAINLINK FENCING	$80.00	LF
21	SPLIT RAIL FENCING	$40.00	LF
22	REGULATORY & WARNING SIGNAGE	$400.00	EA
23	WAYFINDING SIGNAGE	$600.00	EA
24	LANDSCAPING & VEG. CORR. MITIGATION	$10.00	SF
25	OUTFALL RESTORATION	$5,000.00	EA
26	PHASE 1 HAZMAT STUDY	VARIES	LS
27	MITIGATION (WETLANDS+ENHANCEMENT)	VARIES	LS
28	ENVIRONMENTAL PERMITTING	VARIES	LS
29	UTILITY RELOCATION	$50,000.00	EA
	Subtotal		
	CONTINGENCY	40%	%
	ENGINEERING & DESIGN	30%	%
	CONSTRUCTION ENGINEERING, INSPECTION	25%	%
	PROJECT ADMINISTRATION	15%	%
	Subtotal		
	ESMT & ROW ACQUISITION - COMMERCIAL USE (limited)	$0.33	SF
	ESMT & ROW ACQUISITION - COMMERCIAL USE (unlimited)	$23.00	SF
	SUBTOTAL OF BASIC CONSTRUCTION COST		

A	B	C
$17.5M Bridge Crossing Embankment	$2.3M Park Upgrades VC mitigation	$27M Bridge Crossing Boardwalks

D	E	F
$6.5M Boardwalk VC mitigation	$3.1M Retaining Walls VC mitigation	$7.7M Retaining Walls Stream Crossing

City *of* Tigard

Implementation - Segment A1



01 PLAN VIEW
NOT TO SCALE



02 VIEW LOOKING SOUTHEAST - ORGANIC STAIRS
NOT TO SCALE



03 VIEW LOOKING NORTH
NOT TO SCALE

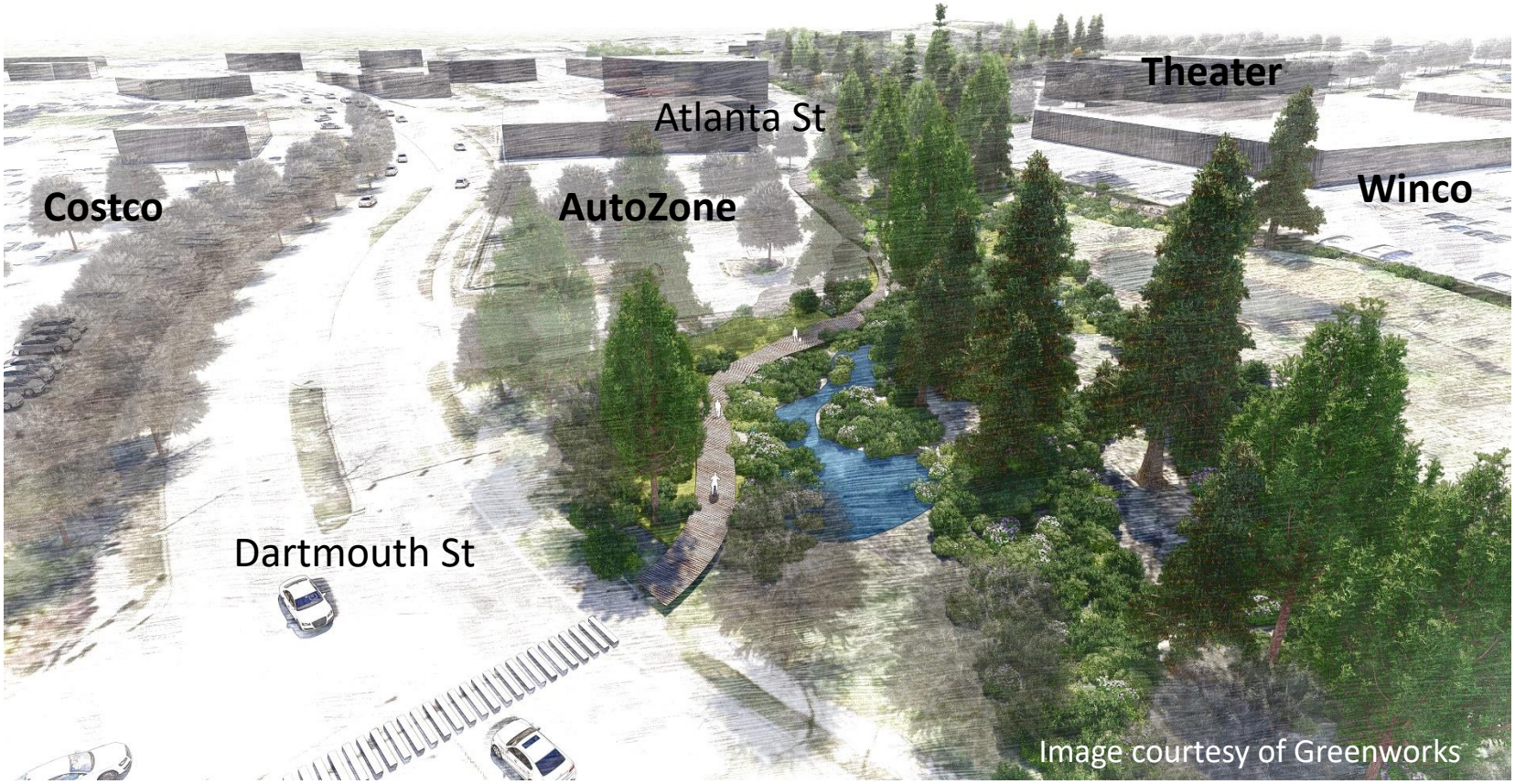
RED ROCK CREEK TRAIL PEDESTRIAN BRIDGE | VISUALIZATIONS

G.K. | NOVEMBER 2, 2020 | PROJECT 17052

Otak

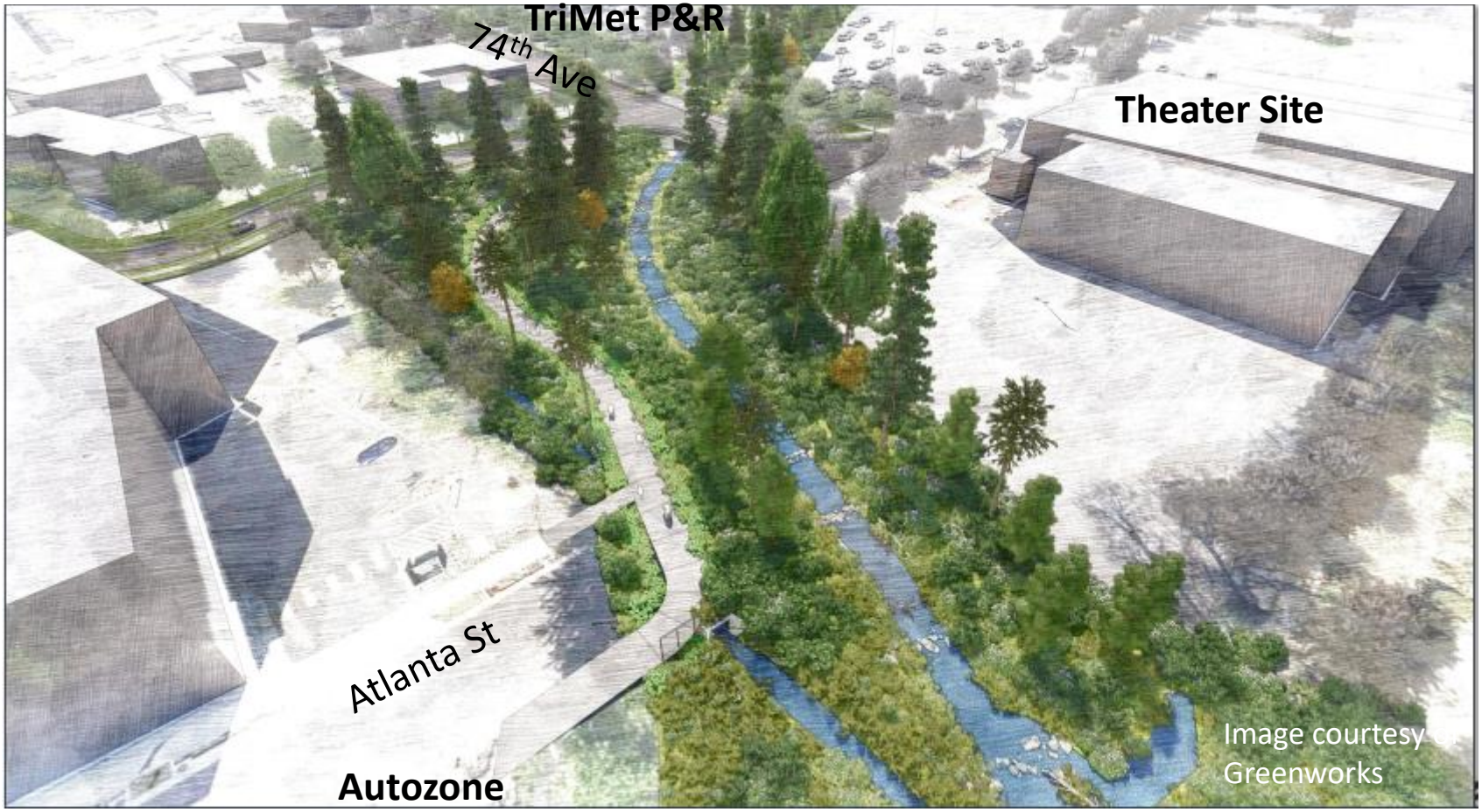
City *of* Tigard

Implementation - Segment D2



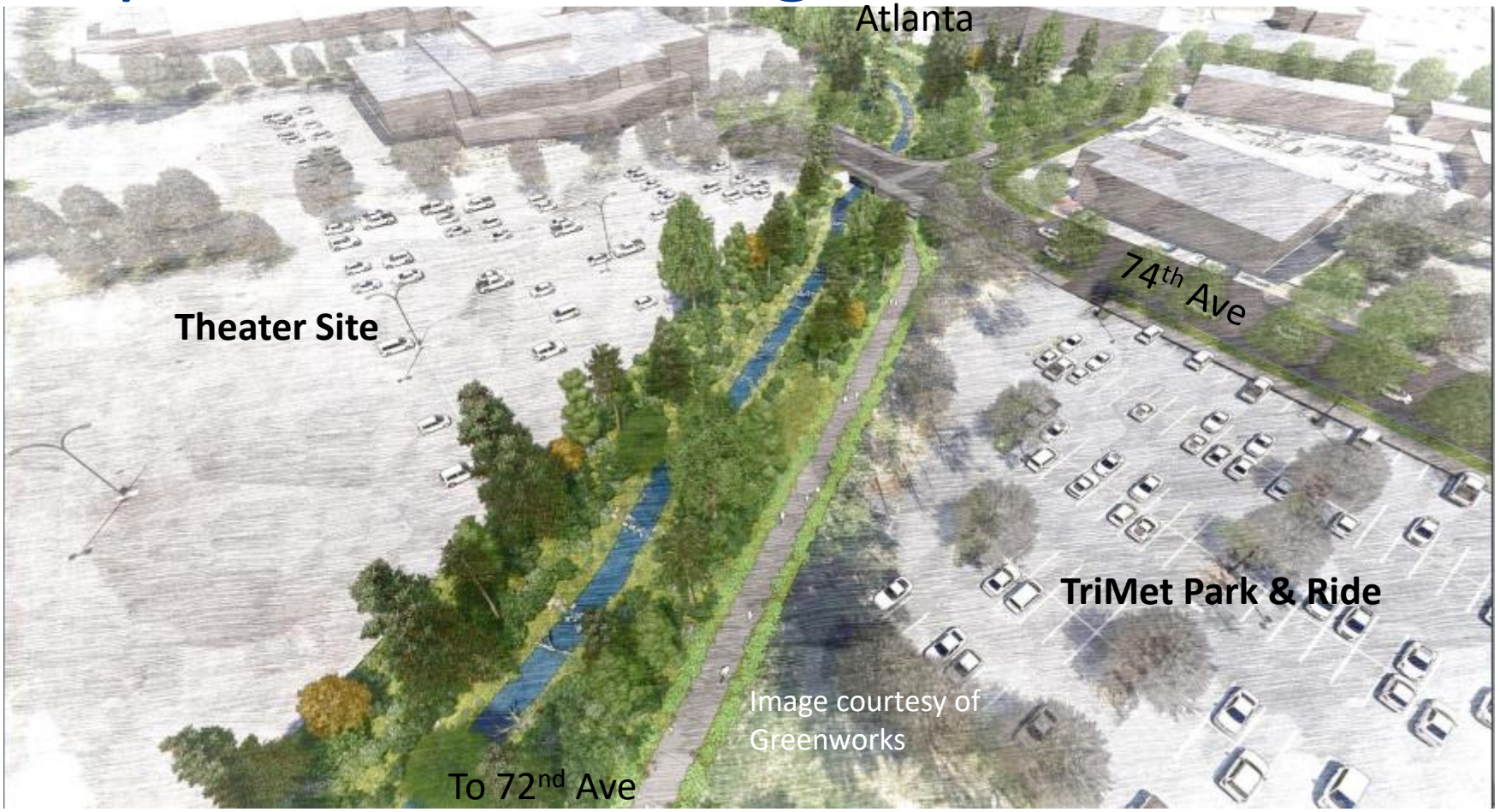
City *of* Tigard

Implementation - Segment D4 South



City *of* Tigard

Implementation - Segment D4 North



Red Rock Creek Trail implements

- Tigard Strategic Plan Vision An equitable community that is walkable, healthy, and accessible for everyone.
- Strategic Priorities:
  - Priority Two - Create a well-connected, attractive, and accessible pedestrian network
  - Priority Three - 3.1G Invest in public spaces that equitably serve the city's diverse residents, workers, and visitors.

2023-2025 Tigard City Council Goals:

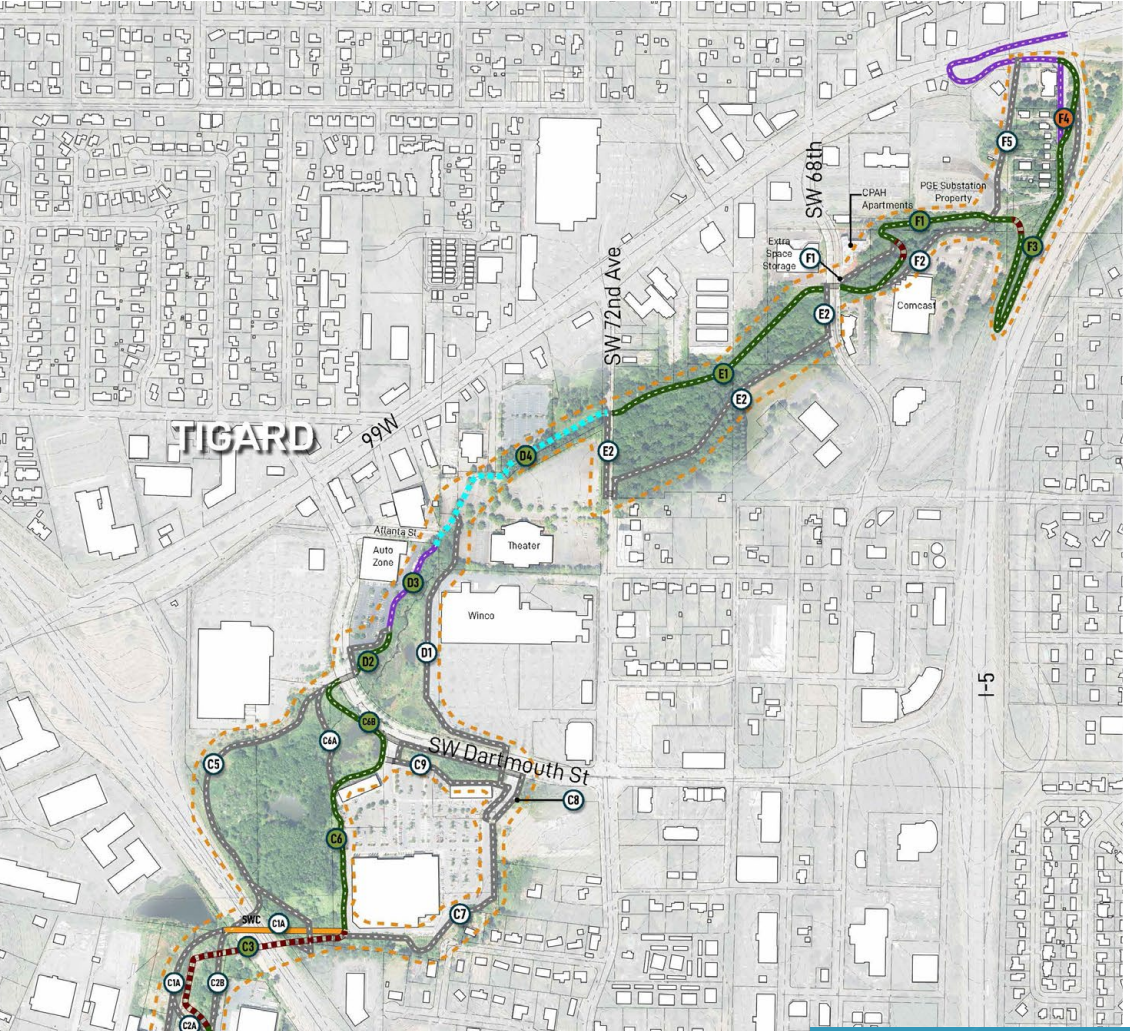
- Address Climate Change: Strategy 2.1 Prioritize carbon responsibility in the City of Tigard operations, projects, and policies.
- Enhance Community Safety and Accessibility: Strategy 4.3 Increase funding to expand connectivity . . .



City *of* Tigard Respect and Care | Do the Right Thing | Get it Done

Red Rock Creek Trail Alignment Study Questions?

Tigard City Council
April 9, 2024





TIGARD

Oregon Department of Transportation

Red Rock Creek Trail Report
Preferred Alignment

MARCH 2024

CONTENTS

Section 1. Executive Summary.....1

Engagement 2
Evaluation Criteria..... 2
Alternatives Analysis..... 2
Preferred Alignment Recommendation..... 2
Implementation 3

Section 2. Purpose, Process, and Schedule..... 5

Purpose 6
Process..... 6
Schedule..... 8

Section 3. Context 9

All about Tigard 10

Section 4. Engagement.....15

Section 5. Trail Criteria 21

Trail Criteria..... 22
Trail Alignments Evaluation Criteria..... 23

Section 6. Existing Conditions, Data Collection .25

Jurisdictional Boundaries 26
Wetland and Sensitive Lands 26
Hydrology & Floodplains 28
Stormwater Drainage..... 28
Hazardous Materials 28
Historic & Cultural Resources..... 30
Utilities 32
Transportation Facilities..... 33
Railroad Ownership & Operations..... 39

Section 7. Alternative Alignments..... 41

Initial Trail Alternative Alignments..... 42
Refined Trail Alternative Alignment..... 43
Response to the Engagement Process 43
Results to Scoring Process..... 46
Further Considerations 46

Section 8. Preferred Alignment 47

Preferred Alignment 48

Section 9. Trail Design Elements.....57

Trail Surfacing..... 58
Amenities 59
Shoulder Landscaping 59
Road Crossings 59
Trail Connections..... 61
Grade-Separated Crossings 62

Section 11. Implementation Strategy.....65

Final Design 68
Probable Cost..... 68
Project Funding Options..... 71
Development Code Requirements..... 72

FIGURES

Figure 1. Overview Map....13
Figure 2. Wetlands and Sensitive Lands....27
Figure 3. Hydrology and Drainage....29
Figure 4. Historical Resources Study Area....31
Figure 5. Road Classification Map....35
Figure 6. Existing Bicycle and Pedestrian Facilities....37
Figure 7. Transit Routes....38
Figure 8. Existing Zoning....40
Figure 9. Initial Trail Alternative Alignments....42
Figure 10. Alignment Alternatives Diagram – Refined....46
Figure 11. Preferred Alternative....48
Figure 12. Typical Pavement Section....59
Figure 13. Segment C3 Crossing Hwy 217 with Elevated Connection to SWC....63

TABLES

Table 1. Projects and Plans....12
Table 2. Engagement Summary....19
Table 3. Existing Gas Crossings....33
Table 4. Roadway Characteristics....34
Table 5. Scoring Table Results....44
Table 6. Red Rock Creek Trail Road Crossings....60
Table 7. Implementation Strategy....66
Table 8. Construction Cost by Trail Segment....68
Table 9. Trail Phasing....70
Table 10. Potential Funding Sources....71

APPENDIX

Appendix A: Community / Stakeholder Results
Appendix B: Existing Conditions Report
Appendix C: Alternatives Analysis Report
Appendix D: Grade Separation Bridges
Appendix E: Type, Size, and Location - Fields Property
Appendix F: Schematic Design Plans and Profiles
Appendix G: Cost Estimate
Appendix H: Letters of Support, Acknowledgement

ACKNOWLEDGEMENTS

RED ROCK CREEK TRAIL MANAGEMENT TEAM

Gary Pagenstecher, City of Tigard
Judi Martin, City of Tigard
Katie Gillespie, ODOT
Amanda Owings, Otak
Ben Johnson, GreenWorks

DESIGN TEAM

Otak, Inc.

Mandy Flett
Craig McNees
David Sacamano
Chris Green
Kevin Timmins
Roger Tiffany
John Rogers
Scott Nettleton

Greenworks, PC

Ben Johnson
Celia Hensey
Jeannine Davis

Archaeological Investigations Northwest (AINW)

Eva Hulse

Commonstreet Consulting, LLC

Kari Lowe
Dave Hansen

Pacific Habitat Services, Inc.

Shawn Eisner

Phronesis Network, LLC

Rachel Winslow

Shannon & Wilson, Inc.

Stephen McLandrich

Wiser Rail Engineering

Tom Wiser

STAKEHOLDER WORKING GROUP

Tom McGuire, City of Tigard
Carla Staedter, City of Tigard
Dave Roth, City of Tigard
Greg Stout, City of Tigard
Basil Christopher, ODOT
Nicole Frankl, ODOT
Prescott Mann, ODOT
Glen Bolen, ODOT
Fiona Lyons, TriMet
Don Baack, SW Trails
Cassera Phipps, Clean Water Services
Dennis Hannah, Portland & Western Rail
Greg Daniels, ESG Investments
Rachael Duke, Community Partners for Affordable Housing
Jilian Saurage Felton, Community Partners for Affordable Housing
Eric Sporre, PacTrust
Megan Garvey, The Wetlands Conservancy
John Knez, Jr., Knez Properties
Melissa Kern, Oregon Education Association
Ralph Schultz, Fred Shearer & Sons, Inc.
Nik Engel, Property Owner/Dartmouth DSK, LLC
Shilla Kim, Property Owner/Dartmouth DSK, LLC
Calista Fitzgerald, Resident
Brett Williams, Field Apartment Resident
Mohanad Alnajjar, Unite Oregon

Section 1. Executive Summary

Leave the road, take the trails.

PYTHAGORAS

Development of the Red Rock Creek Trail is a timely response to planning activities underway that will impact the Red Rock Creek watershed, including the Parks Master Plan Update, Tigard Triangle Equitable Urban Renewal Plan, Southwest Corridor (SWC) LRT, Red Rock Creek Stormwater Master plan, and the actualization of the Triangle District and Hunziker Core for redevelopment. The City is developing a trail designed to regional trail standards centered around the established greenway that will provide a much-needed transportation option, a safe place to walk and bicycle and allow residents to experience nature. The proposed two-mile-long Red Rock Creek Trail (RRCT) will provide active transportation options in Tigard's urbanizing Metro-designated Town Center area and overcome significant barriers to connectivity.

Red Rock Creek, in east Tigard, flows west-southwest from Mount Sylvania to Fanno Creek and, eventually, the Tualatin River watershed. The stream is currently degraded due to the impact from decades of development and is undergoing streambank enhancement, with parts of the stream being daylighted to improve ecological function within the area known as the Tigard Triangle District (Tigard Triangle).

Tigard has undergone a population increase in recent years comparable to other municipalities in the Portland metro region. With this population growth and the targeted efforts to carry out the vision of the Tigard Triangle, multi-modal transportation infrastructure has become more desirable for connectivity as well as fighting climate change. Once completed, the Red Rock Creek Trail will be part of a more extensive regional trail network that will help meet the increased demand for alternative transportation and recreation options, aligning with the city's strategic vision.

Engagement

This alignment study project included a robust engagement process to narrow and refine the alignment segments. The project team created a stakeholder working group (SWG) of 25 representatives from public agencies, private property owners, and local residents. Utilizing a series of meetings, on-line surveys, focus groups, individual interviews, and public workshops, the engagement process provided multiple opportunities to gather comments regarding the trail and scoring of the alignment segments.

Evaluation Criteria

The design team, including city staff and several local consultants, developed a series of trail alignments to study and refine. Each alignment was evaluated on its merits of meeting the following criteria:

- USER EXPERIENCE
- CONNECTIVITY / CONTINUITY
- ENVIRONMENTAL IMPACTS
- EASE OF PERMITTING
- COST, CONSTRUCTABILITY & FUNDING
- PROPERTY OWNERSHIP
- SAFETY & SECURITY
- COMMUNITY SUPPORT

Alternatives Analysis

Utilizing the criteria noted above, each alignment was scored on a scale ranging from -1 to +1. In addition to scores, stakeholders included comments regarding alignments. The refinement process also included high level technical analyses from the various subconsultants who entered their professional opinion of each alignment and the requirements for future implementation. The comprehensive feedback allowed the project team to refine the preferred alignment into the final trail report provided herein.

Preferred Alignment Recommendation

The preferred alignment begins at a connection with the Fanno Creek Trail, just east of the Tigard City Library, provides grade-separated crossings at high-volume/high-risk locations of Portland & Western railroad and Highway 217 (Hwy 217), expands existing sidewalks in constrained areas, travels through natural spaces adjacent to the Red Rock Creek resource, and terminates at the intersection of Highway 99W (Hwy 99W) and Interstate 5 (I-5) southbound on-ramp. The trail is planned to be hard-surfaced for its entirety, at 12-ft wide with shoulders, handrails, or fencing to clearly define the edge of the trail. Future projects to provide final design services will more fully detail amenities, such as plaza spaces, benches, trail lighting, and wayfinding signage. Alignments that were not selected as preferred will remain as candidates for recreation loops trails.

Implementation

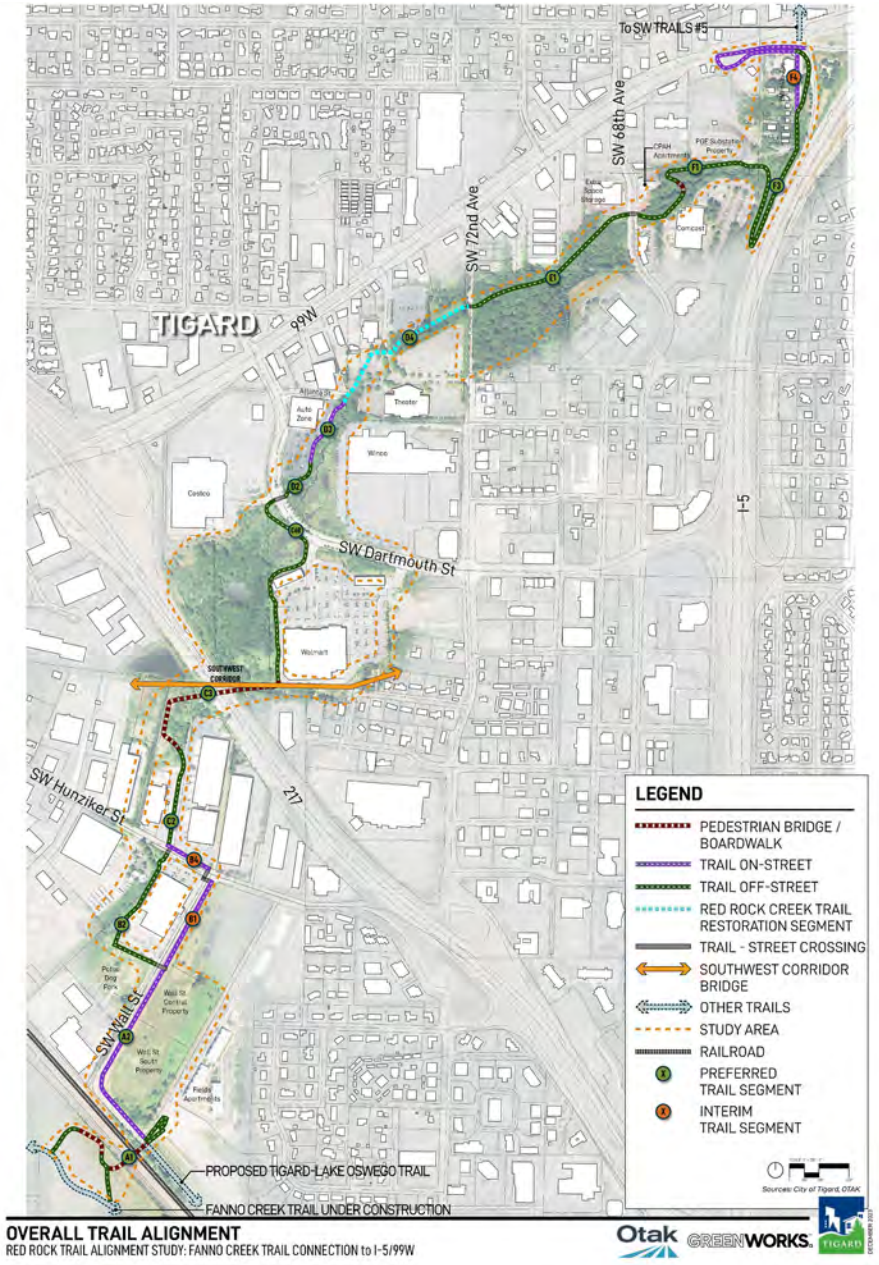
The preferred alignment recommended in this plan is poised for implementation through prioritization of the discrete alignment segments. Ongoing support is necessary to fully implement the trail through grant awards, developer improvements and future capital projects. A number of funding opportunities identified in the report are available for trail design and construction projects.

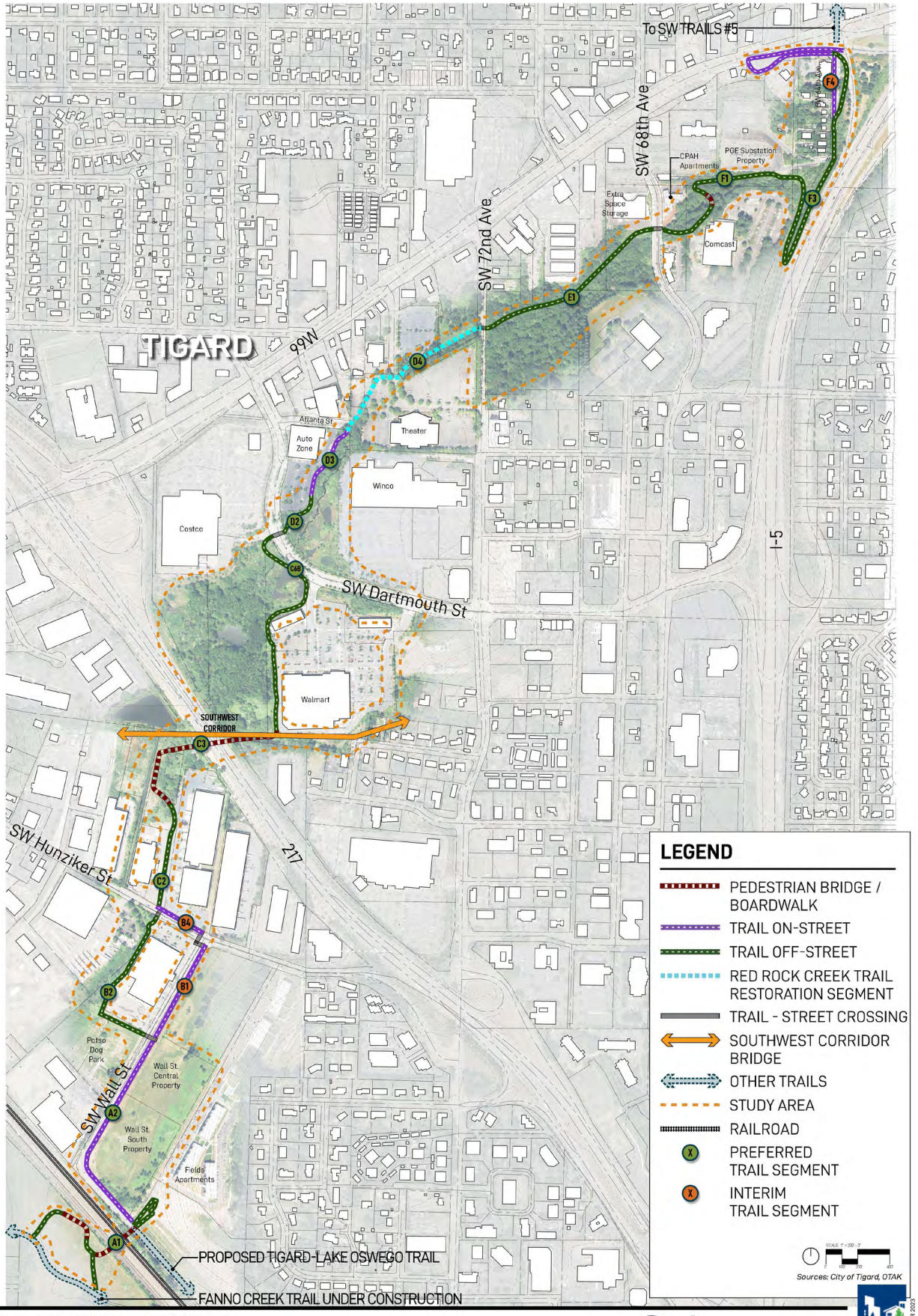
The next steps for implementing the trail involve:

- Collect topographic and boundary survey data
- Layout approximate alignment as shown in this study
- Refine the alignment to address topographic constraints, and minimize impacts to utilities, natural areas, etc.
- Prepare environmental permits: Economic, Social, Environmental, and Energy (ESEE) Analysis, ESA determination for FAHP, DSL/Corp joint permit, CWS Service Provider Letter, Hazmat Phase II, etc.
- Prepare final engineering plan, profile, and details
- Engage the right-of-way acquisition process
- Develop construction plans, specifications, and estimate
- Begin construction

The significance of Red Rock Creek Trail in Tigard cannot be overstated. Tigard aims to become an inclusive community that is pedestrian-friendly, healthy, and accessible to all. Red Rock Creek Trail is crucial in establishing a well-connected, attractive, and easily accessible active transportation network in Tigard.

Preferred Alignment Alternative





OVERALL TRAIL ALIGNMENT

RED ROCK TRAIL ALIGNMENT STUDY: FANNO CREEK TRAIL CONNECTION to I-5/99W

Otak GREENWORKS TIGARD DECEMBER 2023

Section 2. Purpose, Process, and Schedule

All truly great thoughts are conceived while walking.

FRIEDRICH NIETZSCHE

Purpose

The Red Rock Creek Trail Alignment Study aimed to explore alignment alternatives between Hall Boulevard and Interstate 5. The goal was to identify a preferred trail alignment that met the Oregon Department of Transportation (ODOT) shared-use path standards and balances environmental impacts, constructability, cost, and user experience. Identifying an alignment that meets these requirements will enable the City of Tigard to secure funding and move the project forward in incremental phases.

This proposed route will fulfill a critical strategic objective of the City Council by establishing a well-connected, appealing, and easily accessible active transportation network. The alignment will grant access to natural areas within the Tigard Triangle, the Tigard Library, and Fanno Creek Park. It will also provide convenient access for businesses, residents of affordable housing, and individuals in the Hunziker Core district. Furthermore, it will facilitate multi-modal systems planning and integrate into the regional trail systems, connecting Tigard's residents and businesses to the wider Metro Region. This project aligns with the City of Tigard's 2040 Transportation Systems Plan (TSP). It reinforces the city's vision of developing a robust trail network that links various destinations, such as schools, community service areas, places of worship, and businesses. Once entirely constructed, the Red Rock Creek Trail will meet the diverse needs of Tigard's residents by offering enhanced opportunities for active transportation, commuting, recreational activities, and engagement with nature.

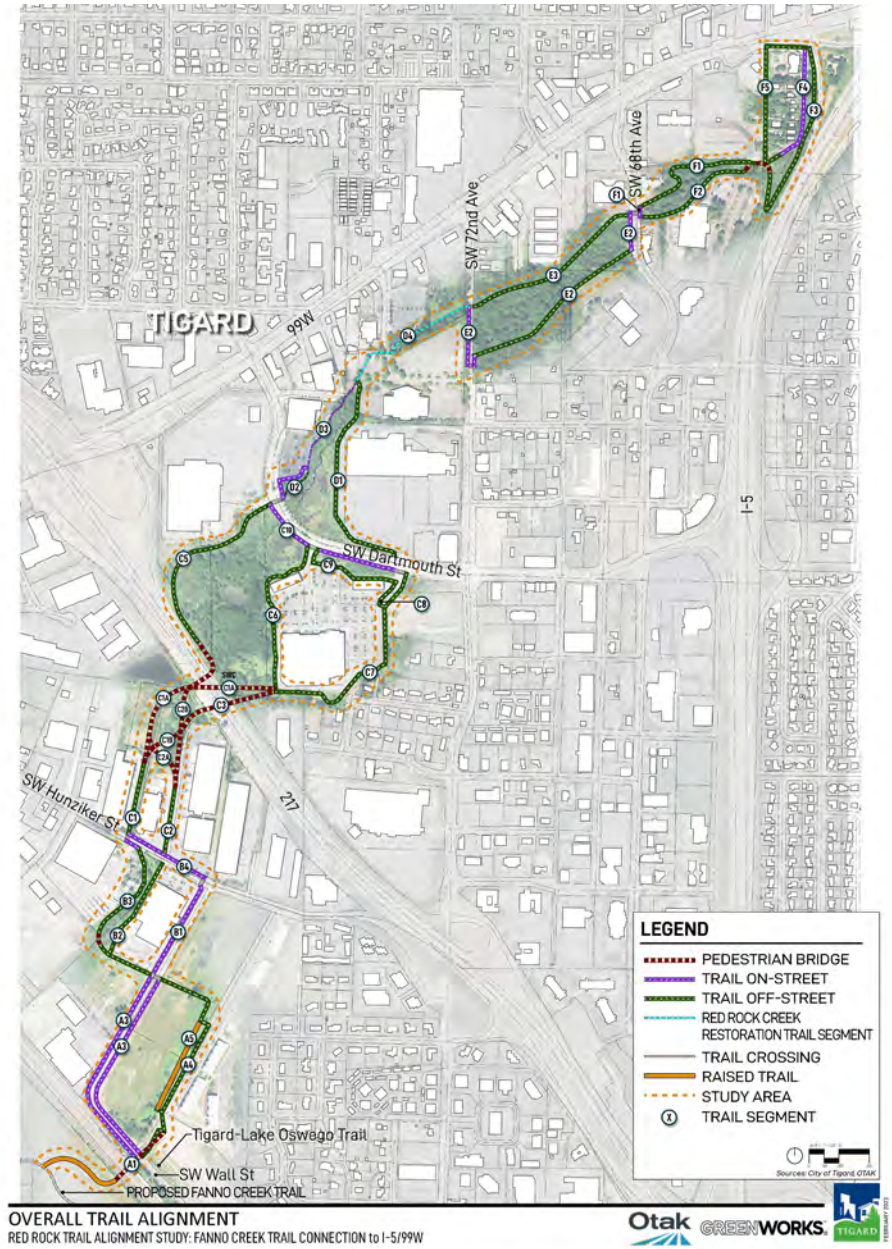
Process

The Red Rock Creek Trail Alignment Study was conducted using a comprehensive process of gathering data, providing reasonable trail options, gathering input from the public and the SWG, and refining those elements into a preferred alternative. Information and background data was utilized at each stage to evaluate suggestions. The consultant team recorded feedback from the numerous outreach activities and used it to determine alignments or adjust the project to respond to perceived impacts. The outreach activities are detailed in Section 3: Engagement.

The scope of the trail alignment study project is outlined in the table.

Environmental Services	Existing Conditions	Identify and Evaluate Alignment Alternatives	Refine Alignment Alternatives	Select Preferred Alignment
Research environmental permits required for future trail design and construction	Technical inventory and analysis Site visits and fieldwork	Establish evaluation criteria Application of the evaluation criteria to the alignment alternatives to determine which ones best meet the terms of the project objectives	Site challenges assessment Design Criteria assessment Further refinement based on feedback from the stakeholder working group and public	Constructability assessment Right of Way examination Cost estimates Final design criteria assessment Phasing opportunity outlined

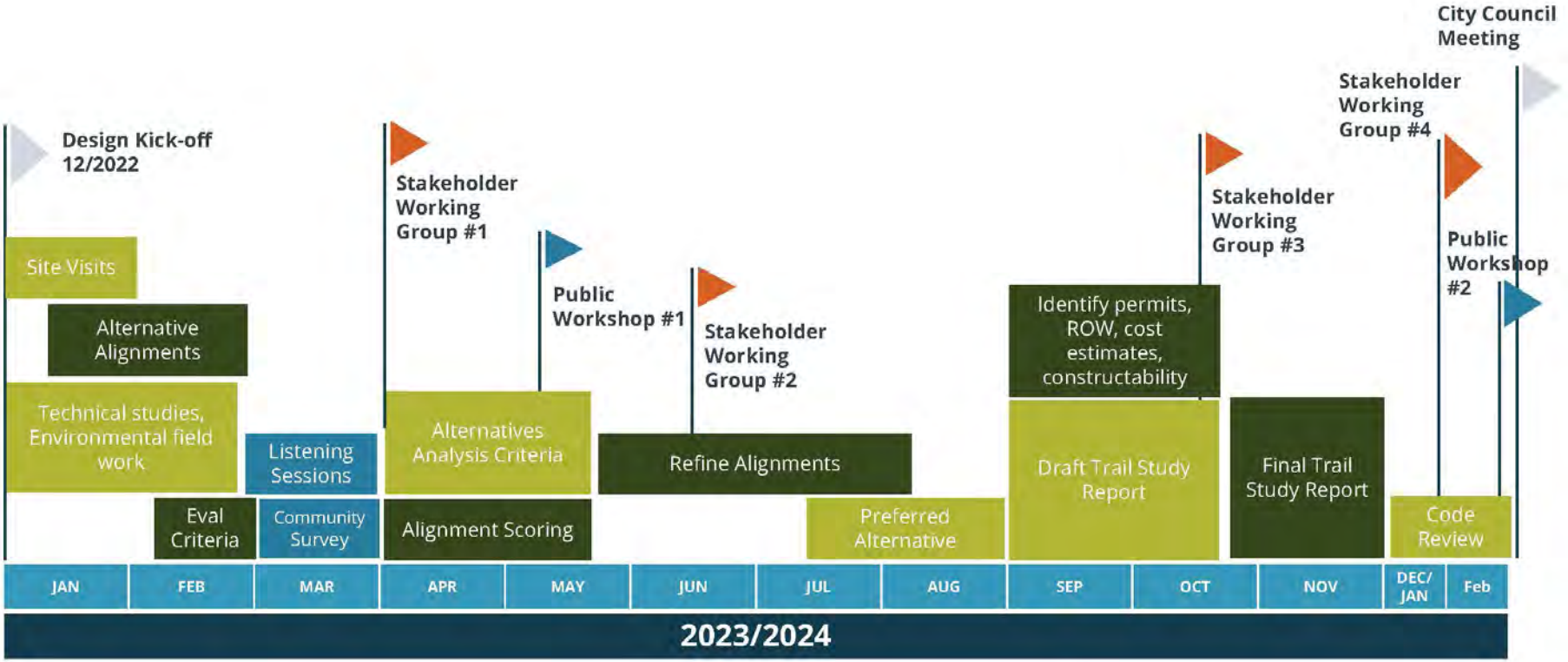
Initial Trail Alternative Alignments



Schedule

The initial Red Rock Creek Trail Alignment Study took place from January 2023 to January 2024. The engagement portion of the project required extra time to conduct interviews, perform site walks, and gather feedback from stakeholders. This task extended the timeline slightly.

The project was successfully completed in March 2024.



Section 3. Context

Nothing compares with the simple pleasure of a bike ride.

JOHN F. KENNEDY

All about Tigard

The City of Tigard reported a population of 57,344 individuals at the time of the 2023 Census. The community has experienced a population growth rate of 1.7% since 2022. The population identified as 80.25% White, 11.93% Latino, 8.52% Asian, 5.44% as two or more races, 0.97% Black or African American, 0.21% Native American, and 0.6% Native Hawaiian or Pacific Islander. The median per capita income in Tigard is $44,977. Additionally, the average commute time for residents of Tigard to reach their workplace was 24.1 minutes.

Regional Trail

The southwest portion of the Portland metropolitan statistical area has approximately 20 regional trails in various stages of completion. The proposed Red Rock Creek Trail will provide a valuable addition to Metro's Regional Trail system. RRCT will directly connect to the Fanno Creek Trail (#16) and the Tigard to Lake Oswego Trail (#53), drawing trips throughout the Tigard Triangle and Portland's SW Trails network immediately to the east. There are few trails in this corridor as major arterial roadways and steep topography have long been a barrier to trail development. Within this study area, proximity to the Red Rock Creek resource also presents a challenge, as the trail will often fall within a vegetated corridor that has been constrained by development. The alignment balanced interaction with the resource as well as access to commercial shopping areas for residents. The preferred alignment results in the length of trail being 11% on-street and 88% off-street.

Regional Trail definition:

Regional trails connect multiple destinations such as centers, parks and natural areas, transit and other regional trails. They serve as important transportation connections for people walking and bicycling, and support longer bicycle trips, often traversing more than one jurisdiction. Regional trails must be at least 75 percent off street and meet several criteria to be identified as regional.

- Metro's Designing for Livable Streets and Trails Guide

The long-term goal is for RRCT to serve as a regional trail. It will connect to:

- Fanno Creek Trail, a 4.5-mile trail running north-south through Tigard and southern Beaverton
  - » Direct connection to Tigard City Library on SW Hall Blvd
- Hunziker Industrial Core, a 138-acre of rich employment, industrial, and manufacturing land with adjacent residential uses
- SW Corridor: TriMet's light rail expansion to connection Portland, Tigard, and Tualatin
- Tigard to Lake Oswego Regional Trail via Wall Street to the existing bridgehead at I-5.
- Commercial shopping areas within Tigard Triangle (Walmart, WinCo, Costco, etc.)
- Ongoing mixed-use development within the Tigard Triangle
- Affordable housing developments within Tigard Triangle and Hunziker Core
- Future connections to SW Trails, no. 5 and 7

Presently, there are only two trails that run east to west and provide connections between Portland's southwest hills and the jurisdictions west of Portland city limits. Connections between RRCT and Portland's SW Trails network have yet to be planned. Planning has started for connections between Lake Oswego and the Tigard Triangle. A future trail between Portland and Tigard could incorporate the RRCT and increase its utility as a regional transportation corridor.

Trail History

The RRCT project has emerged as a community priority over the past decade and is identified as a strategic goal in numerous studies and plan documents. In 2014, the City of Tigard Strategic Plan first identified the RRCT project as a "new active transportation spine" safely linking the Tigard Triangle, Downtown, adjacent neighborhoods, and transportation networks. The RRCT project was also noted as a key project in the Tigard Triangle Urban Renewal vision and a critical component of an equitable and accessible urban neighborhood. In 2019, the City of Tigard applied for Regional Flexible Funds through Metro to prepare an alignment study to develop a preliminary design and identify easement and capital funding requirements to construct the RRCT project. The completed RRCT alignment study project will create the framework for funding and final design for an important active transportation facility in this rapidly developing urban district.

Relevant Projects and Plans

A significant portion of the proposed trail alignment is reflected in the 2040 Transportation System Plan (TSP) and proposed Tigard Triangle Transportation Network adopted in the Tigard Municipal Code. Planned network maps within the TSP (Figure 4 – Planned Pedestrian Network and Figure 8 – Planned Bicycle Network) show both planned and existing segments of the trail from its connection to Pacific Highway near the I-5 interchange southwest to Dartmouth Street. Similarly, a version of the trail alignment is shown in Map 18.660.B, including a segment beyond Dartmouth Street. However, the alignment currently shown in Map 18.660.B turns northward towards Pacific Highway and does not connect to the Highway 217 crossing or the favored alignment further south. In order to ensure implementation of the full trail alignment, each of these maps need to be amended.

Table 1 identifies the applicable documents that mention Red Rock Creek Trail. Tigard's forthcoming updated Trails System Plan will reinforce the importance of this trail and clearly incorporate the preferred alignment in the associated mapping.

Study Area

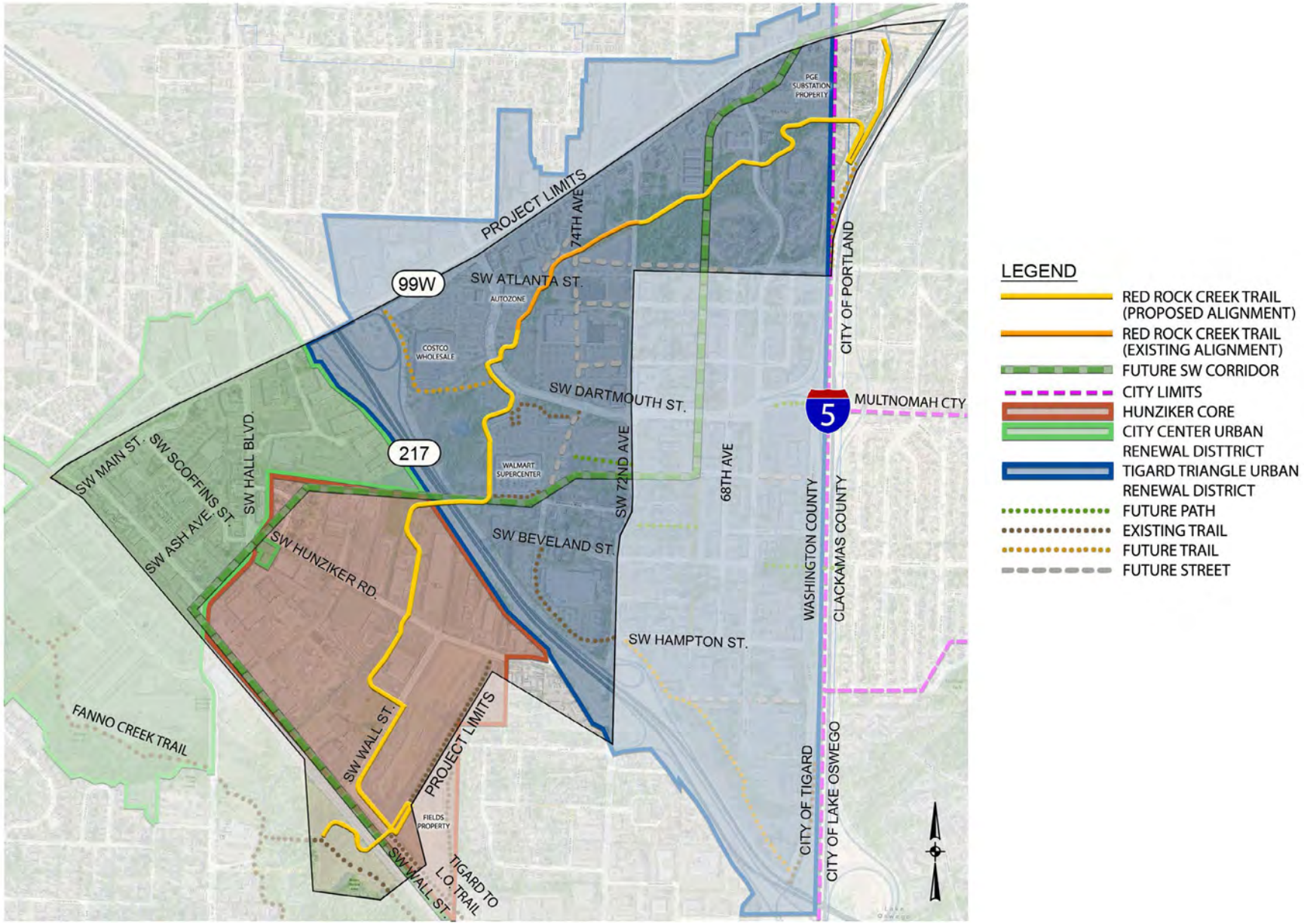
Red Rock Creek in east Tigard, flows west/ southwest from I-5/Hwy 99W toward SW Hunziker Road, draining to Fanno Creek and the Tualatin River watershed. The study area encompasses the area within the Tigard Triangle and the area of land west of Highway 217 toward Hall Boulevard. See the vicinity map.

Table 1. Projects and Plans

Source	Description	Related Project Name
Tigard TSP, 2010	The City shall require and/or facilitate the construction of off-street trails to develop pedestrian and bicycle connections that cannot be provided by a street.	GOAL 3 – Multi-Modal Transportation System
Tigard TSP, 2040 Chapter 4, Modal Plans TSP Projects AT-25, C-2, C-4	Development of the Red Rock Creek with connections across the significant Hwy 217 and railroad barriers to the Fanno Creek Regional Trail, public library, and downtown for people of all ages and abilities. Development will be throughout the Tigard Triangle and across the rail line that creates a barrier to the Public Library and Hall Boulevard. The City has identified potential opportunities to connect this trail to Downtown via the planned Highway 217 overcrossing, a much safer east-west route than the current options that rely heavily on Pacific Highway.	Red Rock Creek Trail
Tigard CIP, 2023-2024 CIP Project 94049	The project will create a sustainable creek, floodplain, and vegetated corridor cross section that can convey current and future predicted storm flows while providing habitat and shading for native fish and other species. It will protect and re-bury exposed sanitary sewer lines. Some piped creek sections will be day lighted. The new creek corridor cross section will be designed to also accommodate as possible a future Red Rock Creek Trail.	Red Rock Creek Stabilization and Enhancement
Tigard Parks and Recreation System Plan, 2022	Approved trail plans will connect the Hunziker Core area to Potso Dog Park and to the Fields Property, connecting Gap Area 8 to these existing parks and the Red Rock Creek Trail. Both Potso and the Fields Property will be developed to incorporate neighborhood-serving park amenities for residents of Gap Area 8 and other nearby residents. In addition, Tigard will explore adding park amenities at the library to provide more recreation value accessible from the trail. Pursue acquisition and development of parks in accordance with plans for the Tigard Triangle and develop the Red Rock Creek Trail and associated projects.	Gap Areas 8 and 9
Tigard Parks and Recreation System Plan, 2022	The Triangle has the potential to support a future trail network that will connect to the broader regional trail along Fanno Creek. In the Triangle, Red Rock Creek is envisioned as a significant east/west trail connection that would follow the Red Rock Creek stream channel and along future road networks to eventually connect to the Fanno Creek Trail west of OR 217. Developing this trail system would be tied to planned stream restoration and stormwater management projects for the corridor. There are also a number of local trail systems that could potentially connect future public spaces. New facilities would likely require additional operations and maintenance time.	Realizing the Tigard Triangle Vision

Not identified in the Tigard Trails Plan, 2011; Neighborhood Parks Plan

Figure 1. Overview Map



THIS PAGE WAS INTENTIONALLY LEFT BLANK.

Section 4. Engagement

Trails contribute to economic vitality, increased property values and increases in regional tourism.

AMERICAN TRAILS, TRAILS FOR ALL AMERICANS REPORT, 1990

The Red Rock Creek Trail Alignment Study actively involved key stakeholders, Tigard Triangle residents, and underrepresented populations. It provided many opportunities for the community to engage with the trail siting through two public workshops, a web-based survey, two listening sessions, and a consensus-based stakeholder working group. The public engagement strategy named three goals: 1) Increase meaningful participation; 2) Involve underrepresented populations; 3) Conduct a process that leads to future funding. To meet these goals, the strategy embedded equity engagement in every stage and intentionally built on past efforts within the Tigard Triangle and across the region by Metro, especially the "2021 Metro Walking-Biking Trails Engagement project with Black, Indigenous, and people of color."

Involving underrepresented populations (Goal 2) and increasing meaningful participation (Goal 1) required that we involve historically underrepresented groups early in the process so that their insights shaped the survey questions, workshop format, and stakeholder agendas. In consultation with Unite Oregon staff, the project team and City Staff determined that the Tigard Triangle target population included residents receiving housing assistance, Spanish-speaking residents, and seniors. We concentrated our efforts on engaging with these priority populations early and consistently. Our focus was less on "gathering" information and more on "engaging" with things held valuable, tensions, and trade-offs. To accomplish this, City of Tigard staff hosted two listening sessions at the Fields and Red Rock Commons apartments in February—both complexes house low-income or very low-income residents. Convening in the apartment complexes brought the event to the people, rather than asking the people to come to us. Facilitators offered food and a raffle as participation incentives. Some of the session questions were drawn from the "2021 Metro Walking-Biking Trails Engagement project with Black, Indigenous, and people of color" building on existing equity work in this area. The residents provided valuable insight into the hopes and concerns of local residents about the trail. (See Appendix A for session notes.) These notes formed the basis for the survey questions and agenda topics for the first stakeholder working group (SWG) meeting. (And one participant from these sessions actually joined the SWG.)



After hosting the listening sessions, the City of Tigard, working with the project team, identified key agencies, residents, and organizations who could participate in the Stakeholder Working Group (SWG). The SWG included representatives from multiple sectors including government agencies alongside private, civic, other non-government entities (including local residents, property owners) Community Partners for Affordable Housing, Unite Oregon, Wetlands Conservancy, trail advocates, public transit staff, ODOT, and City of Tigard staff. Drawing on community feedback, the SWG was tasked with determining the siting of the proposed trail. The group process was based on a shared decision-making model. This model promotes creative solutions that weigh preferences, values, and interests regarding matters of common concern. Participants strive to make decisions that all participants can support—or at least live with (as opposed to using a majority vote). In four separate meetings, the SWG prioritized responsiveness to public concerns highlighted in the agenda items, presentation material, and segment evaluation. Participants reviewed the initial site analysis, heard community concerns, addressed project challenges, discussed initial trail alignment concepts, and assessed compliance with the design criteria.



To launch widespread public engagement efforts, the City of Tigard staff sent a postcard (translated in both English and Spanish) to 1,721 residents in the Tigard Triangle area to invite them to participate in the May 18 public workshop and/or complete the web-based survey. (The survey questions were meaningfully informed by participants in the listening sessions and can be viewed in the Appendix A.) City staff also sent the survey to the SWG, residents who attended the two listening sessions at the Fields and Red Rock Commons apartments, and to the members of the Town Center Advisory Committee and the Tigard Transportation Advisory Committee. Postcards were also posted in the library, targeting areas

specifically where they have special senior programs (since the Tigard senior center is closed, the library has stepped up to supplement programming). A week before the public workshop, the postcard was also shared on the Portland Velo Facebook Group, a bicycle advocacy group that has 1,500 members.

On May 3rd and May 10th, City staff presented information on the trail alignment study to both the Tigard Transportation Advisory Committee (TTAC) and the Tigard Town Center Advisory Commission (TCAC). TTAC consists of eleven members who are residents of Tigard or own or have primary management responsibility for a business in Tigard. The committee includes representation from self-identified pedestrian, bicycle, and transit advocates. They are appointed by the City Council for three-year terms. TCAC consists of eleven members who are residents of Tigard or own a business or property within the TIF Districts. They are appointed by the City Council for 3-year terms. Two alternate members are also appointed for 1-year terms.

The public workshop hosted on May 18th had a highly interactive design. The meeting was held in person, with the option for people to also join on-line. In addition to providing an overview of the project, participants interacted with a large, interactive map of the trail alignment, which detailed the segment alternatives. Participants then ranked their segment preferences. This feedback was communicated to the SWG. To advance the project's equity goals, the workshop offered food, Spanish interpretation, and participation incentives.

Between the first public workshop and the final public meeting on February 28, 2024, the SWG met three times. Over the course of these meetings, the body solicited feedback from key Tigard agencies such as the police and parks departments, scored each potential trail section, discussed the merits





and drawbacks of each segment in large and small groups, and ultimately used consensus-based voting to recommend a preferred alignment. The project team also met individually with key participants to consider specific concerns. Participants, for instance, had concerns with alignment C6. The design team responded to this feedback by reworking the proposal and meeting with the members who had concerns.

Public and SWG feedback altered several segment alternatives, demonstrating the value of the public process. At the final meeting, SWG participants mentioned the responsiveness of the project team and City staff to concerns, especially about user safety. They appreciated hearing feedback in real time and being able to discuss the trade-offs of certain options. One agency planner noted how the process had increased his understanding of what the public really wants.

Insights gathered from all parts of the engagement process were vital in advancing the design process. These inputs helped identify specific areas along the trail that required further investigation, such as Segment C and the alignment alternatives once you cross over Hwy 217.

The final public meeting celebrated the many voices that contributed to establishing preferred trail alignments. The fifty attendees could see how the trail might look in their neighborhoods and near their businesses. Maps, visualizations, and renderings of each final alignment section was displayed on easels. The project team even staked out a 12-foot wide trail section adjacent to the restaurant, giving attendees a sense of what the actual trail would look like. One business owner observed that while he was initially hesitant about the trail project he felt like his voice was heard throughout the process, resulting in a trail alignment that made sense for the area and that he personally would use.

Table 2 summarizes the outreach efforts that took place throughout the entire process of getting to a preferred alignment alternative.





Table 2. Engagement Summary

Event	Location	Participants Involved	Resources Provided	Outcomes
Listening Session #1 February 15, 2023	Red Rock Commons (Affordable Housing)	8 residents, including apartment manager	Raffle, food, table tent ground rules, and questions drawn from the 2021 Metro Walking-Biking Trails Engagement project.	Participants informed the survey questions and agenda topics for the first SWG.
Listening Session #2 February 22, 2023	Fields Apartments (Affordable Housing)	5 residents (huge snow storm affected attendance)	Raffle, food, table tent ground rules, and questions drawn from the 2021 Metro Walking-Biking Trails Engagement project.	Participants informed the survey questions and agenda topics for SWG #1; one resident joined the SWG.
Unite Oregon (CBO) Interview April 4, 2023	Zoom	Mohanad Alnajjar	2021 Metro Trails report; Tigard Triangle demographic data.	Confirmed that the Tigard Triangle target population included residents receiving housing assistance, Spanish-speaking residents, and seniors. Participated in SWG #1.
Stakeholder Working Group #1 April 6, 2023	Zoom	17 participants (residents, business owners, environ. NPOs, agency liaisons from ODOT, trails, TriMet, and railroad)	Trail alignment study overview; maps of potential routes; explanation of segment criteria.	Introduction to trail and purpose of group as a recommending body; established ground rules and received feedback in small group breakout rooms.
Postcard Distribution May 2023	Posted at popular Latino market; at library near senior activities	1,721 Tigard Triangle residents and business owners received postcards	Survey link and public workshop promo translated in both English and Spanish.	Ensured information distributed to entire target population.
Electronic Survey Promotion May 2023	Facebook; Email to Latinx business network, Tigard Downtown Alliance	City of Tigard FB with 9,500 followers; Portland Velo Cycling Group with 1,500 members	Link to survey and invitation to the public workshop.	Ensured information distributed to entire target population.
Web-Based Survey May 2023	Online	32 completed surveys	Incorporated questions drawn from listening sessions and Metro Trails.	Feedback used to shape the first public workshop and to narrow the potential alignments presented at SWG #2.
Tigard Transportation Advisory Committee May 3, 2023	City of Tigard Conference Room	11 members who reside in or own a business in Tigard	Trail alignment study and maps of potential routes; Q&A session.	Invitation to participate in public workshop #1 and contribute feedback to the City.

Event	Location	Participants Involved	Resources Provided	Outcomes
Tigard Town Center Advisory Commission May 10, 2023	City of Tigard Conference Room	11 members who reside in or own a business in Tigard	Trail alignment study and maps of potential routes; Q&A session.	Invitation to participate in public workshop #1 and contribute feedback to the City.
Public Workshop #1 May 18, 2023	Tigard Public Library & Virtual	20 participants	Large interactive GIS map of trail alignment with segment alternatives; offered food, Spanish translation, and participation incentives.	Participants ranked segment preferences using dots; public feedback presented to City staff and the SWG; feedback also led to further investigation of Segment C and alternatives after crossing 217.
Stakeholder Working Group #2 June 27, 2023	Zoom	13 participants	Police and parks reports (as requested by SWG members); Scoring sheets with maps, visuals, renderings of each potential section; Small and large group discussions on merits and drawbacks of each segment.	Each member had the opportunity to rank their preferred alignments and submit these rankings through email so everyone could participate, not just attendees.
Community Partners for Affordable Housing (CBO) Meeting Summer 2023	Zoom	Jilian Saurage Felton (Director of Housing) and Rachael Duke (Executive Director)	Showed the potential alignments that would affect Red Rock Commons.	Voiced concerns about segment F1 and trail lighting being intrusive for ground floor residences; design team shifted alignment based on their feedback.
One-on-one Meetings Summer 2023	Zoom	ODOT staff, SW Trails, Tri-Met, PGE, and property owners	Reviewed any concerns with the potential alignments that would affect existing or planned infrastructure.	Design team shifted alignments presented for SWG #3 based on the feedback in these meetings.
Stakeholder Working Group #3 October 23, 2023	City of Tigard Conference Room & Zoom	10 participants	Preferred alignment presentation with criteria review; Consensus-based voting, using the Fist-to-Five process.	The vote showed consensus over 6 separate alignments and concern with alignment C6. The design team responded to this feedback by reworking the proposal and meeting with the members who had concerns.
Stakeholder Working Group #4 January 31, 2024	Zoom	9 participants	Reviewed preferred alignment, implementation, and costs; highlighted the segments that changed because of SWG feedback (e.g. A2, C2, C6, F2).	Participants mentioned the responsiveness of the project team and City staff to concerns about user safety and willingness to hear feedback in real time; noted how this increased understanding of what the public really wants.
Public Workshop #2 February 28, 2024	48 North Pizzeria	50 participants	Maps, visualizations, and renderings of each final alignment section displayed on easels; staked out 12-foot wide section of actual trail adjacent to restaurant.	Closed the loop by showing how the trail alignments had changed based on public input; celebrated the potential for the trail to become a reality in Tigard.

Section 5. Trail Criteria

Trails promote health and fitness by providing an enjoyable and safe place for bicycling, walking, and jogging, removed from the hazards of motor vehicles.

AMERICAN TRAILS, TRAILS FOR ALL AMERICANS REPORT, 1990

Trail Criteria

FHWA Design Standards

According to research conducted by FHWA and AASHTO, the recommended width for a shared use trail is 10-ft minimum and up to 14-ft for high user volumes. To meet accessibility requirements, the trail shall strive to maintain grades of 5% or less along the path of travel. Where topography is challenging, slopes up to 8% are allowable with landing areas spaced every 200-ft (Source: AASHTO Guide for the Development of Bicycle Facilities, 1999, FHWA Shared Use Paths, 2006).

ODOT Design Standards

To meet shared use path standards, ODOT Bicycle and Pedestrian Design Guide, 2023 recommends the minimum of 10-ft trail width, extending from 12-ft to 16-ft for high use areas. ODOT notes that a shy distance of 2-ft minimum on either side of the trail is a best practice. "This area should be graded level, flush to the path and free of obstructions to allow recovery by errant bicyclists. This applies to excavated or cut-sections, where falling debris can accumulate, stimulating weed growth, further restricting the available width." Boardwalks and bridges require 14-foot clear space between the inside rails of the structure.

10-feet of overhead clearance is typical, but a minimum of 8-feet is required. See ODOT's Oregon Bicycle and Pedestrian Design Guide, chapter 7 for more information.

When the walkway profile is steeper than 5 percent, consider adding level resting opportunities in the available right of way every 200 feet (HDM 810.9.2).

Curve radius of 75-feet will allow for cyclists to commute at comfortable speeds and maintain adequate sight distance for all users.

There shall be 20-ft of separation between the trail and the interstate system. In cases where the trail is adjacent to an on/off-ramp, there must be 5-ft of separation with a safety barrier.

Metro Livable Streets

RRCT is designed to meet the definition of Regional Trail.

> *"Regional trails differ from local trails in that they are usually larger in scope – crossing neighborhood lines and linking cities, counties and even states. As excellent places for hikers, walkers, runners, cyclists, and paddlers to exercise and experience nature, regional trails are destinations unto themselves – but they also take us from the places we live to the places we learn, work, shop, and play.*
>
> *Regional trails are typically separated from roads. Their off-street nature make trails more pleasant for recreational users by reducing interactions with car traffic, which also make them quicker routes for pedestrian and bike commuters."*

Metro recommends a 12-foot-wide pathway with 2-foot-wide shoulders for a typical, regional shared use path. These dimensions may vary depending on volumes at high-demand locations or constrained locations along the facility. See page 104 of METRO's Designing Livable Streets and Trails Guide for further information.

Tigard Greenway Trails System Master Plan

Tigard's Trail System Plan, 2011 is a comprehensive document for trail planning and design. Construction of a trail shall generally comply with the following guidelines:

- The trail surface shall be firm and stable.
- A 12-foot width is preferred in areas with high anticipated use and whenever rails are used.
- Curb ramps shall be provided at roadway crossings. Tactile warning strips and auditory crossing signals are recommended.
- Running grade of the trail alignment:
  - » Slopes typically should not exceed 5 percent. However certain conditions may require the use of steeper slope.
  - » Up to an 8.3% slope for a 200-foot maximum run, landings or resting intervals must be provided at minimum of 20-feet. If steeper segments are incorporated into the shared-use path, the total running grade that exceeds 8.33 percent should be less than 30 percent of the total trail length.
  - » Up to a 10 percent slope for a 30-foot maximum run, with resting intervals spaced every 30 feet at a minimum.
  - » Up to 12.5 percent slope for a 10-foot maximum run, with resting intervals spaced at 10 feet minimum.
- Trail height should be set to allow for small animal movement under the structure, a minimum of 6 inches above grade.
- Trails higher than 30 inches above grade require a 42-inch-high pedestrian rail.
- Bridges should be at least as wide as the paved path, with minimum of 2-foot clear horizontally on either side.

- Bollards at trail entrances at 5-foot spacing is desirable.
- Signs shall be provided indicating the length of the accessible trail segment.

Grade-Separated Crossing Design Standards

The main design parameters for the grade-separated crossings are:

- Width of Trail: 12-feet plus a two-foot shoulder on each side
- Width of Bridge: 12-feet minimum inside of railings, 16-feet preferred (assumed for estimation in this report)
- Vertical clearance over highway: 19.5-feet above paved surfacing, minimum
- Vertical clearance over railroad: 23.5-feet from top of rail, minimum
- Vertical Clearance over future MAX: Wire height under overpass – 14-feet minimum (TriMet Design Criteria)
- Vertical clearance over local roadway: 16-feet from roadway finish grade, minimum
- Vertical Clearance for undercrossing/tunnel: The recommended height of opening is 12-feet, 10-feet, minimum
- Vertical Clearance for trail structure crossing under MAX Elevated Guideway: 10-feet
- Horizontal Clearance: 9-feet clearance between CL of track and vertical structure (e.g. wall, guardrail, pole)
- Slope of trail for ADA compliance: 5 percent, or up to 8.33 percent with landings at 200-foot intervals
- Assumed pedestrian crossing structure thickness at mid-span over Hwy 217: 5-feet (trail surface to bottom of structure)

Trail Alignments Evaluation Criteria

The design team and City of Tigard staff developed the following set of design criteria to provide a base of expectations and guidelines to follow when assessing the alignment alternatives. The design criteria for the trail alignment study are listed below.

USER EXPERIENCE

Ensure all users are comfortable, feel secure, are provided equal access, and have the opportunity to engage with nature while using the trail.

ENVIRONMENTAL IMPACTS

Protect natural areas by minimizing impacts to floodplains, wetlands, Tigard Significant Wetlands, and vegetated corridors.

CONNECTIVITY / CONTINUITY

The alignment is designed in a route that connects users to key destinations. The route is not circuitous or causes out-of-direction travel but has a smooth, intuitive route.



PERMITTING

The design is likely to pass the permitting process.

COST, CONSTRUCTABILITY & FUNDING

Project cost is feasible and not prohibitive of progress; project is likely to receive funding and financial support.

PROPERTY OWNERSHIP

Minimally impact adjacent properties and minimize need of property purchase and/or easements.

SAFETY & SECURITY

Provide a safe and welcoming trail experience for all users designed with clear sightlines, emergency access, and minimal hiding places.

COMMUNITY SUPPORT

Alignment is supported by the public, community, and adjacent businesses.



Photos: Errol Heights Park in SE Portland

THIS PAGE WAS INTENTIONALLY LEFT BLANK.

Section 6. Existing Conditions, Data Collection

An early morning walk is a blessing for the whole day.

HENRY DAVID THOREAU

Red Rock Creek in east Tigard, flows west from I-5/ Hwy 99W toward SW Hunziker Road, draining to Fanno Creek and the Tualatin River watershed. This area of Tigard is gently sloping west/southwest from I-5 to Fanno Creek. The RRCT route will parallel the creek centerline for the majority of the alignment with the exception of roadway crossings. The trail drops a total 225 feet from its highest point near Hwy 99W/I-5 to its low point near Fanno Creek. Significant changes in elevation occur at the Highway 217 crossing and where the trail crosses the railroad tracks adjacent to SW Wall Street.

The existing conditions data collected assessed the following discipline areas:

Data was collected to assess the following:

- Jurisdictional Boundaries
- Wetlands and Sensitive Lands
- Hydrology & Floodplains
- Stormwater Drainage
- Hazardous Materials
- Historic and Cultural Resources
- Utilities
- Transportation Facilities
- Land Use and Property Ownership
- Railroad Ownership

Jurisdictional Boundaries

The study area is bounded by I-5 on the east, Hwy99W on the north, and Fanno Creek on the south. Highway 217 traverses the southwestern portion of the study area, see Figure 2. Fully within City of Tigard limits, the study area context includes the City of Portland Southwest Urban Trail network to the north and east, the Tigard-Lake Oswego Trail to the southeast, and the Fanno Creek Trail to the southwest. Red Rock Creek is fully within Washington County; however, the northeast portion of the study area at the intersection of Highway 99W and I-5 is considered within Multnomah County. The future Southwest Corridor Light Rail project will provide a high-capacity transit link between the Tigard Triangle and Portland and Tualatin. The project area includes the Tigard Triangle Urban Renewal Special District and the Hunziker Core area.

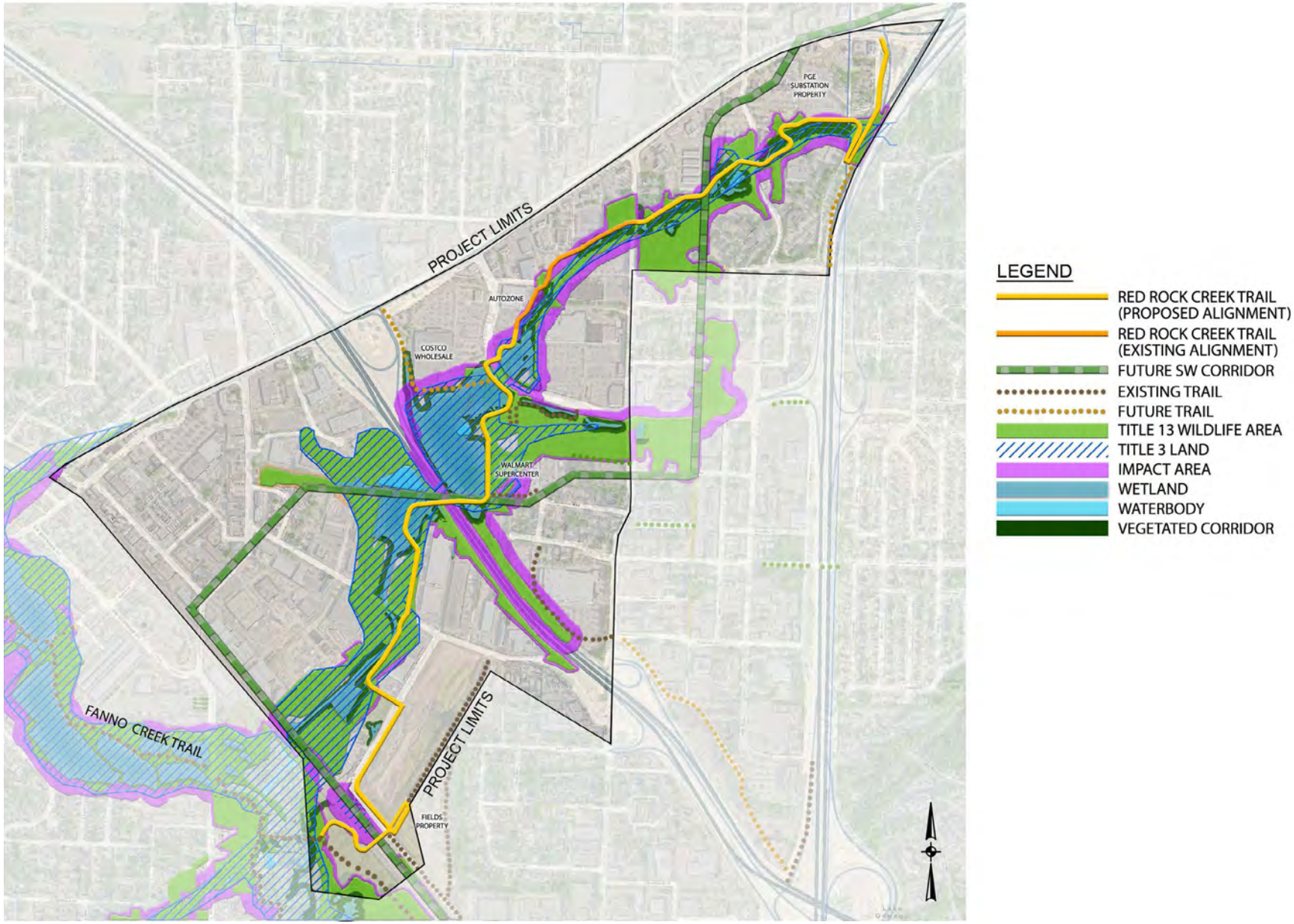
Wetland and Sensitive Lands

The undeveloped lands along the RRCT study area are largely constrained by wetlands and waterways. These resources pose varied challenges to not only path placement from a logistical standpoint, but also require the balancing of public benefits from increased pedestrian and bicycle connectivity with those of wetland protection, water quality, and wildlife habitat.

Red Rock Creek is the primary stream system within the project area. Numerous adjacent wetlands are also present along the stream system. To simplify environmental permitting, avoidance of the natural resources in the project corridor would be ideal but would also be difficult given existing conditions within the areas available for trail development. Lands adjoining Red Rock Creek and extending outward from the channel itself often include wetlands. Both the creek and wetlands are protected by vegetated corridor regulations by both Clean Water Services (CWS) and the City of Tigard. Additionally, wetlands in the project area that are identified on the Local Wetland Inventory are all Locally Significant at the City level and as a result are protected to a higher degree than unmapped wetlands.

As the avoidance of natural resources along the project corridor is not possible, minimization of impacts will need to be the project focus. Minimization will not only result in a decrease in direct or indirect impacts to the resources themselves, but minimization of impacts will also provide a framework for project applications to the various public agencies that will be required to review, and issue permits and approvals for the future trail. Permits for any impacts to wetlands or waterways will be required from both the Oregon Department of State Lands (DSL) and US Army Corps of Engineers (Corps). Permits for any impacts to the vegetated corridor will be required from both CWS and the City.

Figure 2. Wetlands and Sensitive Lands



Hydrology & Floodplains

Red Rock Creek's headwaters fall within the City of Portland, and it flows from the flanks of Mt. Sylvania southwest into Fanno Creek, which is a tributary to the Tualatin River. The majority of the 1,042-acre drainage basin is within the City of Tigard, see Figure 3. There are unnamed tributaries flowing into Red Rock Creek and its flow inputs are comprised almost entirely of stormwater discharge. Because the watershed is highly developed and impervious, the stream is prone to flashy and erosive. In the upper reaches, the creek flows through steep terrain, often in ravines that are deeply incised. Once the creek reaches the wetland and beaver ponds located just upstream of SW Dartmouth Street the stream's longitudinal slope flattens. Eroded soils from the steep reaches are deposited in the flat reaches, where they block culverts and fill wetlands.

The mapped FEMA 100-year floodplain extends from Fanno Creek up to SW Dartmouth Street, encompassing the flatter portions of Red Rock Creek. There is a floodway along Fanno Creek, but no floodway on Red Rock Creek. Trail construction within the 100-year floodplain will require balanced cut and fill to ensure there is no rise in the 100-year flood elevation. If the project does increase the 100-year flood elevation, a Letter of Map Revision (LOMR) will be required.

Stormwater Drainage

The City of Tigard has adopted the Clean Water Services (CWS) Design and Construction Standards for Sanitary Sewer and Surface Water Management. The CWS Design and Construction Standards outline stormwater management requirements including water quality treatment, water quantity control for conveyance capacity, hydromodification, and Low Impact Development Approaches (LIDA) to reduce adverse impacts to drainage infrastructure and water resources of the Tualatin River Basin.

This project is located within the Tigard Triangle, where the City of Tigard has adopted a Red Rock Creek Regional Stormwater Strategy (RRCRSS) that has been approved by CWS. The RRCRSS enables development and redevelopment that occurs within the Tigard Triangle to develop and manage a funding mechanism for enhancing the Red Rock Creek stream corridor instead of providing onsite detention to meet CWS hydromodification requirements, see Figure 3. The stream enhancement project will address water quantity control and hydromodification requirements associated with any new impervious area created by the trail. On-site water quality treatment is required for any new or replaced impervious area (including the trail if its surface is impervious). In locations where the trail is in or adjacent to the VC, CWS allows use of the vegetated corridor as a filter strip for water quality treatment that meets LIDA requirements.

The City of Tigard is currently designing the first phase of the stream enhancement project, which runs from Crystal Lake on the south side of SW Dartmouth Street upstream to SW 72nd Avenue. The stream enhancement design will be coordinated with the trail design, including replacement and enhancement of all stormwater outfalls and piping a major outfall from Highway 99W that reaches the creek at the end of SW Atlanta Street. In the reach between SW Atlanta Street and SW 72nd Avenue, the stream enhancement design will include grading and surface preparation of the trail alignment; paving will occur at a future date when safe trail connections are available.

There are a few existing water quality ponds and swales located adjacent to the creek that will need to be protected in the trail design. The creek flows beneath road crossings through culverts of unknown condition; however, no culverts are anticipated to be replaced as a result of the future trail project.

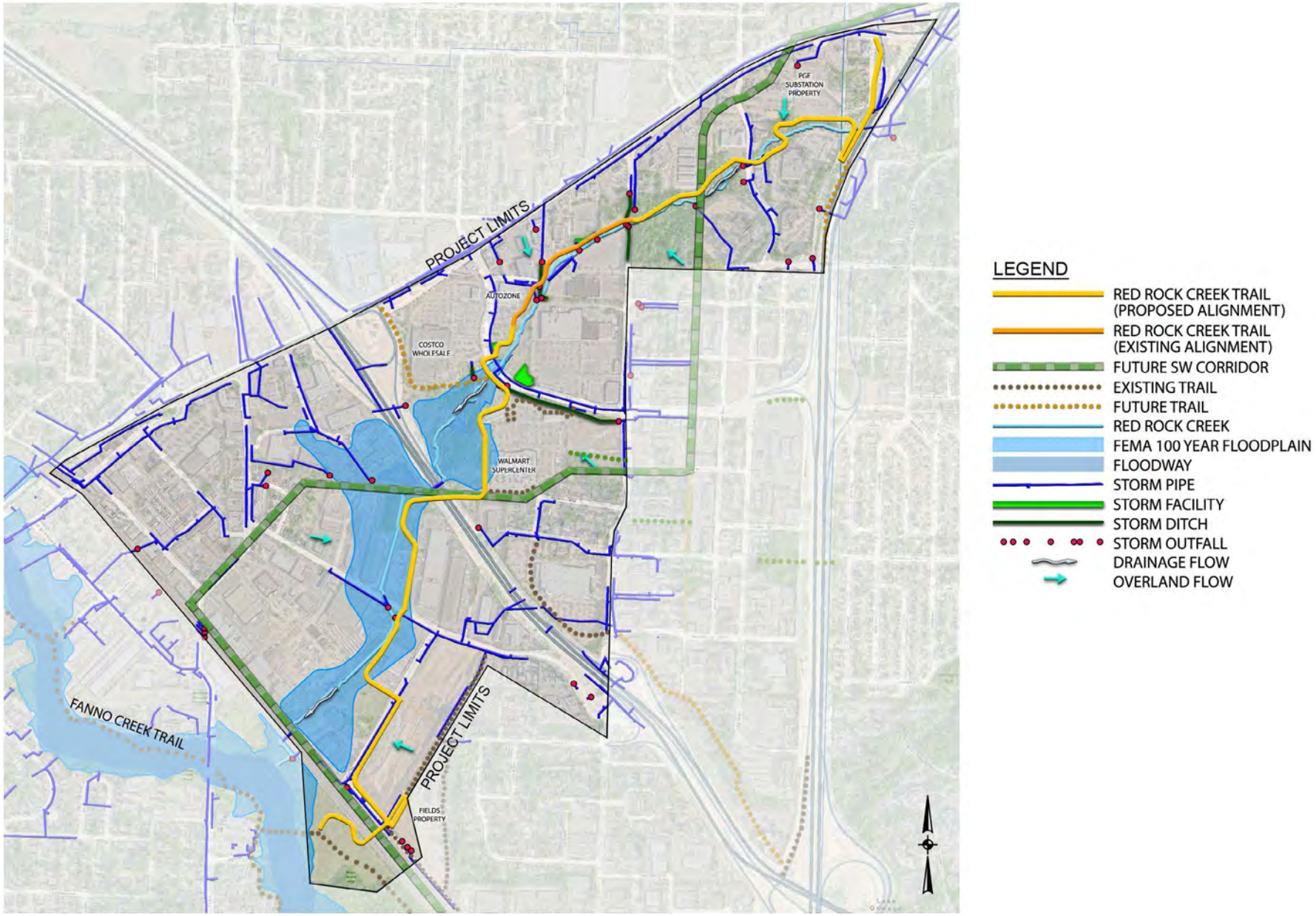
Hazardous Materials

A Hazardous Materials Corridor Study (HMCS) was completed for this study area. Based on the review of environmental and historical records and previous investigations seven environmental conditions were identified, involving a former foundry business, transformer site, lumber distribution and manufacturing facilities, building material facility, railroad, and a construction/ sheet metal facility. Sites of concern are located adjacent to the project corridor at the SW Hunziker Road crossing, the railroad crossing, and the PGE Substation located at the end of SW 64th Avenue. Contaminants of concern include petroleum hydrocarbons, polyaromatic hydrocarbons, metals, polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs).

Recommendations for the project corridor include a Phase II Environmental Site Assessment, performed at the footings of the pedestrian bridges, and a surface soil sampling event performed along the trail segments to determine disposal and excavation and provide for construction worker safety.

A limited Phase II assessment was completed for the RRC Stabilization and Enhancement project between Crystal Lake natural area south of SW Dartmouth St and SW 72nd Avenue. Additional Phase II assessments must be conducted during the preliminary engineering design (30percent level) of each trail construction project (or the entire trail project if funding is available).

Figure 3. Hydrology and Drainage



Historic & Cultural Resources

Historic Resource Review

There is one significant historic resource crossed by the study area: the Southern Pacific Railroad, Tigard Branch. There are 35 potential historic resources (buildings, structures, objects, and sites at least 45 years of age, i.e., constructed before 1978) on parcels overlapped by or adjacent to the study area (Figure 4). Fourteen of these (HR-1 through HR-14) have been previously inventoried and evaluated for other projects. The remaining 21 resources (HR-15 through HR-35) were identified by reviewing construction dates available in Washington County's Intermap Geographic Information System (GIS) and the City of Portland's Portland Maps GIS. These 21 resources have not been inspected in the field, and their National Register of Historic Places (NRHP) eligibility will need to be evaluated if the project will overlap or abut those parcels. Modern construction (buildings, structures, objects, and sites built less than 45 years ago, i.e., 1978 or later) is unmarked Figure 4. No further work is required for modern construction.

Historic resources that are overlapped by or adjacent to the project's Area of Potential Effects (APE) would be inventoried as part of a historic baseline study to meet ODOT review, which would include recommendations of eligibility for listing in the NRHP. For resources that ODOT concurs are not eligible for listing in the NRHP, no further cultural resources work would be needed.

For historic resources that are likely to meet the minimum requirements to be eligible for listing in the NRHP, ODOT would require a Determination of Eligibility. If the project cannot avoid eligible resources, ODOT will require a Finding of Effect. The project alignment appears to cross the parcels of NRHP-eligible historic resources, but it is possible that there will be no adverse effect on those resources. Adverse effects would require mitigation. For eligible resources, the project would need to consider potential use under Section 4(f). The NRHP-eligible railroad is likely exempt from consideration as a Section 4(f) resource. A detailed list of properties is provided in an Appendix B Existing Conditions Report.

Archaeological Review

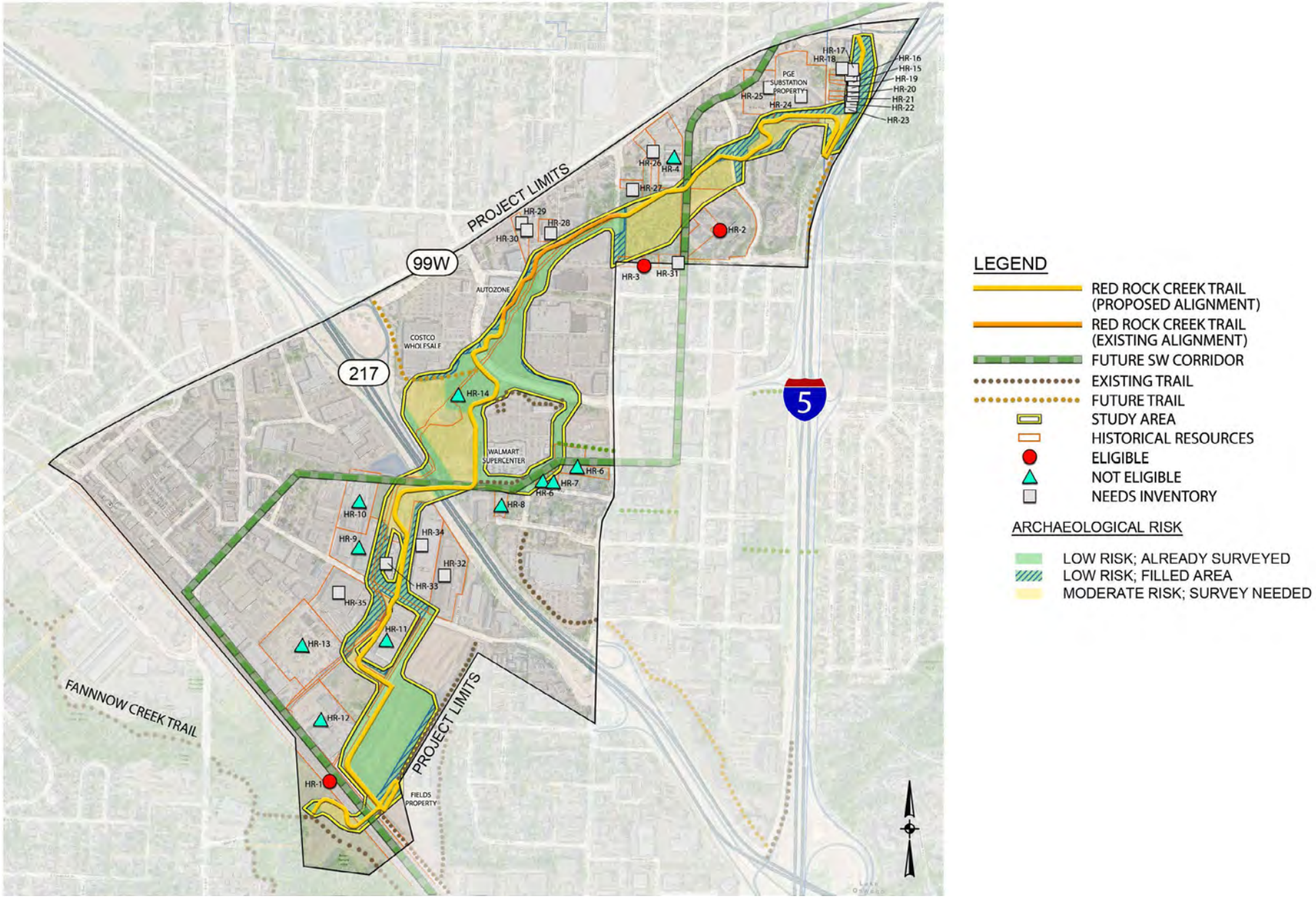
Records were reviewed to determine whether cultural resource surveys have been previously conducted and if previously recorded archaeological resources were present in or near the study area. The team reviewed records utilizing the Oregon Archaeological Records Remote Access system maintained by State Historic Preservation Office (SHPO), materials in the AINW library, and other historic maps and documents. Twenty-three cultural resource studies have been conducted on lands overlapping or adjacent to the study area. Not all of these previous studies conducted a full archaeological survey, including shovel testing, within the study area. No archaeological resources have been previously recorded within the study area. Small archaeological resources have been previously recorded near the study area and suggest that there is a moderate probability of encountering an archaeological resource along the proposed trail alignments.

Previously surveyed areas that did not encounter archaeological resources are considered low risk with respect to the proposed RRCT project's likelihood of encountering archaeological resources. These areas are indicated in green in Figure 4. Additionally, paved or filled areas within the study area are considered low risk for encountering archaeological resources if the proposed trail will not impact native soil. These areas will need baseline-level study within the preferred alignment to meet ODOT review, but Phase I subsurface archaeological survey is not recommended.

Unpaved and unfilled areas that have not been previously surveyed for archaeological resources, or where previous studies have recommended shovel testing (a Phase I study), are indicated in yellow in Figure 4. These areas have moderate risk of having an archaeological resource. Moderate-risk areas are adjacent to the creek northeast and southwest of SW 68th Parkway, in the wetlands northeast and southwest of the Beaverton-Tigard Highway (OR-217), between SW Hunziker Road and Potso Dog Park, and south of the Portland and Western Railway.

Identified archaeological resources would be recorded with SHPO. Before Phase I survey can be conducted on publicly owned land, the cultural resource consultant will need to obtain a SHPO permit. If archaeological resources are identified their eligibility for listing in the NRHP will need to be evaluated, which may require a Phase II study. It is possible that the project will have no effect or no adverse effect on eligible archaeological resources. Adverse effects would require mitigation.

Figure 4. Historical Resources Study Area



Utilities

Public Utilities

WATER

Tigard residents and businesses are served either by The City of Tigard or Tualatin Valley Water District (TVWD), both of which provide water from the Clackamas River. The Tigard Triangle falls into the TVWD's Service area. There is a TVWD water main that runs from water storage towers near the intersection of 67th Avenue and Baylor Street. This main runs west on Baylor Street, south on 68th Avenue, then east on Beveland Street until it crosses Hwy 217.

SANITARY SEWER

The sanitary sewer system is owned and operated by the City of Tigard throughout the study area. There is a 10" sanitary sewer main that runs along Red Rock Creek and appears to service a large portion of the Tigard Triangle. Several incoming 8" sanitary pipes flow into this trunk line at the street connections (65th, 68th, 72nd, Atlanta, etc.). South of Dartmouth, the sanitary pipe increases in diameter and crosses under Highway 217 approximately 250-ft north of the preferred alignment crossing.

Sanitary sewer lines parallel several segments of Red Rock Creek Trail preferred alignment. While sanitary mains are not anticipated to significantly conflict with the trail construction, it is something to consider, especially when positioning foundations for the trail's elevated structures. A paved trail above or adjacent to a sanitary line is an opportunity for maintenance access.

STORM SEWER

The stormwater sewer system is owned and operated by the City of Tigard, which partners with Clean Water Services (CWS) for stormwater permitting. At the north end, Red Rock Creek outfalls from a culvert beneath I-5 near the south end of SW 64th Avenue. ODOT maintains a small system of stormwater pipes that contribute to the creek in this area.

There are stormwater mains running along the majority of streets that cross Red Rock Creek, with the creek crossing all roadways within culvert pipes. At 68th Ave, the creek passes through a 42" diameter culvert. There are two 30" diameter culverts under 72nd Ave. Crossing Dartmouth, there are two 48" diameter culverts. At Highway 217, a box culvert beneath the roadway lies approximately 170-ft north of the preferred alignment crossing. With Red Rock Creek being the primary drainage basin for the Tigard Triangle, the trail will be adjacent to storm sewer outfalls that may need to be accommodated in final design.

In the Dartmouth area, the preferred alignment weaves between two water quality facilities using boardwalk structures to minimize impacts. Along Wall Street, there are several water quality planters capturing stormwater from the roadways; the trail is planned to widen the sidewalk space, thereby preserving the location and function of water quality facilities along the curb line.

The trail will likely impact storm pipes from private properties that drain to Red Rock Creek, many are not currently mapped and will be discovered in a topographic survey. The outfall pipe may have to be replaced with a stronger material to withstand the load of the trail section and the end treatment enhanced with riprap and vegetation.

Hydraulic modeling was recently completed with the streambank enhancement adjacent to Dartmouth and 72nd Avenue. Additional hydraulic modeling will be required to determine the appropriate elevation of crossing structures/ boardwalks, scour depth, and revegetation mitigations.

On-site water quality treatment is required for any new or replaced impervious area (including the trail if its surface is impervious). Boardwalks are considered pervious area and does not need to be treated. In locations where the trail is in or adjacent to the vegetated corridor, CWS allow filter strips along the trail as treatment to satisfy the water quality requirements.

Private Utilities

Based on communications with utility providers and requesting information through the Oregon Utility Notification Center, the following utilities are present within the study area:

- Portland General Electric (PGE): owns parcels of land within the study area.
- NW Natural Gas
- Communication providers
  - MCI
  - Comcast Cable
  - Ziply Fiber
  - Verizon

PGE

The design team shared the initial alignment alternatives with PGE to discuss potential conflicts and trail easements needs. It was identified that within Segment A1 there is a potential powerline conflict due to clearance between the proposed bridge and the overhead powerline. When the trail moves into the design phase, PGE requested CAD files and control points set up so they can better align. They requested early engagement in the design process as it would allow the team to determine best path forward such as maybe needing to underground the distribution, raise the transmission and work through permitting and access around the tracks.

Along Segment F1, there is a PGE Substation that the trail will follow along on the south edge of their property. PGE felt that an easement would be supported as long as there aren't expansion plans in the near future. They do want to ensure that the trail will not block access to existing poles and there may need requirements for the trail in this segment to accommodate line trucks or be located out of their access path and work zones all of which can be coordinated during design.

NW NATURAL

NW Natural provides mapping of the gas distribution network via their website. In review of this area, gas crossings exist at the following locations, Table 3. Service lines appear to be outside of trail alignments.

COMMUNICATION PROVIDERS

Communication utilities run aerially, sharing space on existing utility poles, or are placed in underground conduits. Relocation or design adjustments will be necessary in final design should conflict arise between the trail alignment and utility poles or the overhead lines. Underground utility conflicts are of low concern, as the trail will typically be constructed at or above existing ground surface. In areas where the trail will be on structure or boardwalk, utility locates will be critical to avoid conflict with structure footings. As information was available, placement of the preferred alignment avoids traffic signal cabinets, utility poles, and sewer manholes. Consequently, where the trail is adjacent to a manhole, the trail may be utilized as access for maintenance vehicles. Extensive utility coordination will occur during final design.

Table 3. Existing Gas Crossings

Location	Segment	Line	Note
SW 68th Parkway	E2	2" poly	Trail crosses perpendicular to line
SW 72nd Ave	D4	2" steel wrapped	Trail crosses perpendicular to line
Walmart outbuilding	C6	2" poly	Trail runs parallel to gas line
SW Hunziker Rd	B2	4-1/2" steel wrapped 2" steel wrapped	Trail crosses perpendicular to lines
SW Wall St (A1, A2)	A1, A2	2" poly	Trail crosses perpendicular to line

Transportation Facilities

The study area of the Red Rock Creek Trail is an urbanized environment with a variety of street classifications, pedestrian and bicycle facilities that include trails, and transit services. Unique to this area are the elevation changes, natural resource areas and significant highway facilities that create challenges for continuous, direct travel across the study area.

Roadways

The roadways within this area are primarily City of Tigard right-of-way; highways and the interstate are under Oregon Department of Transportation (ODOT) jurisdiction. The Tigard Triangle's existing roadway infrastructure consists of one main arterial road (72nd Avenue) with collector roads bringing traffic from the local neighborhoods, businesses, and the surrounding highways and interstate, see Figure 5. Below is a summary table of the classified roads in the study area.

Table 4. Roadway Characteristics

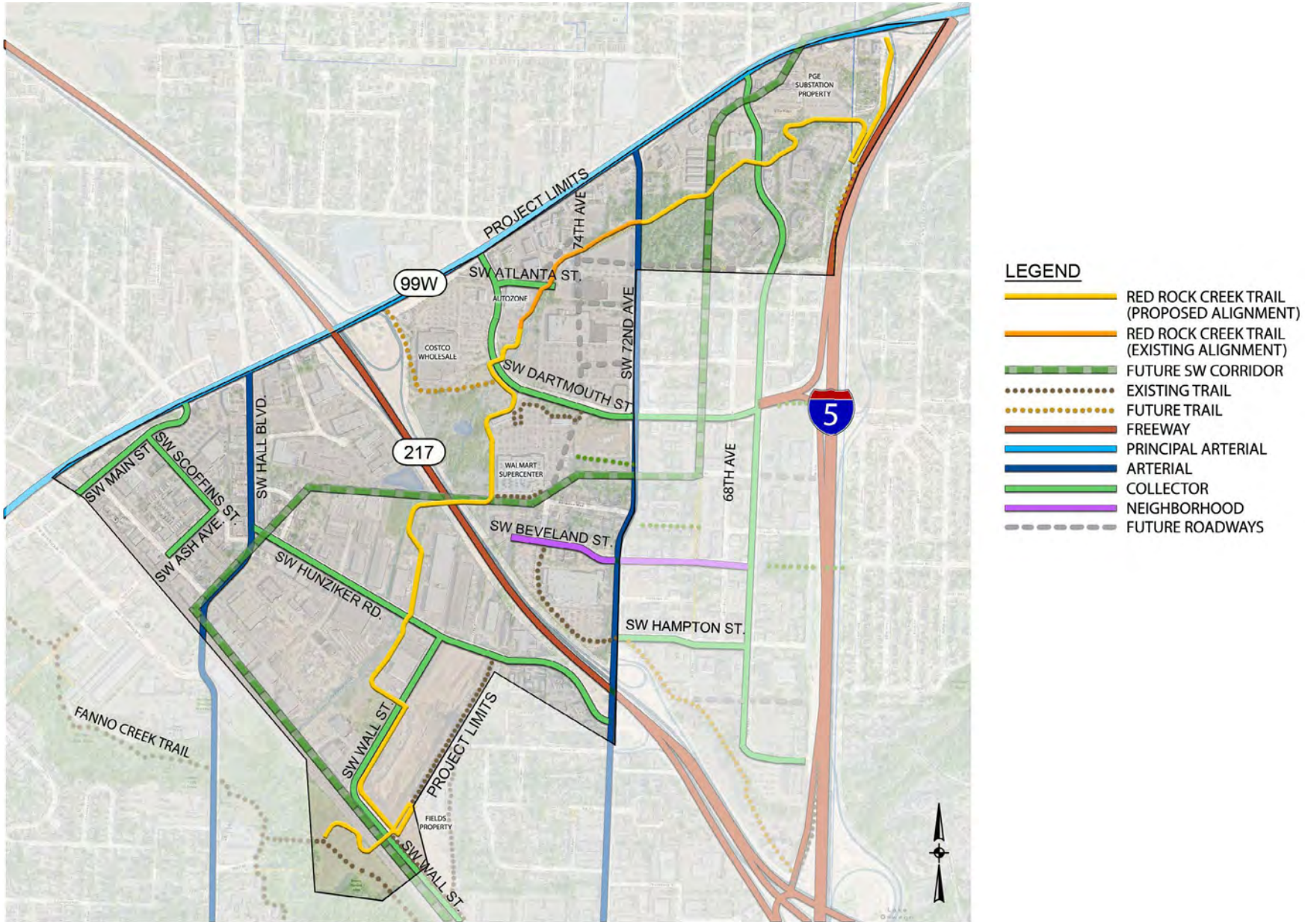
ROADWAY CHARACTERISTICS								
Road	**Functional Classification**	**2019 Annual Average Daily Traffic (ADT)**	**Posted Speed (mph)**	**Turn Lanes**	**Travel Lanes**	**Bike Lanes**	**On-Street Parking**	**Sidewalks**
Pacific Highway (OR 99W)	Principal Arterial	50,000	35	1	4	1 (WB)	No	Both Sides
SW 72nd Avenue	Arterial	8,500 to 14,000	30	0-1	2	Partial	Partial	Partial Both Sides
SW Bonita Road	Arterial	17,500	35	0-1	2	2 Partial	No	Partial Both Sides
SW Hall Boulevard	Arterial	13,400	35	0-1	2	2 Partial	No	Partial Both Sides
SW 68th Parkway	Collector	6,000 to 9,500	30-35	1	2	2	No	Partial Both Sides
SW 64th Avenue	Local	< 1,000	30	0	2	0	Yes	None
SW Atlanta Street	Collector	< 1,000	25	0	4	0	Yes	Both Sides
SW Dartmouth Road	Collector	15,000	35	0-2	4	2	No	Both Sides
SW Hunziker Road	Collector	8,000 to 9,200	35	0-1	2	2 Partial	No	Partial Both Sides
SW Wall Street	Collector	< 4,000	25	0-1	2	2	No	Partial Both Sides
SW Beveland Street	Neighborhood	2,500 to 5,000	25	0-1	2	0	Partial	Partial Both Sides

The Red Rock Creek Trail will encounter a number of at-grade road crossings, described below:

- SW Wall Street is a collector running generally north-south that is paved with asphalt, providing local access to housing, parks, and office buildings.
- SW Hunziker Road is a collector road running generally east-west paved with asphalt just southwest of the Tigard Triangle. Hunziker provides access between Hall Blvd and 72nd Avenue which are both arterial roads. Hunziker Road runs through mainly industrial properties and has a high volume of heavy truck traffic.
- SW Dartmouth Street is a collector road running generally east-west that is paved with concrete. Dartmouth provides access to the large commercial business in the Tigard Triangle. The trail is planned to cross at the existing signalized intersection of Dartmouth/Costco driveway.
- SW 72nd Avenue is an arterial road running generally north-south that is paved with asphalt. This is the busiest road in the Tigard Triangle and has partial sidewalks and bike lanes throughout the length of road, but neither exist where the trail is planned to cross. Tigard anticipates improving 72nd Avenue with sidewalks, bike lanes, and transit accommodations. At the trail and creek crossing, the City is contemplating a grade-separated crossing using a bridge or long-span culvert.
- SW 68th Parkway is a collector road running generally north-south that is paved with asphalt. This road has horizontal and vertical curves, requiring a sight distance analysis of the trail crossing during final design.
- SW 64th Avenue is a local service roadway running generally north-south with an east-west portion at its southern-most point. 64th Avenue has portions of asphalt pavement and gravel surfacing and is under Portland Bureau of Transportation's purview. The topography in this area is steep, making Americans with Disabilities Act's (ADA) accessibility compliance challenging.

The city has developed "Streetscape Design Plan: Tigard Triangle Strategic Plan Implementation" published December of 2016. The three main principles this plan outlines for its urban design framework is to provide safe and effective multimodal transportation access to and from the Tigard Triangle, integrate land use and transportation planning to ensure a vibrant town center, and build upon unique characteristics that currently exist in the Tigard Triangle.

Figure 5. Road Classification Map



Bicycle and Pedestrian Facilities

BICYCLE NETWORK

The bicycle network throughout the study area is incomplete in terms of connectivity. Dartmouth Street, 68th Avenue, and Wall Street have dedicated bike lanes throughout the majority of their corridor. Bike lanes are identified as future upgrades to 72nd Ave and Hunziker Road. New roadways within the Tigard Triangle are all designed to accommodate bicycles using dedicated bike lanes or shared lanes with sharrow markings. All bicycle facilities are adjacent to roadways; there is no separated, dedicated bicycle facility in the study area.

SIDEWALKS

Throughout the Tigard Triangle, sidewalks are intermittent. New development is required to provide sidewalks on all street frontages. As the sidewalk network is more complete, access to the Red Rock Creek Trail will improve. Presently, sidewalk access to the trail alignment is lacking at 64th Ave and 72nd Ave. Refer to Figure 6 for more details, including existing trail facilities.

EXISTING TRAILS

Recreation trails are present in neighborhoods and commercial developments surrounding the study area, including:

- Portland's SW Trail network has two trails, #5 and #7, situated approximately 0.3 miles and 0.5 miles, respectively from the Red Rock Creek Trail study area.
- A portion of the Red Rock Creek Trail exists along the rear property line of the AutoZone building, connecting users between Dartmouth to the terminus of SW Atlanta Street.
- The Walmart property maintains a 5-ft wide paved perimeter trail, directly connecting to the Red Rock Creek Trail alignment.
- The Fields Property Development Trail connects directly to the Red Rock Creek Trail and serves both the Fields housing development and the adjacent neighborhood to the east.

Transit Facilities

WESTERN EXPRESS SERVICE (WES) COMMUTER RAIL

The WES line is a commuter rail line serving Beaverton, Tigard, Tualatin, and Wilsonville. Through the area of study, the WES line runs Northwest-Southeast, parallel with Hwy 217. In Tigard, the WES station is located downtown on Commercial Street, just a half block south of Main Street. WES utilizes one of the tracks adjacent to Wall Street.

BUS ROUTES

There is limited bus service within the Tigard Triangle. TriMet's 96 bus route runs north-south along 68th Avenue then uses Beveland Street and Hampton Street as turnaround, providing access to the 78 and 38 bus routes at the intersection of SW 72nd Avenue and Hwy 217. The 12, 64, and 94 routes run along Hwy 99W. TriMet's Service Enhancement Plan lists a new bus route to run from Hwy 99W to Dartmouth, then turning south to serve SW 72nd Ave. The Tigard 2040 TSP identifies Project T-1 to provide a local connector (shuttle) service between Tigard Triangle – Downtown Tigard – Washington Square Mall.

SOUTHWEST CORRIDOR (SWC) LIGHT RAIL

There is not currently light rail servicing the Tigard Triangle. The Southwest Corridor Plan was developed in 2018 to deliver a high-capacity light rail corridor to Tigard and points south. Three stations are planned within the study area:

- 68th Avenue Station
- Elmhurst Station
- Hall Boulevard Station

SWC will cross Hwy 217 with an elevated guideway in a location adjacent to the preferred alignment for Red Rock Creek Trail. Depending on timing of construction, there is a possibility to integrate Red Rock Creek Trail into the elevated guideway structure crossing Hwy 217. Refer to Figure 7 for transit routes.

Land Use and Ownership

The Tigard Triangle area underwent a master planning process in 2015, resulting in zone changes, economic development plan, and a series of public improvements identified in the various infrastructure plans within the Comprehensive Plan. (Figure 8)

Within the Tigard Triangle, the existing development pattern consists of primarily suburban land uses including large commercial retail buildings, office buildings, multi-family residential, and some remaining single-family units. The west side is zoned General Commercial; the east side is zoned Triangle Mixed Use (TMU). TMU is implemented through the City's Tigard Triangle Plan District code section (18.660), a "lean code" targeted at facilitating development and providing pedestrian-friendly areas.

South of Highway 217, the properties along SW Hunziker Road are developed with large warehouse and manufacturing facilities, approximately 5–6-acre parcels zoned as light industrial and industrial park. Red Rock Creek flows through culverts and constrained topography between buildings in this area. Immediately adjacent and east of SW Wall Street, the land uses are identified as mixed-use employment and residential. Within this segment is the 2.5-acre Potso Dog Park, maintained by City of Tigard Parks and Recreation.

Figure 6. Existing Bicycle and Pedestrian Facilities

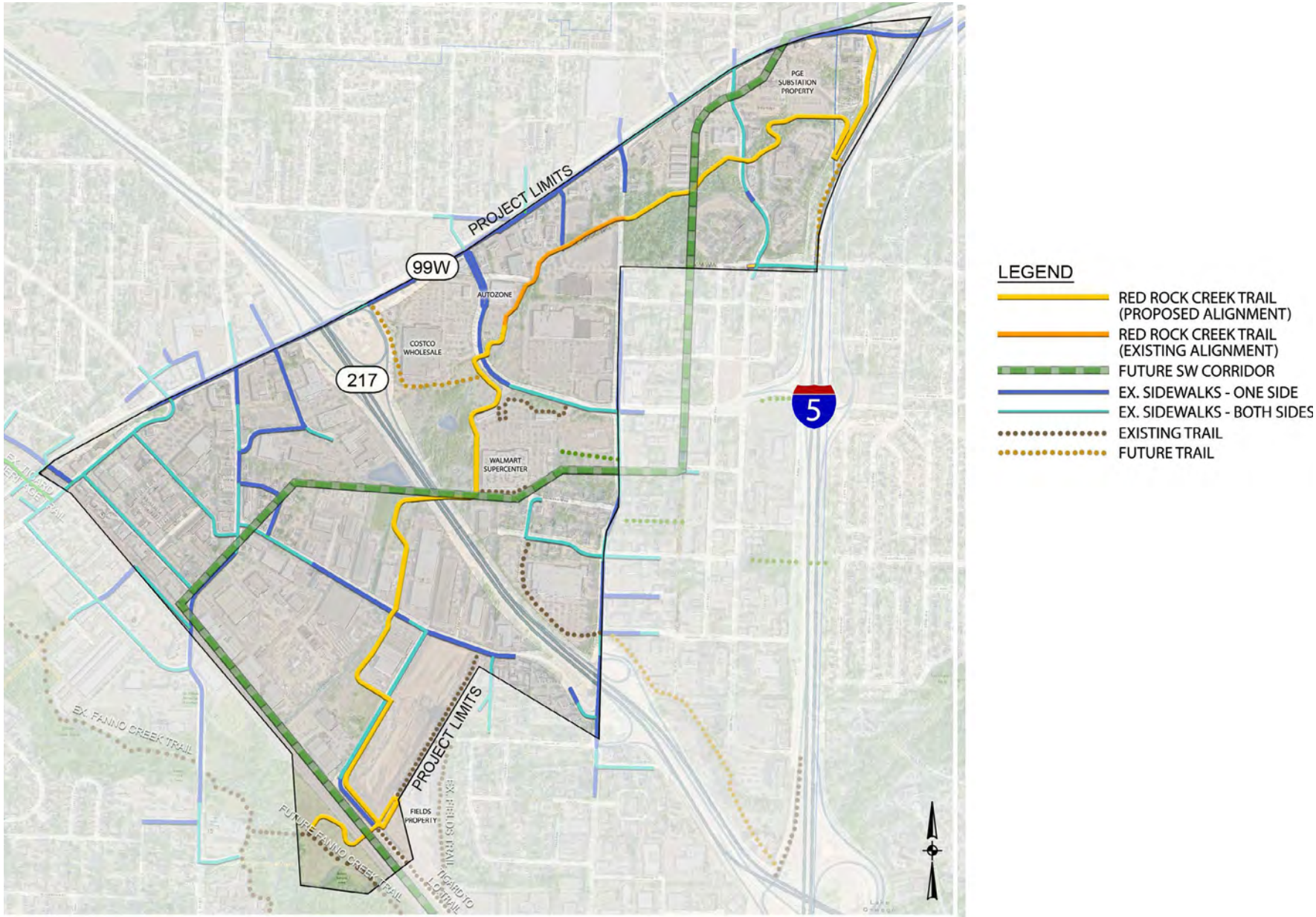
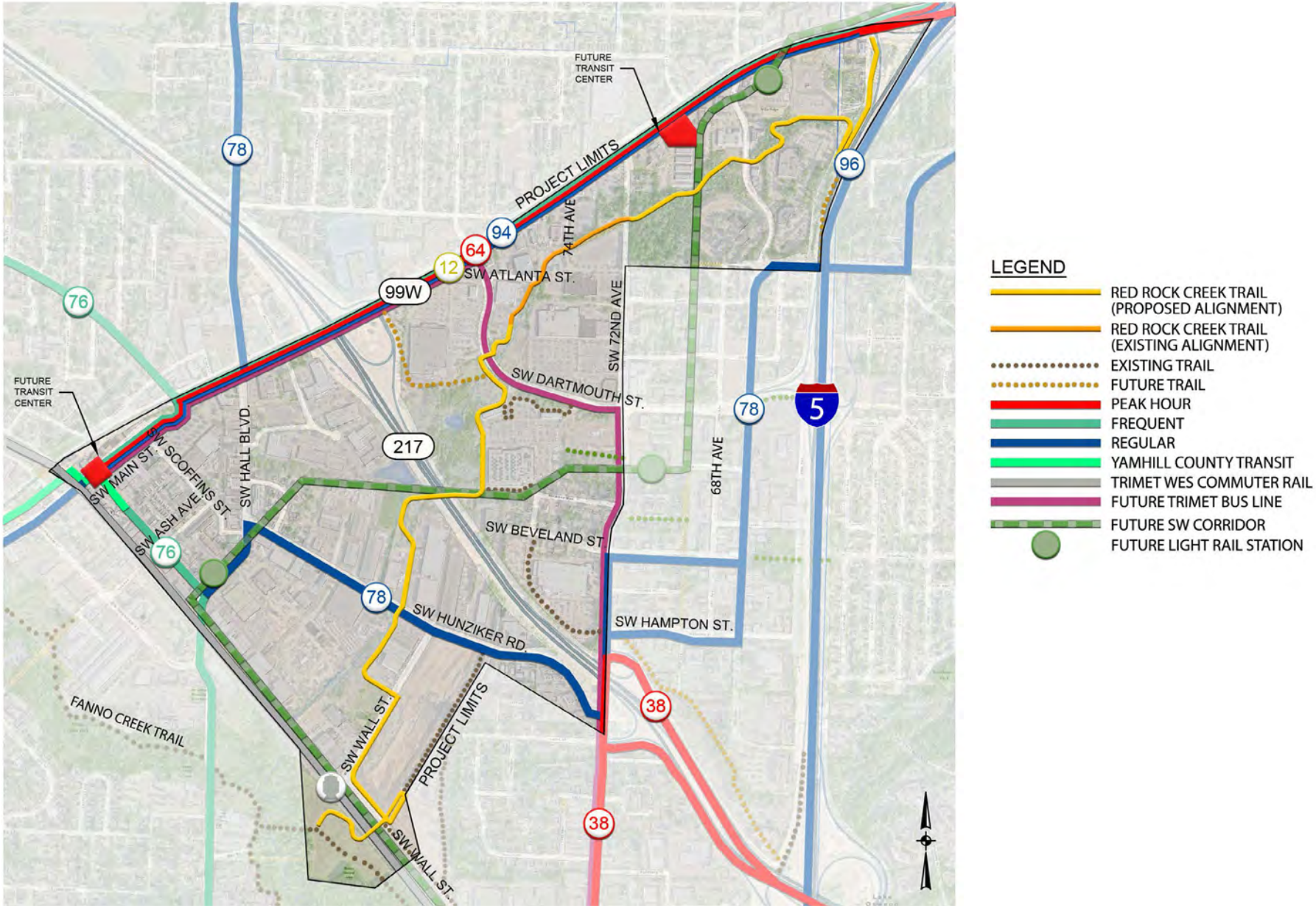


Figure 7. Transit Routes



Within the study area boundaries, the following zoning definitions apply:

- Tigard Mixed Use (TMU): Intended to be an active, urban, multimodal, and mixed-use district that accommodates a variety of housing options and uses, promotes pedestrian-oriented development, and limits new auto-oriented development.
- General Commercial: Designed to accommodate a full range of retail, office, and civic uses with a citywide and even regional trade area with limited residential use.
- Light Industrial: The I-L zone provides appropriate locations for general industrial uses including, but not limited to industrial services, manufacturing and production, research and development, warehousing and freight movement, and wholesale sales activities with few, if any, nuisance characteristics such as noise, glare, odor, or vibration.
- Industrial Park: The I-P zone provides appropriate locations for combining light manufacturing, office, and small-scale commercial uses, such as restaurants, personal services, and fitness centers, in a campus-like setting with no nuisance characteristics such as noise, glare, odor, or vibration.
- Mixed use Employment: Designed to apply to areas where employment uses such as office, research and development, and light manufacturing are concentrated. Commercial and retail support uses are allowed but are limited, and residential uses are allowed that are compatible with the employment character of the area.
- Parks and Recreation: This zone applies to City-owned parks, open space, and recreational facilities.

There are no anticipated impacts or changes to zoning designations through implementation of the Red Rock Creek Trail. Property values and ownership decisions are often positively impacted by a trail, but such analysis was not part of this alignment study.

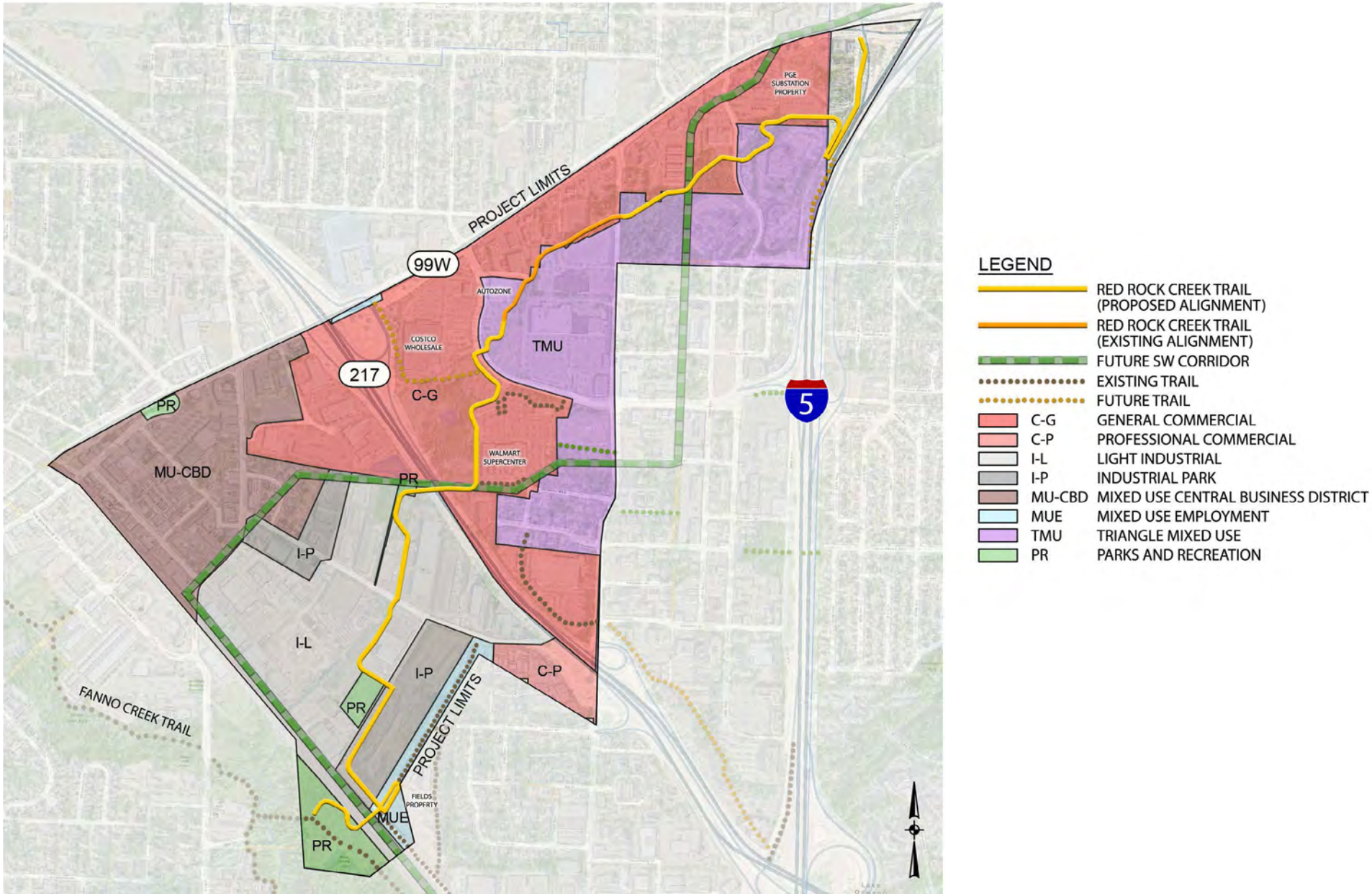
Railroad Ownership & Operations

The rail right-of-way through the Fuller Yard is owned by the Portland and Western Railroad, a subsidiary of the Genesee and Wyoming Railroad (GWRR). TriMet operates the Westside Express Service (WES) corridor on the tracks on the west side of the rail yard where they have a series of tracks for sorting, storing, or loading and unloading rail vehicles. TriMet is currently in the preliminary design phases of the Southwest Corridor light rail extension, which positions the light rail along the east side of this railroad right-of-way, and it is anticipated that the TriMet will want to purchase a segment to support this alignment. Currently, the nearest crossings of the railroad in this area are at-grade crossings at Hall Boulevard to the west and Bonita Road to the east. The underlying railroad is a typical switchyard configuration with multiple tracks.

The proposed trail crossing would encompass an overhead bridge crossing spanning across the rail right-of-way. The design will meet the latest edition of the GWRR Public Project Manual. Coordination with rail providers and ODOT Rail will require an ODOT Rail Order Application with exhibits showing the bridge structure with clearances, dimensions, and locations. The ODOT Rail process from start to finish typically takes 6-12 months.



Figure 8. Existing Zoning



7

Section 7. Alternative Alignments

The world reveals itself to those who travel on foot.

WERNER HERZOG

Initial Trail Alternative Alignments

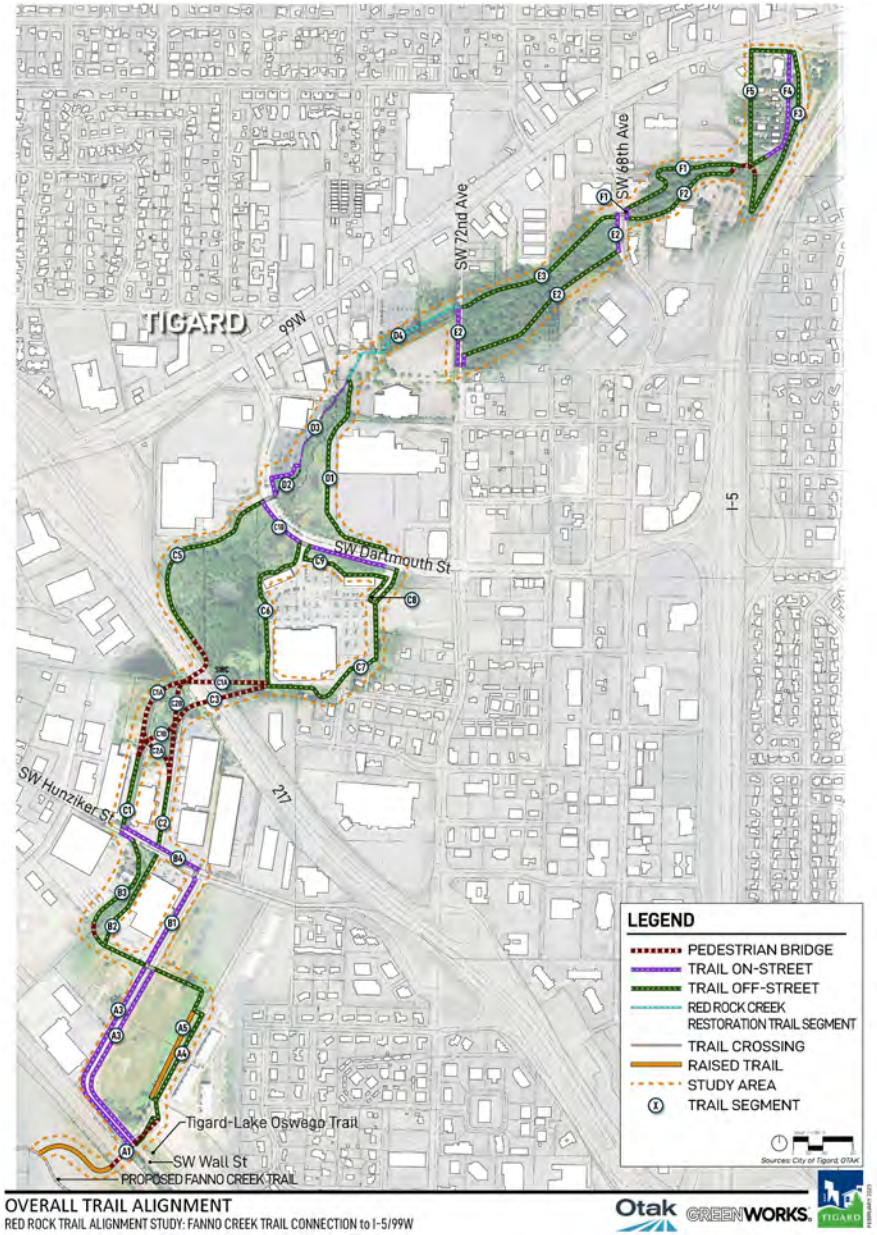
An early task in the Red Rock Creek Trail Alignment Study was to provide reasonable alignments, achieving a continuous trail starting from the south at the Fanno Creek Trail near Tigard Library and ending in the north where Hwy 99W and I-5 intersect.

The study area was divided into six segments to better organize and evaluate these areas at an appropriate design scale, Figure 9. Thinking ahead toward construction, segments were assembled to begin and end at an established user access point (roadway or trail). This way, segments can be constructed individually as opportunities arose and trail users would never encounter a dead-end.

- Segment A: Fanno Creek Trail to Potso Dog Park
- Segment B: Potso Dog Park to SW Hunziker Rd.
- Segment C: SW Hunziker Rd to SW Dartmouth St.
- Segment D: SW Dartmouth St to SW 72nd Ave.
- Segment E: SW 72nd Ave. to SW 68th Pkwy.
- Segment F: SW 68th Pkwy. to Hwy 99W

The design team drafted a series of trail alignment alternatives based on local knowledge of the study area, field observations, technical analysis, and feedback from city staff. The alignment alternatives looked at sensible on-street and off-street options, with safety roadway crossings. Alignments were identified in existing trail locations primarily used for recreation. Where possible, the design team drafted alignments that approached or crossed Red Rock Creek to allow trail users to interact with nature. In all cases, alignments avoided buildings or large property acquisitions. This effort produced 30 alignment alternatives.

Figure 9. Initial Trail Alternative Alignments



Refined Trail Alternative Alignment

Once alignment options were drawn, they were evaluated by the Stakeholder Working Group, general public, and technical consultants to assess the feasibility of each potential segment. Alignments that were evaluated using the eight criteria noted earlier. Each group was provided with a scoring system to rate each alignment as well as provide commentary. At the public workshops and Stakeholder Working Group meetings, feedback was gathered through conversations in small groups, comments gathered via email, and consensus voting. The engagement section provides further detail of the extensive outreach efforts for Red Rock Creek Trail.

Response to the Engagement Process

At various stages of engagement, the alignments were narrowed down until one preferred alignment was selected. In several instances, the combination of two alternatives were reformulated into one new alignment that was, again, evaluated by the technical team for feasibility. Obviously infeasible alignments were omitted; others were retained to study in further detail.

The design team met with the SWG to discuss what are the kinds of elements that should affect the trail location and to identify the key values the preferred trail alignment needs to encompass. This was the first time the design team was meeting with the stakeholders and through small group discussions safety, user experience, accessibility to all, and property protection were identified as the key values that need to be taken into consideration when choosing the preferred alignment.

When it came to choosing the trail location within each segment, members stated that the trail location and design should focus on:

- design features that allow for safe use of multi-modal activity
- access to nature
- restricting access to homeless people to keep the trail available to other trail users
- preservation of the ecosystem and of private property
- providing connections currently missing between businesses, destinations, housing, and other trails
- utilize existing trails/sidewalk when possible

In addition, the City hosted a questionnaire on their website that allowed the public to review this information and provide feedback. Public comments were consistent with what was shared by the SWG. The top key values were users' safety, accessibility to everyone, enjoyment of the outdoors, and preservation of the ecosystem.

Using the trail alignments evaluation criteria, a decision matrix with further developed descriptions and scoring was used to evaluate each alternative by both the SWG and public at the first public meeting. Scores for the criteria were defined as:

- -1: impacts the criteria negatively
- 0: neither meets nor impacts criteria
- +1: meets criteria

With this information the design team was able to further reduce the options. Table 5 shows the results of the matrix that was completed by the SWG and members of design team experts.







Table 5. Scoring Table Results

DESIGN CRITERIA	TRAIL SEGMENT ALTERNATIVES														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C1A	C1B	C2	C2A	C2B	C3
1: USER EXPERIENCE	11	5	9	11	-6	12	9	1	3	8	8	3	8	11	8
Ensure users feel comfortable	4	2	4	4	-3	4	3	0	1	2	2	2	2	3	2
Ensure users feel secure	4	2	2	4	-1	2	1	1	1	2	2	3	2	3	2
Ensure all users have an equal opportunity to engage with nature	3	1	3	3	-2	6	5	0	1	4	4	-2	4	5	4
2: CONNECTIVITY/CONTINUITY	6	7	9	9	5	5	6	6	5	4	4	6	6	6	6
Provide frequent/intuitive connections for access	2	4	4	4	3	1	2	3	2	1	1	3	3	2	2
Provides continuous route	4	3	5	5	2	4	4	3	3	3	3	3	3	4	4
3: ENVIRONMENTAL IMPACTS	18	20	16	16	16	-6	-4	21	-13	-4	8	15	-8	6	10
Minimize impacts to floodplains	5	5	4	4	4	-1	-2	5	-4	-1	-1	3	-2	1	4
Minimize impacts to wetlands	5	5	4	4	4	-3	-2	5	-3	-1	3	3	-2	1	2
Minimize impacts to Tigard Inventoried Wetlands	5	5	4	4	4	1	-2	4	-3	-1	3	3	-2	1	0
Minimize impacts to vegetated corridors	3	5	4	4	4	-3	2	7	-3	-1	3	6	-2	3	4
4: EASE OF PERMITTING:	1	6	5	5	2	-3	-2	4	-3	-3	-3	5	-3	0	2
The design should pass the permitting process with ease	1	6	5	5	2	-3	-2	4	-3	-3	-3	5	-3	0	2
5: COST, CONSTRUCTABILITY & FUNDING	6	11	7	7	5	8	3	6	4	1	3	8	0	0	5
Project cost is feasible	-1	4	2	2	2	3	0	2	1	0	0	2	-1	-1	0
Project cost is not prohibitive of progress	3	4	2	2	2	2	1	2	1	-2	0	2	-1	-1	0
Project is likely to receive funding and financial support	4	3	3	3	1	3	2	2	2	3	3	4	2	2	5
6: PROPERTY OWNERSHIP	5	8	4	2	2	4	-2	6	-4	2	2	-2	0	0	4
Minimal impact to adjacent properties	3	4	2	2	1	2	-1	3	-2	2	2	1	1	1	4
Minimal need of property purchase and/or easements	2	4	2	0	1	2	-1	3	-2	0	0	-3	-1	-1	0
7: SAFETY & SECURITY	17	15	13	14	7	9	1	8	2	8	11	3	9	14	9
Provide a safe trail experience for all users	4	2	2	3	1	4	0	1	0	3	4	1	4	5	4
Provide a welcoming trail experience for all users	4	1	2	3	-3	4	2	0	-1	4	4	-1	3	4	3
Clear sight lines	5	4	3	3	3	1	0	2	1	3	3	1	3	4	3
Emergency access	1	4	3	2	3	-1	-1	3	0	-2	0	0	-2	-1	-2
Minimal hiding places	3	4	3	3	3	1	0	2	2	0	0	2	1	2	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8: COMMUNITY SUPPORT	6	2	4	4	-2	2	2	-2	0	-1	-1	-2	-1	1	2
Alignment is supported by the community	3	1	2	2	-1	1	1	-1	0	-1	-1	0	-1	0	1
Alignment is supported by adjacent businesses	3	1	2	2	-1	1	1	-1	0	0	0	-2	0	1	1
TOTAL	70	74	67	68	29	31	13	50	-6	15	32	36	11	38	46

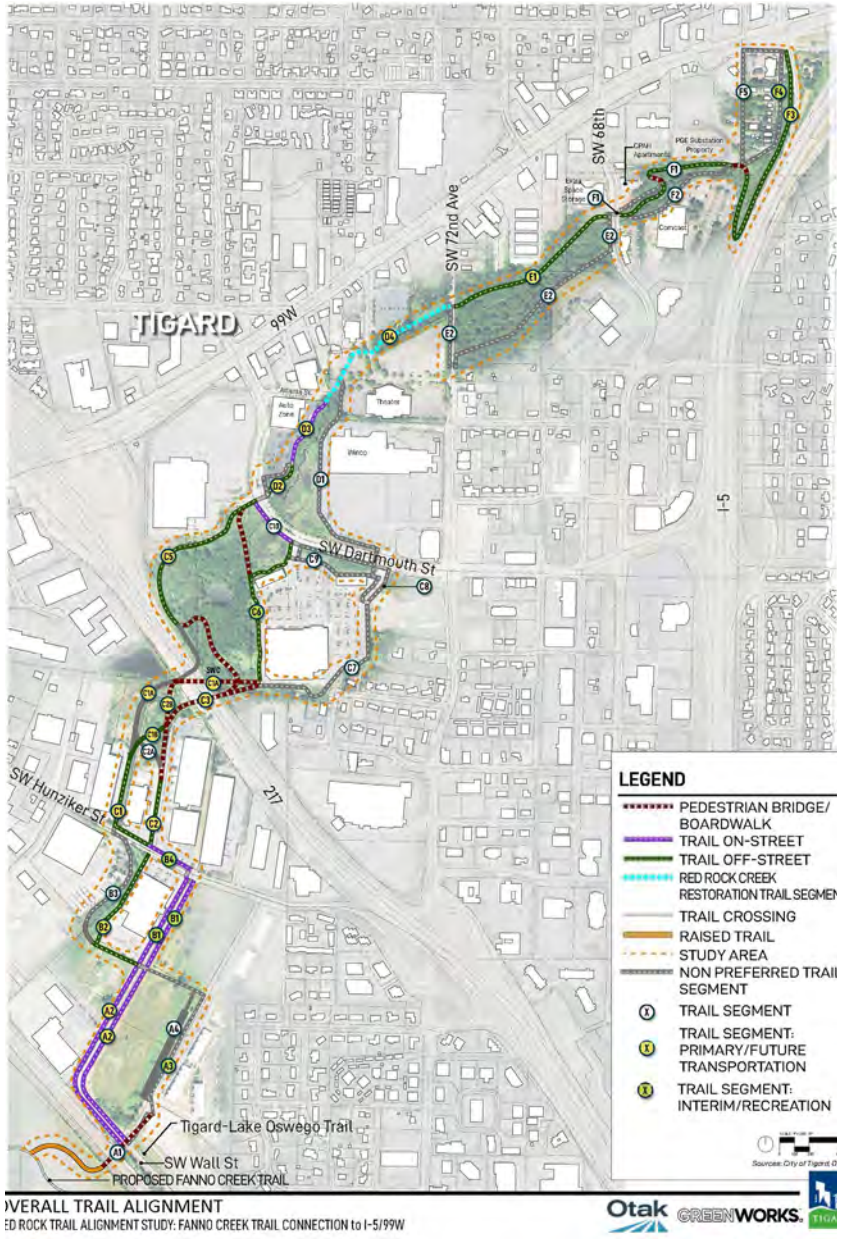
scoring criteria
(-1) Impacts Criteria Negatively
(0) Neither Meets nor Impacts Criteria
(1) Meets Criteria

TRAIL SEGMENT ALTERNATIVES

DESIGN CRITERIA	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	E1	E2	F1	F2	F3	F4	F5
1: USER EXPERIENCE	9	11	2	5	10	2	11	9	14	14	8	2	6	11	-3	0	6
Ensure users feel comfortable	1	3	1	2	3	-1	3	3	4	5	3	1	1	4	-3	0	2
Ensure users feel secure	3	3	1	2	3	1	3	1	5	3	1	-1	1	2	0	0	2
Ensure all users have an equal opportunity to engage with nature	5	5	0	1	4	2	5	5	5	6	4	2	4	5	0	0	2
2: CONNECTIVITY/CONTINUITY	6	5	2	1	3	3	5	8	9	9	7	-3	7	6	0	4	4
Provide frequent/intuitive connections for access	1	1	0	-1	1	0	2	4	3	3	1	-2	1	3	-1	0	1
Provides continuous route	5	4	2	2	2	3	3	4	6	6	6	-1	6	3	1	4	3
3: ENVIRONMENTAL IMPACTS	-4	15	22	18	20	10	16	-2	15	5	14	18	8	10	14	19	8
Minimize impacts to floodplains	2	0	6	4	4	1	4	0	5	5	5	4	5	3	4	4	2
Minimize impacts to wetlands	-2	5	6	5	6	4	6	-2	5	1	6	6	3	3	6	6	2
Minimize impacts to Tigard Inventoried Wetlands	-2	5	4	4	4	1	5	-2	2	2	2	4	3	3	4	4	2
Minimize impacts to vegetated corridors	-2	5	6	5	6	4	1	2	3	-3	1	4	-3	1	0	5	2
4: EASE OF PERMITTING:	-2	0	3	2	4	3	-3	-3	5	-2	-1	-2	0	2	-2	2	4
The design should pass the permitting process with ease	-2	0	3	2	4	3	-3	-3	5	-2	-1	-2	0	2	-2	2	4
5: COST, CONSTRUCTABILITY & FUNDING	9	9	3	3	6	3	4	1	13	13	11	6	10	7	6	6	3
Project cost is feasible	3	3	1	1	2	1	0	-1	3	3	2	1	2	2	2	2	1
Project cost is not prohibitive of progress	3	3	1	1	2	1	2	1	5	5	4	2	4	2	2	2	1
Project is likely to receive funding and financial support	3	3	1	1	2	1	2	1	5	5	5	3	4	3	2	2	1
6: PROPERTY OWNERSHIP	9	6	-2	-1	4	2	2	4	6	5	3	-4	2	2	-2	6	2
Minimal impact to adjacent properties	6	3	-1	1	3	1	2	2	4	4	3	-2	3	3	1	3	1
Minimal need of property purchase and/or easements	3	3	-1	-2	1	1	0	2	2	1	0	-2	-1	-1	-3	3	1
7: SAFETY & SECURITY	4	12	9	8	11	7	15	13	24	13	9	3	3	13	-5	13	5
Provide a safe trail experience for all users	2	3	1	1	2	1	3	4	5	2	3	1	2	3	2	2	0
Provide a welcoming trail experience for all users	2	3	1	0	2	1	3	4	3	5	3	0	2	2	-3	1	1
Clear sight lines	3	3	2	2	2	2	3	2	5	3	3	2	0	3	0	3	2
Emergency access	-2	3	4	3	4	2	3	1	6	2	0	0	-1	2	-3	4	1
Minimal hiding places	-1	0	1	2	1	1	3	2	5	1	0	0	0	3	-1	3	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8: COMMUNITY SUPPORT	2	4	-2	-2	0	-2	2	4	6	4	2	1	2	2	0	2	2
Alignment is supported by the community	1	2	-1	-1	0	-1	1	2	3	2	1	1	1	1	0	1	1
Alignment is supported by adjacent businesses	1	2	-1	-1	0	-1	1	2	3	2	1	0	1	1	0	1	1
TOTAL	33	62	37	34	58	28	52	34	92	61	53	21	38	53	8	52	34

scoring criteria
(-1) Impacts Criteria Negatively
(0) Neither Meets nor Impacts Criteria
(1) Meets Criteria

Figure 10. Alignment Alternatives Diagram – Refined



Results to Scoring Process

Based on the initial scoring, the alignments were further refined in SWG meeting #2 and represented in Figure 10. They were evaluated by technical consultants to assess the feasibility of each potential segment. Alignments that were not feasible or did not meet the criteria were omitted; others were retained to study in further detail.

With this information the design team reviewed the remaining options and developed pros and cons for the segments that still had more than one option remaining. Segments A and E did not require further evaluation as the SWG reached early consensus on these alignment alternatives. For the detailed results, see Appendix C. Alternatives Analysis Report.

Further Considerations

Recreation Loops

Throughout the alternative selection process, the design team learned that many alignments have value to stakeholders. Their location and connectivity make these remaining alignments eligible to serve as a trail for recreation purposes. Often, residents or employees desire facilities in a series of loops to be used for personal fitness, socializing, or pet exercise. While they are not selected for the preferred alignment for transportation purposes, these remaining alignments, shaded in gray on the Overall Trail diagram, should be further studied to serve as recreation loops and identified in the update to Tigard's Trails Master Plan or Parks and Recreation Master Plan.

Section 8. Preferred Alignment

The world reveals itself to those who travel on foot.

WERNER HERZOG

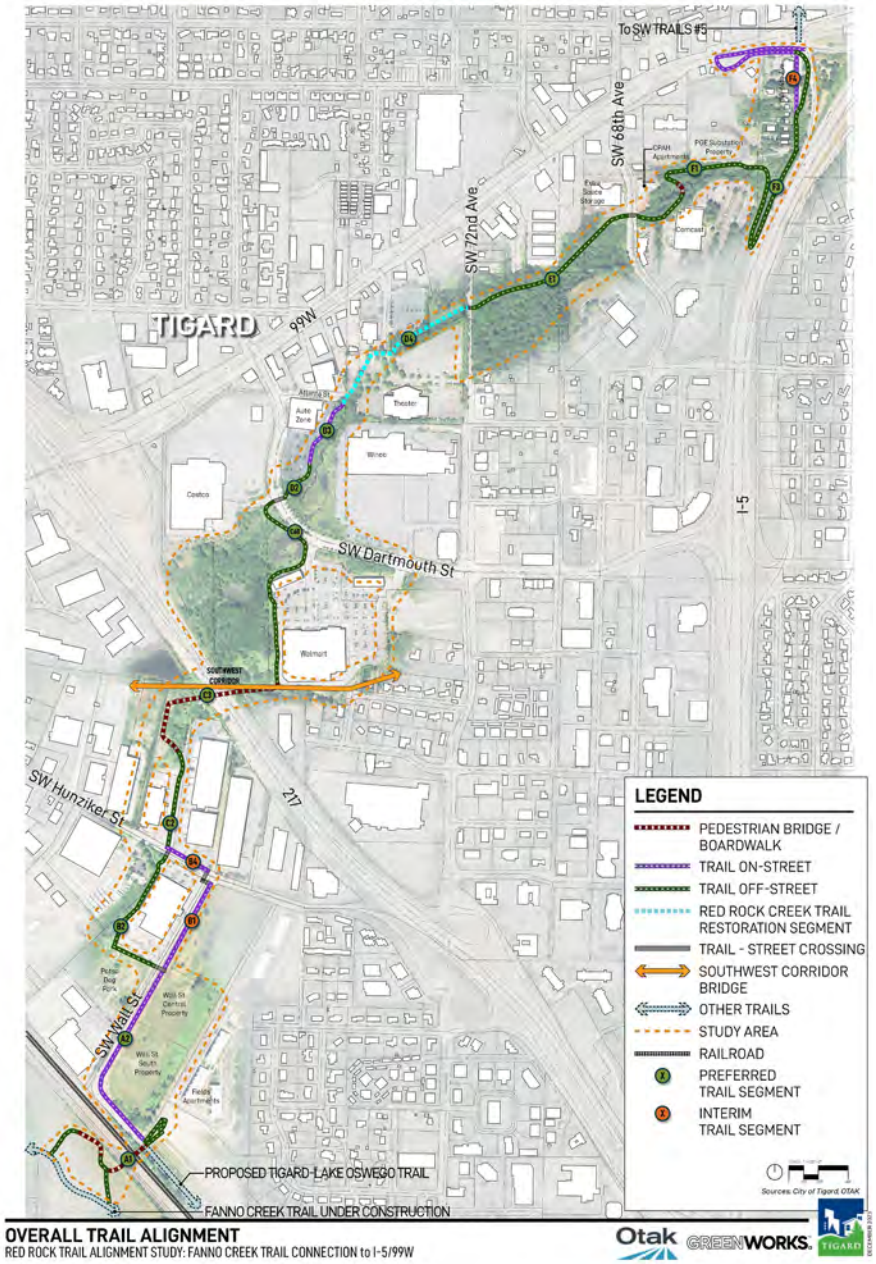
Preferred Alignment

After the refinement of the alternatives and thorough alternative analysis by the technical team, the preferred alignment surfaced. A description of each segment and design assumptions is presented on the following pages.

The design team presented the final findings at SWG Meeting #3. The committee was able to meet consensus on all alignments. Figure 11 represents the Preferred Alignment.

Appendix D. Schematic Plans, show each segment and refers to preliminary drawings that represent the basic layout, alignment, and features of the RRCT trail system. These designs include the proposed route, along with key elements such as trailheads, access points, crossings, viewpoints, and amenities. These were developed to help visualize and plan the overall layout and configuration of the trail network before moving on to more detailed design development.

Figure 11. Preferred Alternative



Project Limits: Segment A

Fanno Creek Trail to Potso Dog Park

A1: Linking to the Fanno Creek Trail, Red Rock Creek Trail's southern terminus includes a pedestrian bridge crossing over several railroad tracks and SW Wall St. The west approach includes raised pathways leading to the crossing. The east approach is on an elevated development-ready mixed-use parcel with an existing public access easement designed for the bridgehead and ADA access to Wall Street below it.

A2: This segment of trail coincides with SW Wall Street by expanding the sidewalk to a 12-ft width and retaining the existing stormwater planters and marked bike lanes. This segment includes an at-grade, mid-block roadway crossing from the east side of SW Wall St. to the Potso Dog Park.

Segment Length (approximate):

- A1: 1340 feet
- A2: 1400 feet

Design Assumptions:

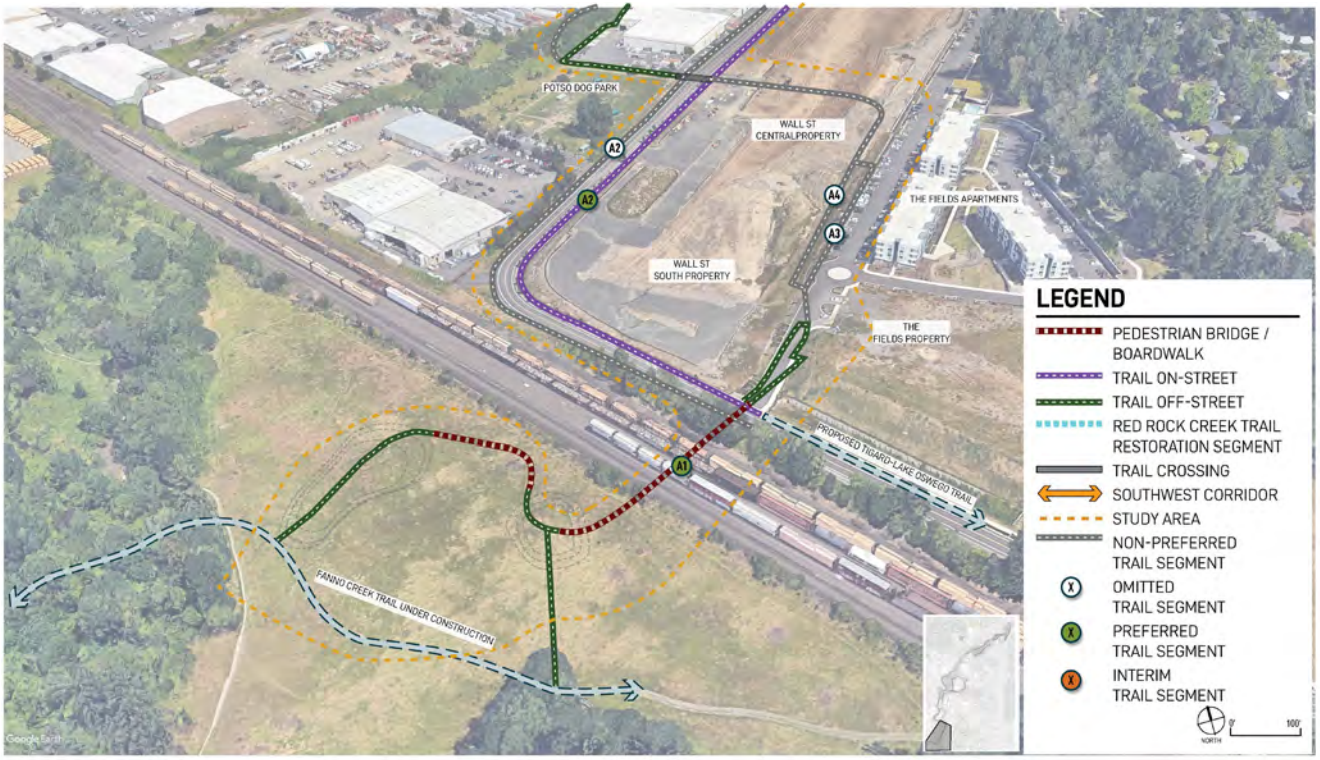
- Grade-separated crossing over railroad and SW Wall St. from the Type, Size, and Location Report dated January 8, 2021.
- Widen sidewalk to shared use path width along east side of Fields Apartment driveway and along north and east side of SW Wall St.
- Mid-block crossing at SW Wall St. designed for safety.
- Cost estimate includes revisions to LIDA stormwater facilities and street light relocation.
- Signage and pavement markings provide wayfinding for users.

A1: Trail Crossing Fuller Yard Railroad



A2: East Side of Wall Street





SEGMENT A ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Tigard Otak GREENWORKS

Project Limits: Segment B

Potso Dog Park to SW Hunziker Road

B2: Utilizes a strip of land along the northern boundary of Potso Dog Park, then turns north to run between the rear of an industrial building and the creek.

Segment Length (approximate):

- B2: 973 feet

Design Assumptions:

- Protective fencing along Potso Dog Park.
- Pedestrian scale fencing along active private property.
- Interim: widen existing facilities along SW Wall St. and SW Hunziker Rd.
- Enhanced mid-block crossing at SW Hunziker Rd. designed for safety.
- Cost estimate includes landscaping buffer along existing building.
- Signage and pavement markings provide wayfinding for users.

B2: North side of Potso Dog Park



B2: Behind Industrial Building Along Natural Area







SEGMENT B ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Project Limits: Segment C

SW Hunziker Road to Walmart Trail

C2+C3: Involves a connection from SW Hunziker Rd. that straddles the parking lot and landscape strip between two industrial use businesses. At the north end of the industrial land, the trail is elevated on structure to cross over Hwy 217, fully spanning the highway with no bridge columns in the median. This pedestrian bridge crossing results in a clear span approximately 250-ft long and located south of the proposed SWC overcrossing and north of an existing billboard structure.

Segment Length (approximate):

- C2: 635 feet
- C3: 1230 feet

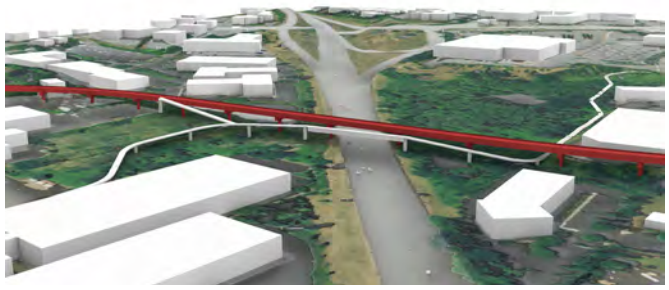
Design Assumptions:

- Convert portion of existing landscape median to sidewalk for pedestrian trail users.
- Signage and pavement markings provide wayfinding for users.
- Mark portion of drive aisle for shared use.
- Grade-separated ramp structure minimizes wetland impact.
- Grade-separated crossing over Hwy 217.
- Minimizes impact to existing billboard structure.
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots.
- Crossing location is compatible with the SWC elevated guideway plan and profile, including an elevated, ramped connection between alignments.

C2: Trail through Industrial Vehicle Area



C3: Highway 217 Crossing





SEGMENT C ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Project Limits: Segment C

Walmart Trail to SW Dartmouth Street

C6B: Once across Hwy 217 the trail will connect onto an existing path along the west side of the Walmart property heading north. The existing trail will still be accessible to the south. The northern portion will be rebuilt with the wider Red Rock Creek Trail section.

Continuing to utilize the existing path, enhancements will be made to incorporate larger turns to allow for better sight lines and safety. At the corner of the builiding north of Walmart, the trail will be constructed along the existing sidewalk using a raised boardwalk to enhance the user experience and to protect the natural area before ending at a plaza at the Dartmouth Street crossing.

Segment Length (approximate):

- C6B: 1588 feet

Design Assumptions:

- Signage and pavement markings provide wayfinding for users.
- Pedestrian scale fencing separating trail and natural space.
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots.
- Boardwalk structure minimizes wetland impact.

C6B: Plaza Area at Dartmouth Street/Costco Driveway



C6: West of Walmart on Existing Trail Alignment



C6B: North of Walmart on Existing Trail Alignment



C6B: Boardwalk along Natural Area





SEGMENT C ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Tigard Otak GREENWORKS

Otak

Project Limits: Segment D

SW Dartmouth Street to SW 72nd Avenue

D2: Using the signalized intersection crossing at SW Dartmouth St. and Costco driveway, the trail provides an in-line connection through the sensitive lands connecting to the existing trail adjacent to the AutoZone property. Portions of this segment will be constructed using a boardwalk structure to address the elevation change between Dartmouth St. and AutoZone.

D3: Utilizes the existing trail along the vegetated corridor adjacent to the AutoZone parking lot. Strategically placed street lighting can enhance the trail. Future parking lot pavement maintenance can increase trail width.

D4: Between SW Atlanta St. and SW 72nd Ave., this trail segment traverses through natural space created by the Red Rock Creek Stabilization and Enhancement project, Phase 1. The trail will utilize existing infrastructure at the interim crossing at SW 74th St.

Segment Length (approximate):

- D2: 300 feet
- D3: 384 feet
- D4: 1260 feet

Design Assumptions:

- Pedestrian scale fencing separating trail and natural space.
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots.
- Boardwalk structure minimizes wetland impact.
- Mid-block crossing at SW 74th Ave. designed for safety.
- Grade-separated undercrossing opportunity at SW 72nd Ave. (future).
- Enhanced mid-block crossing at SW 72nd Ave. designed for safety (interim).
- Signage and pavement markings provide wayfinding for users.

D2: Darmouth Street through the Natural Environment



D3: Future Trail at Streambank Enhancement Project



D4: SW 74th Avenue South of TriMet Park and Ride





SEGMENT D ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Project Limits: Segment E

SW 72nd Avenue to SW 68th Parkway
E1: Provides a link through undeveloped property between SW 72nd Ave. and SW 68th Pkwy. and follows the north side of the vegetated corridor.

Segment Length (approximate):
- E1: 1233 feet

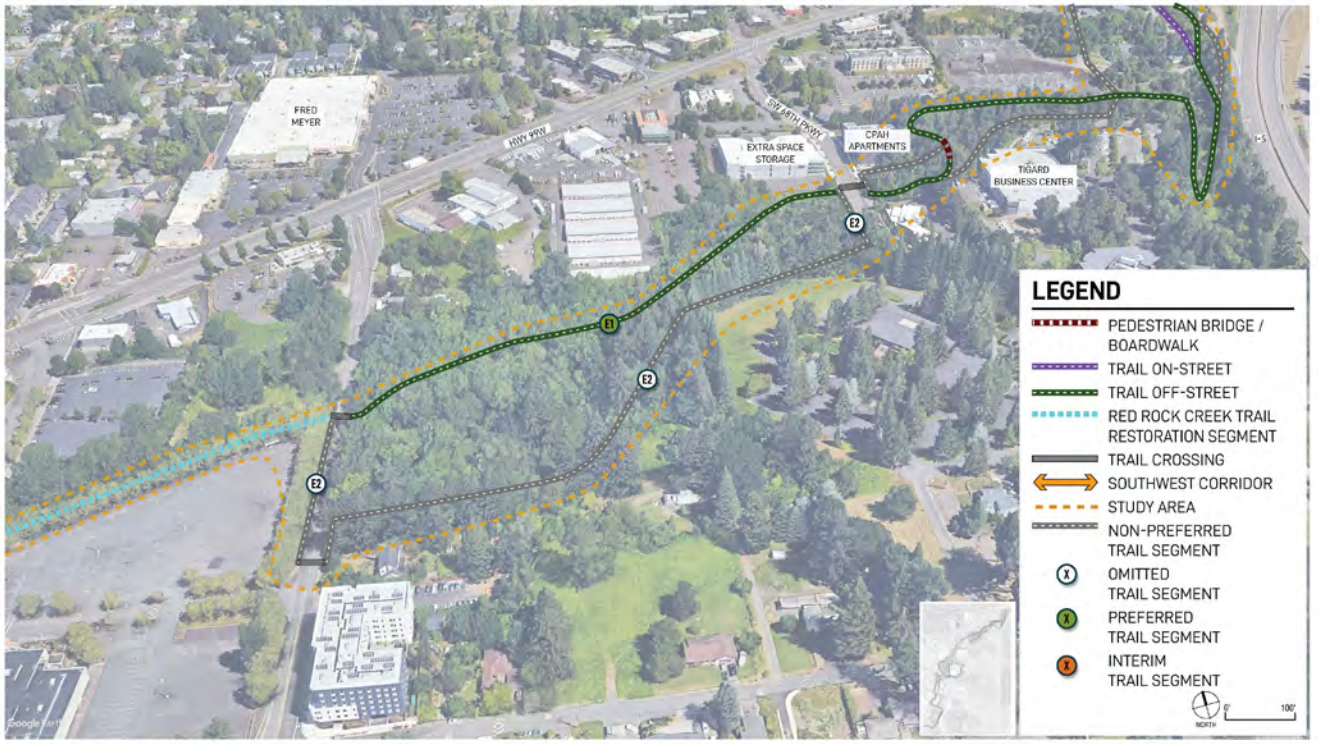
Design Assumptions:
- Low retaining walls manage side slope differential.
- Pedestrian scale fencing or handrails where necessary.
- Mid-block crossing at SW 68th Pkwy. designed for safety.

E1: Possible SW 72nd Ave Undercrossing



E1: Approaching SW 68th Parkway





SEGMENT E ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Tigard Otak GREENWORKS

Otak

Project Limits: Segment F

SW 68th Parkway to Highway 99W

F1: Begins at a mid-block crossing on SW 68th Pkwy. and enters the wooded area along the southern edge of Red Rock Creek before turning north and crossing the creek. Once past CPAH's Red Rock Creek Commons apartments, the trail follows the northern edge of the natural area. This segment continues along the south side of the PGE substation property and connects at base of PGE driveway.

F3: This alignment utilizes natural space between the SW 64th Ave. right-of-way and southbound I-5. Due to steep topography, segment F3 traverses the forested hillside to climb grade. The upper reach of the RRCT terminates at Hwy 99W/Barbur Boulevard on the SW side of I-5.

F4: Interim use of SW 64th Ave. and SW Coronado St. rights-of-way to connect to Hwy 99W/Barbur Blvd.

Segment Length (approximate):

- F1: 1200 feet
- F3: 1665 feet

Design Assumptions:

- Landscape buffer along active private property.
- Bridge crossing over Red Rock Creek.
- Retaining walls manage side slope differential.
- Pedestrian scale handrails where vertical change is 30" or greater.
- Pedestrian scale fencing separating trail and natural space.
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots, substation.
- Protective barrier separating trail along I-5 on-ramp.
- Signage and pavement markings provide wayfinding for users.

F3: SW 64th Ave.



F3: Along I-5 SB On Ramp



F1: Along PGE Substation



SEGMENT F ENLARGEMENT
RED ROCK CREEK TRAIL

DECEMBER 2023

Tigard Otak GREENWORKS

THIS PAGE WAS INTENTIONALLY LEFT BLANK.

Section 9. Trail Design Elements

Trails educate young and old Americans alike about the value and importance of the natural environment.

AMERICAN TRAILS, TRAILS FOR ALL AMERICANS REPORT, 1990

Trail Surfacing

Red Rock Creek Trail is intended to be a hard-surface trail for its entirety. Surface materials can include asphalt, concrete, pervious pavement, steel grating, and a variety of boardwalk decking materials. Where the trail is constructed on grade, the trail surface is assumed to be asphalt for its lower material cost, ease of construction, and durability. Where the trail coincides with a sidewalk facility, the trail surface shall be concrete, adhering to City of Tigard standard construction details. In the case of grade-separation when the trail is on a structure, the surface will depend on the selected structure type to be determined during final design.

Per Tigard's Trail Master Plan (2011), Exhibit 16, a typical pavement section includes 3" thick asphalt concrete over 4" aggregate base and geotextile fabric.

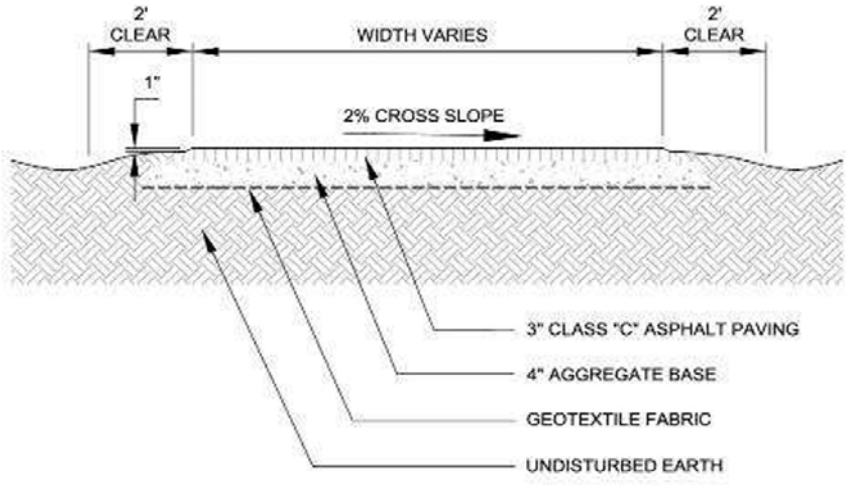


Rendering of proposed Plaza at SW Dartmouth Street

Amenities

The trail experience can be enhanced by amenities for pedestrians and cyclists of all ages and abilities. Recommendations include benches, gateways, bollards, bridge and boardwalk structures, lighting, public art, fencing, handrails, and unique wayfinding signage. Amenities provide a level of safety for users, encourage and stimulate trail use, and offer opportunities for public impact through recognition plaques, caretaking responsibilities, or community events held along the trail. Lighting at roadway and trail crossing locations and along buildings elevates the safety and visibility in these key areas. Through a future project phase, development of a consistent palette of amenities can tie together the various segments of Red Rock Creek Trail and build a sense of place.

Figure 12. Typical Pavement Section



The Tigard Trail Master Plan includes several design elements to incorporate into the final design for a complete trail.

Shoulder Landscaping

The Red Rock Creek Trail provides opportunities for special landscaping, water quality filter strips, and restoration along both the trail and adjacent areas. The existing vegetation, unique topography, adjacent and nearby buildings, roadways, fencing, driveways, and other hardscape conditions of each section of the trail should be considered when planning the landscape design. When selecting plant material, consider using plant species and communities that exist along the trail. In-kind replacement is recommended where possible. Native or naturalized plant species should always be used for any landscape restoration design. This includes special landscape circumstances such as providing planting buffers, screening, or transition zones between planting strips along roadways and the trail. All areas with exposed soil with or without plants should be covered with mulch or other permeable material. Consider maintenance requirements, drought tolerance, establishment and long-term irrigation needs, seasonal interest, and the growth habit and form of the plant to prevent view obstructions that can impede on trail safety. Any new landscaping along the trail should maintain the natural character of the site, benefit local ecosystems, and enhance the user's safety and experience.

Road Crossings

The Red Rock Creek Trail crosses or intersects nine roadways, Table 6. The roadway types vary significantly. Each crossing treatment reflects the speed, traffic volume, and crossing distance. The majority of the crossings occur at-grade and will require enhancements to improve safety for the trail users. Three crossings are planned to be grade-separated with a structure. The proposed crossing treatments are based on industry-accepted guidelines, preliminary evaluation of existing conditions, and traffic data available at the time of study. For mid-block crossings, each was evaluated using the FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations and/or the NCHRP Improving Pedestrian Safety at Unsignalized Crossings to determine the appropriate treatment. In preparation for construction, final design documents will be updated for each roadway crossing using the most current data available.

Table 6. Red Rock Creek Trail Road Crossings

Segment	Roadway Crossing	Recommended Crossing Type
A1	SW Wall Street - south	Grade-separated, 310-ft span bridge Dedicated pedestrian bridge over Wall Street (118-ft span) and railroad (190-ft span)
A2	SW Wall Street – north	At-grade Mid-block crossing Enhanced crossing: pavement markings, advanced signage
B2	SW Hunziker Road	At-grade Mid-block crossing Enhanced crossing: pavement markings, advanced signage
C3	Highway 217	Grade-separated, 250-ft single span Dedicated pedestrian bridge
C6B	SW Dartmouth Street	At-grade Existing signalized intersection Pedestrian-actuated crossing
D4	SW 72nd Avenue (interim)	At-grade Mid-block crossing Enhanced crossing: Pedestrian-actuated signal (RRFB)
D4	SW 72nd Avenue (preferred)	Grade-separated, 60-ft undercrossing Roadway supported by bridge or culvert structure
E1	SW 68th Parkway	At-grade Mid-block crossing with refuge island Enhanced crossing: pavement markings, advanced signage
F3	Highway 99W (F3 only) @ SW 64th Avenue	At-grade Existing signalized intersection





EXAMPLES OF ROAD CROSSINGS

Trail Connections

Expanded connectivity is a cornerstone of regional trails. Intersections with complementary trails offer opportunities for active users to continue their routes to further destinations using facilities separated from vehicle uses. There are several trail connections along Red Rock Creek Trail that will require careful design and treatments customized for trail users:

- Fanno Creek Trail – At-grade, tee intersection at the southern terminus of RRCT; align connection using 90-degree intersection with soft-radius curves for easy turning movements; include wayfinding signage.
- Tigard-Lake Oswego Trail – Although its alignment is to be determined, the Tigard-LO Trail is anticipated to connect to Red Rock Creek Trail at SW Wall St where both trails will utilize the on-street infrastructure to facilitate trail connectivity. Wayfinding signage will be important for trail identification.
- Southwest Corridor Elevated Guideway – During Southwest Corridor LRT design development, a memorandum of understanding between Tigard and TriMet established the City's desire for a multi-use path along the elevated guideway between Elmhurst (72nd Ave) and Hall St (Hunziker Rd) stations. Designated as a betterment to the Southwest Corridor, this elevated pedestrian facility is still in concept planning. A trail connection will allow Red Rock Creek Trail users traveling north/south to access the elevated guideway pedestrian facility running east/west. It is anticipated this connection will occur above grade on the west side of Hwy 217, linking Red Rock Creek Trail's elevated structure along segment C3 to the SWC elevated guideway. The RRCT alignment study finds the connection will be feasible should the elevated guideway be located on the south side of the SWC structure. See Figure 13 on the following page.
- Perimeter trail behind Walmart building – Red Rock Creek Trail will utilize approximately 800-ft the existing alignment of the perimeter trail between Dartmouth and the Walmart building. An intersection of the perimeter trail and Red Rock Creek Trail is essential to retain the purpose and viability of the recreation trail constructed by the development. A tee intersection with clear

sight lines will provide smooth, continuous travel and express safety to trail users.

- Recreation Trails – in the vicinity, there are several recreation trails that can support and enhance the use of RRCT. Connecting those trails to RRCT may be as simple as installing wayfinding signage. In more complex situations, extension of the recreation trail may be necessary. Examples include: Fields Apt trail, perimeter trail north of Walmart building, all non-preferred alignments from the study.
- SW Trails - In anticipation of the trail network, Portland's SW Trail #5 is planned to extend from its current terminus at SW 64th Ave. and Dickinson St. with a potential connection to RRCT at Hwy 99W.

Grade-Separated Crossings

The Red Rock Creek Trail grade separation structures are two major bridge crossings required to safely provide uninterrupted pedestrian access along the proposed Red Rock Creek Trail alignment.

Two crossings are identified in proposed study as alignments A1 to cross the railroad and SW Wall Street and C3 to cross over Highway 217 without interim support in the highway median. A lengthy ramp structure approach will be required at the south approach. The north approach also will require ramping to the main grade separation but to a lesser extent. Complicating this selection is the standing agreement between City of Tigard and TriMet to incorporate this pedestrian crossing into the planned Southwest Corridor (SWC) expansion of MAX light rail in the Portland metropolitan area. Alignment C3 is identified as a separate structure from the SWC structure. See Appendix D to review the Grade Separation Bridges; OR217 and Portland and Western Railroad Feasibility Report.



KISSIMMEE TRAIL BRIDGE – STEEL TRUSS (APPROX. 225 FT. MAIN SPAN)



HOLBEIN BRIDGE – HYBRID SUSPENSION (APPROX. 400 FT. MAIN SPAN)

Segment A1

The Portland and Western railroad crossing on proposed alignment A1 has been previously studied and the Type, Size, and Location report for that structure is available in Appendix E. As an outcome of this study, it was determined to adjust the location of the center span bridge column to rest between the TriMet LRT tracks and the Portland and Western tracks. Information concerning the anticipated TriMet MAX vertical clearance at this structure has been investigated and added to the proposed structure elevation, confirming that the proposed grade separation will provide vertical clearance for the MAX line without need to modify the structure grade.



PETER COURTNEY MINTO ISLAND BRIDGE – TIED ARCH (APPROX. 300 FT. MAIN SPAN)



STRESS RIBBON BRIDGE (APPROX. 300 FT SPAN)

Segment C3

Located at approximately milepost 6.30, RRCT is planned to cross Hwy 217 using a grade-separated pedestrian bridge. Alignment C3 is proposed in close proximity to the planned SWC elevated guideway. The trail alignment is skewed at approximately 60 degrees relative to the right-of-way. This was decided upon to better align with the existing recreational trail along the Walmart property on the east side of Hwy 217 and avoid the existing billboard on the west side of Hwy 217. ODOT engineering and planning staff provided feedback during the Alignment Study regarding future expansion projects along northbound Hwy 217 and the off-ramp to Hwy 99W, as well as the recommendation for the pedestrian bridge to fully span the highway with no bridge columns in the median. The crossing results in a clear span approximately 250-ft long and located south of the proposed SWC overcrossing and north of an existing billboard structure. See Appendix F for plan and profile schematic.

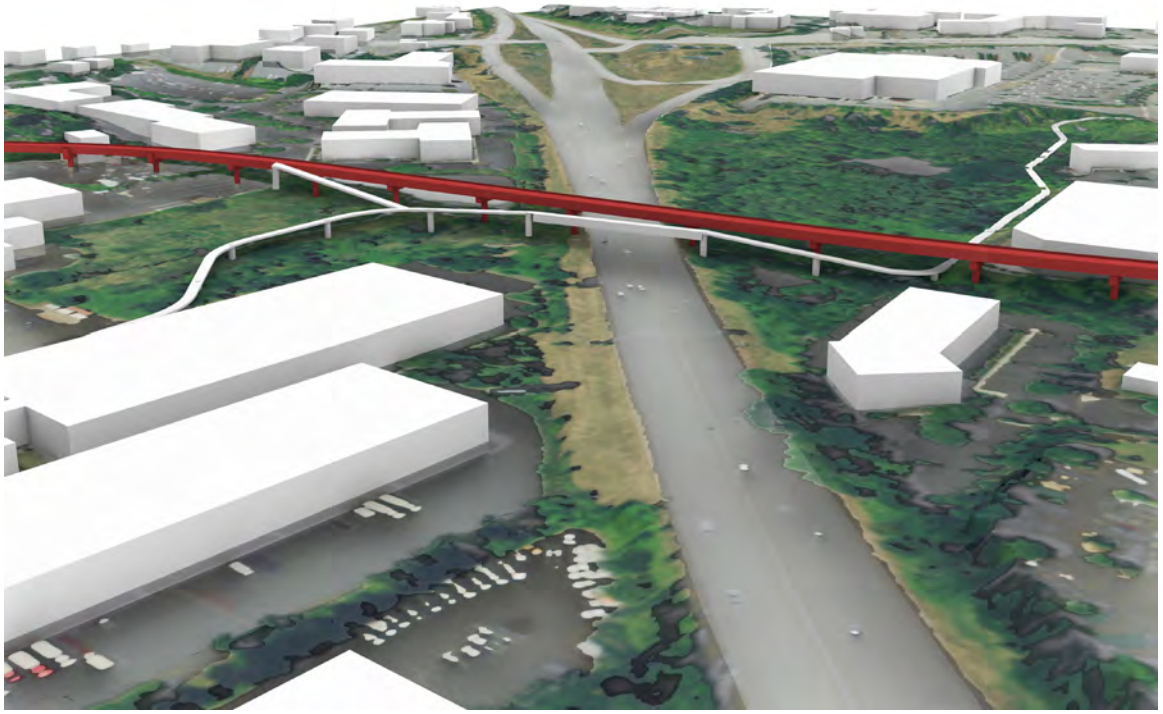
This can be achieved using a number of structure types, some structure types that have been successfully installed at this length include:

- Steel Truss
- Suspension
- Arch
- Stress Ribbon

The pedestrian bridge is planned at 12-ft wide trail width to match the at-grade trail width in other areas. An assessment of this crossing is outside of the ODOT right-of-way, RRCT will remain on structure until it meets grade. On the east side of Hwy 217, the structure will turn north and go under the SWC structure before touching down to meet with the existing recreational trail behind the Walmart building at 7600 SW Dartmouth Street, Tigard.

On the west side of Hwy 217, the structure will weave its way through vacant natural area north of Hunziker Road before meeting grade an existing parking lot between 8015 SW Hunziker Road and 8001 SW Hunziker Road.

Figure 13. Segment C3 Crossing Hwy 217 with Elevated Connection to SWC



THIS PAGE WAS INTENTIONALLY LEFT BLANK.

Section 10. Implementation Strategy

Everywhere is walking distance if you have the time.

STEVEN WRIGHT

The Red Rock Creek Trail implementation strategy provides a development framework that will ensure a systematic approach to project phasing, funding, permitting, and development of the trail's preferred alignment through the study area. Once the preferred alignment has been adopted into Tigard's land use and transportation plans, the City should engage in a project refinement phase to further develop preliminary designs, evaluate development opportunities and funding, and to initiate permitting work in order to streamline project implementation. During subsequent phases of this project, it will be critical to keep project stakeholders and Tigard's community engaged and informed of project progress.

For a general framework for next steps, the implementation strategy is summarized in the following tasks:

Table 7. Implementation Strategy

No.	Task	Responsibility	Cost Impact
1	Trail plan adoption: • Refine project description and scope for trail alignment and associated maps. • Adopt alignment by ordinance into city's Comprehensive Plan and Transportation System Plan. • Amend city's development code to include trail alignment and design standards. • Add trail to GIS layer.	City	Low
2	Capital improvement planning: • Confirm project phasing and define CIP projects for individual segments. • Update city capital improvement plans.	City	Low
3	Preliminary project funding: • Secure planning phase funding through city sources. • Apply for planning phase funding grants.	City, ODOT	Low
4	Preliminary Project Planning: • Wetland Delineation: field work, report, concurrence » Benefits to completing this for the multiple segments at one time. • Public engagement. • Obtain topographic survey of trail segments. • Prepare preliminary engineering design. • Prepare land use permits, if required. • Prepare and submit Joint Permit Application & CWS Service Provider Letter » consider submitting application for entire project area. • Coordination with TriMet and SW Corridor project. • For crossings: prepare Type, Size, & Location study prior to final design.	City, ODOT & Consultants	Medium

No.	Task	Responsibility	Cost Impact
5	Right of way acquisition: • As private development occurs, obtain dedications or permanent public access easements for the construction of the trail. • Work with willing sellers to acquire ROW or easements for trail development. • Obtain public right of way access agreements.	City, ODOT	Low to Medium
6	Construction Project Funding: • Secure planning phase funding through city, regional, state, and federal sources. • Apply for construction phase grants.	City, ODOT	Low
7	Final Project Engineering: • Public engagement. • Prepare trail design plans, specifications, and cost estimates. • Obtain grading and engineering permit approvals. • Obtain permits to occupy or perform work in the right-of-way (Tigard, Portland, & ODOT). • Obtain removal-fill and NPDES permit approvals. • Advertise project for construction.	City, ODOT & Consultants	Medium
8	Construct permanent trail improvements: • Construct trail segments and provide construction support during development phase. • As capital projects occur in Tigard Triangle, (e.g., widening of SW 72nd Ave), coordinate development of trail segments. • Project closeout and as-built documentation.	City, ODOT	High
9	Maintain and operate trail: • Establish stewardship group for ongoing maintenance, support, education, and promotion. • Monitor trail use and engage with users. • Maintain trail in safe working condition.	City, partner groups	Low

Final Design

The next stage for trail implementation is the preliminary engineering (planning) and final engineering phases. Each segment, whether contracted as a single design project or bundled, will require a fully developed scope of work.

Probable Cost

Red Rock Creek Trail will be constructed in phases over the course of several years. This report provides preliminary cost estimates of each segment with a common list of construction items corresponding to this conceptual level of design. Each estimate is considerate of the earthwork, trail surfacing, roadway modifications, landscaping and fencing, retaining walls and structures, lighting, utility relocation, environmental permitting, and land acquisition. In response to the unknown costs associated with engineering design and construction experienced throughout public infrastructure work, contingency items account for level of design, final engineering, construction engineering, and inspection, and overall project administration. The final engineering design effort will further refine the trail alignment and design, thereby reducing contingency factors.

Time is also a consideration when setting aside funds for construction. Trail construction costs shall be indexed based on the future year budgeting.

The total estimated cost for the preferred alignment of the Red Rock Creek Trail is approximately $66 million. Table 7 outlines the cost for construction by segment excluding interim options. A detailed cost estimate is included in Appendix G. Costs were determined using year 2022 estimated design and construction costs published by ODOT. Trail construction costs shall be indexed based on future year budgeting.

Table 8. Construction Cost by Trail Segment

Segment No.	Segment Length (LF)	Construction Cost ($)	Easements & Acquisition Area (SF)	Easement & Acquisition Cost ($)	Total Cost ($)
A	2965 LF	$8,396,504	15,740 SF	$270,768	$16,300,456
B	1030 LF	$1,092865	11,020 SF	$327,147	$2,413,526
C	3200 LF	$14,751,725	84,730 SF	$741,600	$28,903,984
D	1580 LF	$3,327,456	29,230 SF	$122,382	$7,110,039
E	1275 LF	$1,739,051	27,130 SF	$120,984	$3,440 ,990
F	2873 LF	$3,917,6387	38,878 SF	$174,834	$7,653,961

Trail Maintenance and Operations

Trail maintenance is an ongoing cost obligation that extends beyond initial trail development and must be considered during the project planning phase. Costs to maintain trails vary depending on factors such as surface material, slope, trail amenities, lighting, and bicycle and pedestrian volumes. Preliminary research of existing trail master plans and state agency web-based resources reflect a range of costs based on the varying trail conditions above. Based on this research, trail maintenance costs and range from $1,200 to $6,000 per mile per year, with the high end being the cost for hard surfaced, amenity-rich trails that may include road crossings, lighting, and bathroom and trash services.

Trail maintenance is primarily the responsibility of the city's operations staff and is typically funded through the city's general fund. These anticipated maintenance costs can be mitigated using education and community engagement, including:

- Installing signage to remind users to keep the trail clean and enforce trail rules.
- Engaging volunteers, civic groups (Tigard Walks! And Tigard Runs!) and service organizations (schools, churches, etc.) to support trail clean-ups and repairs.
- Establishing a "Friends of Red Rock Creek Trail" group to support trail maintenance, fundraising, and stewardship.
- Encouraging adjacent property owners and business to support maintenance and beautification efforts.
- Using donated materials and services to support ongoing trail maintenance.

Trail Security and Patrols

Security patrols by Tigard Police Department is not calculated or factored into the cost of trail construction. Ongoing patrols are considered incidental to existing services. Construction of a regional trail creates additional rights-of-way and will impact the department's budget and resources to provide patrols along Red Rock Creek Trail.

Structure Maintenance

Maintaining structures is an important factor to ensure users' safety on the trail and surrounding infrastructure. Bridges must be inspected at regular intervals to ensure no damage or vandalism has occurred; retaining walls require some monitoring to ensure drainage is functioning properly and that no surcharging is applied above the wall.

For the major crossings and retaining structures along Red Rock Creek Trail, the City of Tigard will require an intergovernmental agreement with ODOT's District Office to define maintain responsibilities for all the elements constructed within ODOT right-of-way. Maintenance tasks include structure inspection, transient camp cleanup, litter and graffiti cleanup. The District office should be engaged in the next phases of trail refinement and preliminary engineering, not later than 30% design, to appropriately plan for permitting a structure in ODOT right-of-way.

Similarly the Railroad crossing will require easement over the right-of-way and entering into a complete construction and maintenance agreement with Portland and Western Railroad.

Phasing Options

A trail phasing plan establishes a logical sequence of construction that provides the greatest service for trail users. The success and positive public reception of initial phases will impact the development timeline of subsequent segments. Positive public recognition will increase the project's ability to garner funding through federal grants, public-private partnerships, and capital improvement plans based on public demand.

Near Term: Early implementation of the trail in high use areas where the trail will be effective for daily commutes as well as regular errands will increase public use and recognition. This positive reception will build the momentum for future trail construction. The trails immediately adjacent to Segment D3 are strong candidates for near term implementation due to the accessibility provided by the existing trail adjacent to the AutoZone development (D3) and the early grading activity through Segment D4 as part of the Red Rock Creek streambank enhancement project. Implementation of the "A" segments is anticipated to occur in the near term due to the preliminary work and agreements in place with the existing property owners. The "A" segments can begin the process of final design and build upon the existing agreements by property owners of the Fields Apartments. This represents approximately 7,800 ft of trail.

Medium Term: this phase represents 5,500 ft of trail and builds connectivity between segments in the southern portion of the trail. The timing of construction for Segments C2 and C3 will need coordination to provide a continuous pathway between public access entrance locations

Long Term: this final phase of implementation completes the connections for Red Rock Creek Trail. This phase includes the most complex segments involving coordination with private property owners for acquisition of easement to accommodate the trail. This represents 2,750 ft of trail.

Each segment was intentionally drafted to serve as stand-alone projects that, when constructed, create a route for users without dead-ends. Each segment begins and ends at a roadway crossing for access to the trail from either direction. Below is a recommended phasing schedule:

Table 9. Trail Phasing

Trail Segment	Phasing / Priority	Comments
A1: Fanno Creek Trail to SW Wall Street, includes railroad overcrossing	Near term : 0-5 years	• Connects to affordable housing. • Public access easements are already recorded. • The 30 percent bridge design is completed, grant-ready. • Coordination with P&W railroad, TriMet rail.
A2: SW Wall Street to Potso Dog Park	Near term : 0-5 years	• Opportunity to implement trail prior to adjacent site development. • Interim route uses existing ROW along SW Wall St to SW Hunziker St. • Requires private property acquisition or easement.
B2: Potso Dog Park to SW Hunziker Road	Medium term: 5-10 years	• Interim route uses existing ROW along SW Wall St to SW Hunziker St. • Requires private property acquisition or easement.
C2: SW Hunziker Road to Highway 217 overcrossing	Medium term: 5-10 years	• Requires private property acquisition or easement.
C3: Highway 217 overcrossing to Walmart trail	Medium term: 5-10 years	• Needs a planning grant (Type, Size, & Location study). • Requires permit and coordination with ODOT.
C6A: Walmart trail to SW Dartmouth Road /Costco intersection	Long term: 10+ years	• Requires private property acquisition or easement. • Opportunity for plaza/gathering spaces. • Existing trail available for interim use.
D2: SW Dartmouth Road to AutoZone trail	Near term : 0-5 years	• Boardwalk structure between creek and stormwater facility.
D3: AutoZone trail	N/A	• Trail complete.
D4: SW Atlanta Street to SW 72nd Avenue	Near term : 0-5 years	• Trail grading completed through Red Rock Creek streambank stabilization and enhancement plan. • Connects to future mixed-use areas. • Grade-separated crossing dependent on future improvements of SW 72nd Avenue.
E1: SW 72nd Avenue to SW 68th Parkway	Medium term: 5-10 years	• Connects to future mixed-use areas.
F2: SW 68th Parkway to SW 64th Avenue	Long term: 10+ years	• Connects to affordable housing. • Requires property acquisition or easement through natural space. • Support from PGE; maintain security adjacent to trail. • Coordinate with Portland Bureau of Transportation.
F3: SW 64th Avenue to Highway 99W	Medium term: 5-10 years	• Connects to residential area. • Interim route uses existing ROW along SW 64th Ave to SW Coronado St. • Preferred route requires permit and coordination with ODOT and Portland Bureau of Transportation. • Requires sizable property acquisition or easement.

Project Funding Options

The Red Rock Creek Trail will likely be constructed in multiple phases using a range of project funding sources including local funds, grants, and federal sources. Many of the trail segments will be associated with other transportation projects such as roadways, transit, and bridges which may be eligible for state and federal funding through a variety programs. The Red Rock Creek Trail will serve a transportation function, as defined throughout this study process, thereby expanding the opportunities available for funding.

Funding for the Red Rock Creek Trail can be secured through grants available from the federal, state, and regional level. These grants may require local matches and projects may be required to fulfill certain minimum requirements including permitting and federal wage rates. The table below provides an overview of key funding sources for trail design and construction as well as limited sources for land acquisition funding. It's important to note that the terms and conditions of these sources can change, new programs may arise, and existing ones may end. Additionally, funding availability and cycles fluctuate. Therefore, it is advisable to assess the current programs and funding cycles before initiating grant applications or construction planning.

A list of potential funding sources for the Red Rock Creek Trail include the following:

Table 10. Potential Funding Sources

Source	Match Req.	Awarded Funding
Federal		
FTA Capital Investment Grants Program. (link)	Variable/Grant Specific 20-70%	Funding award varies, Total federal funds for any project type may not exceed 80 percent. Usually only applicable to trails when in conjunction with transit projects.
Transportation Alternatives Program (TAP) (link)	20%	Funding award varies, Grant program funds construction, planning, and design of on-road and off-road trail facilities for pedestrians, bicyclists, and other nonmotorized forms of transportation, including sidewalks, bicycle infrastructure, pedestrian and bicycle signals, traffic calming techniques, lighting, and other safety-related infrastructure.
Bridge Investment Program (BIP) (link)	20%, min.	Open to all levels of government, this discretionary program focuses on existing bridges or culverts. A grant received for an eligible project under BIP may be used for: • a wide range of development phase activities (specified in statute); • construction, reconstruction, rehabilitation, acquisition of real property, environmental mitigation, construction contingencies, acquisition of equipment, and operational improvements directly related to improving system performance; and • expenses related to the protection of a bridge, including seismic or scour protection.
Safe Streets and Roads for All (SS4A) Grant Program (link)	20%, min.	The SS4A program supports the development of a comprehensive safety action plan (referred to as an "Action Plan") that identifies the most significant roadway safety concerns in a community and the implementation of projects and strategies to address roadway safety issues.
State		
Land and Water Conservation Fund (link).	1:1 match required	Funding award varies, Grant program for developing outdoor recreation activities and support facilities needed by the public for recreation activities, including providing basic facilities and improvement of basic facilities. LWCF provides up to 50 percent project funding. Eligible matches include local budged funds, donated funds, and the value of property, equipment, materials, and/or volunteer labor.
ODOT/DLCD Transportation Growth Management (link)	12%	The TGM program typically awards between $2 and $2.5 million statewide, per cycle. Award amounts range between $125,000 and $250,000 per project.

Source	Match Req.	Awarded Funding
Oregon Community Paths (link)	30%	Funding award varies, Grant program for project development, construction, reconstruction, major resurfacing, or other improvements of multiuse paths that improve access and safety for people walking and bicycling. Federally Project Refinement funding is limited to $150,000 - $750,000 per project. Federal Construction funding is limited to $500,000 - $6,000,000 per project. State Construction funding is limited to $300,000-$1,000,000 per project.
Oregon's Clean Water State Revolving Fund (link)	To be determined	Oregon communities pursue sustainable solutions to restore and protect water quality. Oregon's Clean Water State Revolving Fund provides communities a set-aside reserve for funding green projects.
ODOT/Safe Routes to Schools: Construction (link)	40% local cash match	Funding award varies, States can use Transportation Alternatives Set-Aside funds for Safe Routes to School projects. Funding request minimum: $60,000 and maximum: $2 million.
Oregon State Lottery Funds (link)	Varies	Funding can support a variety of activities associated with parks, natural habitats, trail maintenance, and project stimulating economic growth.
Regional		
Washington County: Major Streets Transportation Improvement Program Opportunity Fund (MSTIP) (link)	0% *Often used as a match for state grants	Funding award varies, Total MSTIP Opportunity Fund allocation (2012-present) is $20m, remaining MSTIP funds balance varies based on expended and obligate amounts.
Metro: Regional Flexible Funds Allocation (RFFA) (link)	10.27%	Funding award varies, Program allocated $152.8 million for years 2025-2027 (link)
Local		
Parks System Development Charges	n/a	Acquisition, development and expansion of recreation spaces and facilities in newly developing areas or to increase capacity in the system.
City General Fund	n/a	General fund revenue from property taxes is primarily used to fund operations but can be used for capital at the City Council's discretion.
Tax Increment Finance District	n/a	Urban renewal capital project funding targeting multi-modal transportation including trails, parks, and recreation. The City's TIF districts include the City Center and Tigard Triangle.
Utility Fee (Park and Recreation Fee)	n/a	These funds are dedicated to park maintenance and supporting recreation programming.
Transient Lodging Tax	n/a	Can be used for capital or operations.

Development Code Requirements

Like other facilities making up the City's transportation network, portions of the Red Rock Creek Trail may be implemented in conjunction with private development activity along the trail corridor. Existing development code language includes standards for dedication and construction on properties within or adjacent to planned alignments for streets and active transportation facilities.

Within the Tigard Triangle Plan District

The Tigard Triangle Plan District (TMC Chapter 18.660), adopted in 2017, implements focused planning for the Tigard Triangle area through a "lean code" that encourages mixed-use development and multi-modal transportation options. Within this chapter, TMC Map 18.660.B shows the existing and future transportation network for the area, including sections of the Red Rock Creek Trail, clearly depicting how the trail alignment relates to individual parcels and connects to other network elements.

Section 18.660.090, Transportation Facility Standards for the Tigard Triangle Plan District (TTPD), specifies connectivity and block length requirements, facility design, and dedication and fee-in-lieu requirements for the transportation facilities shown on Map 18.660.B. These standards provide an effective basis for implementing the trail alignment as planned. In order to ensure that code requirements are consistent with the proposed alignment and design of the trail, the City should consider the following revisions to Chapter 18.660:

Source	Match Req.	Awarded Funding
General Obligation Bond	n/a	Voter-approved bonds can fund capital projects. The City is currently repaying park and library bonds.
Construct In-Lieu	n/a	As the condition of a land use approval or development agreement, a developer can construct a portion of a trail in-lieu of paying system development charges or other infrastructure investment. The City should evaluate this option on a case-by-case basis.
Non-Governmental Organization Funding and Donations		
Varies		Funding may be available from non-profit and NGO sources including the Rails-to-Trails Conservancy, Travel Oregon, American Trails, People for Bikes, and individual and organizational benefactors. Donations can also include in-kind services, labor, and materials.

- Update Transportation System Plan Figure 4 (Planned Pedestrian Network) and Figure 8 (Planned Bicycle Network), and TMC Map 18.660.B to show the preferred alignment of the Red Rock Creek Trail for the segment between Dartmouth Street and Highway 217 at the edge of the TTPD.
- Amend the minimum easement, right-of-way, and paved improvement widths in 18.660.040.C.3.e.v to add a minimum 16-foot-wide easement/right-of-way width and 12-foot-wide improvement width specific to the Red Rock Creek Trail.

Outside of the Tigard Triangle Plan District

Portions of the Red Rock Creek Trail west of Highway 217 are not within the TTPD and are not subject to the development standards specific to that area. Code requirements for trail dedication and construction for these segments are contained in TMC Chapter 18.910, which addresses improvement standards across the City more generally. Section 18.910.110 specifically addresses “Bikeways and Pedestrian Pathways,” with a variety of definitions for various types of active transportation facilities, and refers to facilities mapped in several different plans. These definitions, map and plan references should be consolidated to refer to active transportation facilities shown in the Transportation System Plan and plan district network maps adopted in code. Other recommended changes include:

- Update Transportation System Plan Figure 4 (Planned Pedestrian Network) and Figure 8 (Planned Bicycle Network) to show the updated preferred alignment of portions of the Red Rock Creek Trail between Dartmouth Street and Highway 217, the Highway 217 crossing, and proposed trail segments west of Highway 217.
- Amend the minimum right-of-way and paved improvement widths in 18.910.110.C to include references to easements, and add a minimum 16-foot-wide easement/right-of-way width and 12-foot-wide improvement width specific to the Red Rock Creek Trail.

In addition to these updates above, future code development for Chapter 18.910 should consider:

- Including network connectivity and block length standards similar to those adopted in 18.660.090.C.3. to apply outside of the TTPD.
- Providing a fee-in-lieu of construction (FILOC) option like the one outlined in 18.660.090.D to required active transportation facility improvements outside the TTPD, with a similar notation that FILOC may not be used in lieu of right-of-way or easement dedication.
- Clarifying that active transportation facilities may be located within easements, and not just right-of-way.
- Providing an on-site density transfer to offset the impact of land dedicated for the trail alignment.



503.287.6825 | OTAK.COM | 808 SW THIRD AVENUE, SUITE 800 PORTLAND, OR 97204

Appendix A: Community/Stakeholder Results

Memorandum

To: Stakeholder Working Group

From: RRCT Design Team

Copies: Gary Pagenstecher, Judi Martin, Katie Gillespie

Date: March 4, 2024

Subject: Alignment Alternatives Comment Summary

Project No.: 20291

Below is a summary of the comments the design team has received to date on the Red Rock Creek Trail Alignment Alternatives. The comments are broken down into responses received from the online survey. We have also summarized the comments that were received at the Thursday, May 18 open house that was held at the Tigard Public Library and the feedback we received from the Stakeholder Working Group (SWG).

Online Survey Results

When thinking about how the trail will be used, what is the most important to you?

Options	Total Votes
Users' safety	13
Enjoyment of Outdoors	10
Preservation of Ecosystem	8
Protection of Private Property	2
Accessibility to all	7
Ongoing Maintenance	8

Some other ideas for how the trail will be used:

Based on the online survey conducted among the public, several additional ideas were suggested for how the trail could be utilized effectively:

1. Establishing a central pedestrian greenway that incorporates smaller loop segments within the Tigard Triangle, providing a versatile and interconnected trail system.
2. Ensuring convenient access to adjacent parts of the city and mass transit, enabling seamless connectivity for trail users, and enhancing overall transportation options.
3. Facilitating organized walks and runs, with accessibility from Potso Dog Park, creating a recreational hub for fitness enthusiasts and promoting a healthy, active lifestyle.
4. Implementing a minimalist approach to signage and landscape design along the trail, preserving its natural beauty while maintaining functionality and navigability.
5. Promoting easy and accessible pathways for individuals experiencing homelessness to navigate the area, fostering inclusivity, and providing necessary mobility support.
6. Addressing the need for a pedestrian bridge over the 217 freeway, which is currently the only metro-area freeway lacking such infrastructure. Constructing a bridge would enhance safety and connectivity, allowing pedestrians to traverse the area efficiently and securely.
7. To get to Walmart and Costco without a car safely.
8. Safe alternative bike/ped connection between neighborhoods across hwy 217
9. Access to Triangle shopping from Hall/Hunziker intersection
10. Organized walks/runs, accessible from Potso Dog Park

11. Minimal signage and minimal designed landscaping
12. Please build a bridge over the 217 freeway. 217 is the only metro-area freeway without a pedestrian bridge or tunnel.
13. Access to adjoining parts of the city and mass transit.
14. Easy access for the homeless to get around the area.
15. A central pedestrian greenway that also provides segments for smaller loops with the Tigard Triangle.

By incorporating these suggestions, the trail can become a multi-purpose space that caters to various community needs, encourages active lifestyles, fosters inclusivity, and enhances overall accessibility and connectivity.

In what ways could you see yourself to those close to you using a nearby trail?

Options	Total Votes
Bike/Scooter Path	10
Running/ Walking Route	14
Connection to Other Transportation (e.g. bus, rail)	9
Nature walk	12
Family Outings	6

According to people who took the online survey some other ways the trail might be used:

The online survey revealed several additional ways in which the trial could be utilized:

1. Alternative Transportation:
   - Using the trail for rollerblading and as an alternative to driving for localized trips.
   - Relieving congestion on Pacific Hwy by providing an alternative route.
2. Recreation and Nature:
   - Engaging in personal nature photography along the trail.
   - Enjoying bird watching and finding stress relief in the tranquil environment.
   - Accessing nearby grocery stores and local fun activities.
3. Educational and Community Activities:
   - Organizing school group visits for educational purposes.
   - Extending dog exercise opportunities from Potso Dog Park to the trail.
   - Facilitating learning groups from libraries focused on birding, plants, and more.
4. Conservation and Wildlife:
   - Encouraging nesting birds and supporting their habitat along the trail.
5. Connectivity:
   - Providing a safe route for commuting between Beaverton and Lake Oswego.

What features of a trail would help you to feel the most welcome and safe?

1. Accessibility:
   - The trail should be usable for someone with a walker.
   - There is a concern about the trail being usable for bicycles and whether it is desired.
2. Location:
   - The preference is to have the trail on the side opposite of the apartment building at Red Rock Creek Commons.
   - Concerns about people having access behind where you live.
   - I recommend that the trail should be restricted to the sidewalks in the Triangle. This is because what is left of the natural areas in the Triangle is composed of primarily mitigation sites and/or small natural areas that should not be disturbed at all.
3. Trail Hours and Encampments:
   - Is the trail planned to be open at all hours?
   - There are already a couple of encampments in the area and concerns about whether the trail would encourage more.
4. Maintenance:

- Regular and consistent maintenance is essential.

5. Safety and Accommodation:
   - There should be restrictions on bicycles/scooters or a wide enough trail to accommodate both walkers and those using apparatus safely.
   - Concerns about the safety of walkers due to motorized vehicles on the trail.
6. Amenities:
   - Lighting along the trail is important.
   - The trail should have amenity furnishings and be well-maintained.
   - Fencing should be in place.
   - There should be a clear line of sight, with no overgrown vegetation.
   - Multiple access points to main roads and neighborhoods are desired.
   - Flashing light pedestrian crossings should be installed.
   - Separate lanes for walkers/wheelchairs/runners and bikes/strollers/skateboarders.
   - Limited interaction with vehicles is preferred.
   - Benches should be installed for seating.
7. Security:
   - A large, cleared area surrounding the trail is desired to prevent hiding in the brush and improve safety.
   - Lighting should be provided along the trail to enhance security.
8. General Comments:
   - Prioritized crossings of Hunziker and Dartmouth
   - maintained clean, no camping.
   - Definitely adequate width to allow peds and bikes to share the path safely. A path at least 14ft wide would allow enough room for a variety of different multi-modal users.
   - Usable for someone with a walker. Do we want it usable for bicycles? I live at Red Rock Creek Commons and I'm not excited about people having access behind where I live. I would prefer the trail be on the side opposite of the apartment building. Would it be open at all hours? FYI There are a couple of encampments in this area already. Would this encourage more?
   - Clear lines of sight (not overgrown) Multiple access to main roads/neighborhoods.
   - Trail Lighting, Flashing Light Pedestrian Crossings, Separate Walker/Wheelchair/ Runner lanes from Bikes/Strollers/Skateboarders lanes
   - Regular/consistent maintenance. Restriction on bicycles/scooters or a wide enough trail that it is able to safely accommodate both walkers and those using apparatus. I don't want to get mowed over by anything motorized on the trail.
   - planting Oregon White Oak trees and Pacific Madrone trees. Put in benches for seating.
   - Large cleared area surrounding the trail (so no one can hide in the brush and jump out) and lighting.
   - Fencing and lighting.
   - Limited vehicle interaction.
   - Lighting, amenity furnishings, well maintained.
   - Wide enough for patrol cars to traverse the section on a regular basis.
   - No electric scooters or bikes. They are silent and dangerous.

When you think about a trail along Red Rock Creek, do any concerns come to mind?

A summary of the concerns expressed by individuals regarding the trail along Red Rock Creek

1. Homeless population: Some respondents are concerned about the presence of the homeless population in the area, particularly due to potential safety issues.
2. Off-trail traffic and privacy: People residing in Red Rock Creek Commons are worried about increased foot traffic near their homes and a potential intrusion of privacy.
3. Impact to the creek: The respondents emphasize ensuring that the trail's development benefits both people and the natural environment, specifically addressing concerns about potential adverse effects on the creek.
4. Wildlife protection and pedestrian access: Balancing the protection of wildlife with providing pedestrian access through a greenway system is a crucial consideration for trail development.

5. Litter, damage, and drug use: Concerns are raised about littering and damage to the natural area, along with camping by transients and drug use, including the disposal of needles.
6. Trail flooding and unauthorized camping: Flooding of the trail and unauthorized camping are mentioned as potential issues that need to be addressed.
7. Land acquisition and safety: Questions are raised about how the land for the trail is being acquired, as well as ensuring safety for trail users and managing interactions with local business traffic.
8. Opposition to big box stores: Some individuals express their opposition to the construction of big box stores in the area, although it is not directly related to the trail concerns.
9. Clearing of the homeless population and police patrol: One respondent specifically suggests clearing the area of the homeless population and increasing police patrols for the safety of trail users, particularly families.
10. Much of Red Rock Creek has been put in a pipe or what is remaining is a small natural area with little habitat for wildlife.
11. Accessibility to businesses along 99W
12. Same concerns with the rest of the Fanno creek trail system which is camping and drug use. City of Tigard has done a good job to keep this from happening on existing trails and I assume it will be the same here.
13. Maintenance is key. making sure the path asphalt remains smooth is necessary to ensure safety of users. Uneven paths with potholes narrow the useable area of the path and increase conflict between users.
14. Off trail traffic. Privacy for residents of Red Rock Creek Commons. In general, I like trails.
15. Trail flooding and unauthorized camping.
16. Impact to the creek. The trail should benefit both people and nature.
17. Please stop allowing construction of big box stores.
18. The current houseless population that resides there is a major concern for me. I have come in contact with a few individuals and while they have been nice, they have had weapons openly displayed in their possession, which is an unsettling situation for a family bike ride. I would like the area to be cleared of the current houseless population, and patrolled by Tigard police.
19. Litter and damage to natural area, along with camping from transients. Needles from drug use.
20. How is this land being acquired? Safety for trail users and interactions with local business traffic.
21. Homeless population
22. balancing wildlife protection with pedestrian access with a greenway system.
23. Making it a priority to keep houseless people and drug users/criminals from taking over the space as they have other areas nearby.
24. It is a good idea. I did not know such a creek existed.

Do you have any other thoughts to share regarding the trail?

When asked, "Do you have any other thoughts to share regarding the trail?" we received a range of insightful feedback from individuals who participated in the online survey. Here are some key themes that emerged:

1. Preserving Nature and Cleanliness: Many respondents expressed a desire to ensure that the trail area remains "natural" and clean. They emphasized the importance of maintaining the ecological integrity of the surroundings and preserving the pristine beauty of the area.
2. Prioritizing Construction for Tigard Triangle Residents: Several participants suggested prioritizing the construction of the trail to serve the new residents of Tigard Triangle primarily. This would provide them with convenient access to nature and outdoor spaces.
3. Enhancing Opportunities for Children: Respondents recognized the potential of the trail to create recreational areas for children who may not have other opportunities to experience nature. They highlighted the significance of establishing connections to areas of the city that are currently disconnected due to roads and freeways.
4. Addressing Walkability and Mass Transit: Many individuals expressed the need for improved walkability and mass transit options within the city. They emphasized that the trail could contribute to making the city more pedestrian-friendly and accessible, especially for those without personal vehicles. Access to food was also noted as a potential challenge for non-drivers.

5. Positive Reception and Existing Trail Connection: The overall sentiment towards the trail proposal was highly positive. Respondents highlighted the popularity and success of the existing Fanno Creek Trail and expressed confidence that the new trail would be equally well-utilized. They considered it a fantastic addition to the current trail network.
6. Management and Maintenance: Some individuals raised questions about the management of the trail once it is constructed. They inquired about who would be responsible for overseeing its use, preventing misuse, and ensuring proper clean-up to maintain its integrity.
7. Native Planting: Numerous participants advocated for the use of native plants along the trail. They recognized the ecological benefits, and the positive impact native plant species can have on local biodiversity.
8. Need for More Green and Outdoor Spaces: Finally, many respondents enthusiastically supported the idea of the trail, emphasizing the need for more green and outdoor spaces within the Tigard Triangle. They saw it as an opportunity to enhance the quality of life in the area.
9. We don't see any demand for this trail. Why is it being proposed?
    - Many years ago, when the city of Tigard was planning for this area, that would have been the time to set aside land for a trail in the area. Now, what we see is a creek that's been put in pipes in the Triangle or is still above ground with very little habitat that lends itself for a wide enough buffer for a trail.
    - What is left of the open space, natural areas along the creek, should be protected for wildlife. For example, a study that was released this winter shows that many of our native birds have declined in population by 50% or more. This is an alarming trend, and we all need to do everything to protect our birds. Having trails in nesting habitat can cause nesting birds to abandon a new altogether. This we want to avoid at all costs.
10. Commuting, grocery shopping, access to businesses adjacent to 99W, connection to Lake Oswego.
11. good connection to shopping.
12. Connection that allows peds and bikes to avoid 99W while still allowing access to destinations along the corridor.
13. Personal nature photography.
14. School group education; an extension of dog exercise from Potso Dog Park; library learning groups (birding, plants, etc).
15. Encourage nesting birds.
16. getting safely from Beaverton to Lake Oswego.
17. Bird watching, stress relief, access to grocery shopping and local fun.
18. Rollerblading.
19. Alternative to driving for localized trips, relieving congestion on Pacific Hwy.
20. This will be the ONLY pedestrian crossing of 217 in the Tigard area. It could be a major asset to our transportation system. Please consider how it can connect to the businesses, including ways to the food cart pod near the UHaul and Fred Meyers.
21. I Live in this area and am excited for a connection to the rest of the Fanno Creek trails. Currently the route for us to get to the Fanno Creek trails has us on busy streets with our kids which is dangerous and limits our usage. Excited for this section of trail to be built!
22. Please try to build in connections to various businesses and ensure that bikes and peds don't need to take unnecessary detours. As someone who bikes to Costco and Winco in this area, it is already hard enough to cycle in this area
23. Dartmouth crossing: 1. Dartmouth is a busy street - need more than grade level crossing. Possible pedestrian overpass. 2. Elevate Dartmouth to alleviate high water - possible pedestrian underpass. 3. Realign (straighten) Dartmouth to ease L turn lane into Costco.
24. How does the area remain "natural" and clean?
25. This looks amazing! The Fanno Creek trail is so well used, I'm sure this will be as well!
26. It sounds like a great addition to the existing trails, especially Fanno Creek Trail.
27. Please plant native plants.
28. Would provide areas for children that may otherwise not have a place to experience nature. Could bring a connection to areas of city that are disconnected by roads and freeways. This City, in areas, are not walkable or mass transit friendly. Access to food, if not driving, can be limited.
29. Love the idea. The triangle needs more green/outdoor spaces.

30. Once this trail gets constructed, who manages the use / misuse of the trail and clean-up?
31. Let's prioritize construction to serve new Tigard Triangle residents.

SWG and Open House Feedback

Segment A

SWG Segment Comments

- A1: Near CWS sanitary sewer and within NSES project boundary polygon.
- A1: No alternative but this seems like a logical alignment to connect across the tracks. Assume this would be elevated? Or could it be at grade with crossing bells etc.?
- A2: No sensitive area or Vegetated Corridor
- A3: No sensitive area or Vegetated Corridor
- A3: Does this route ped/bikes through extra topography compared to other alts? Nice that it brings the trail closer and to the heart of these residential developments.
- A4: Why is this elevated/raised?
- A4: No sensitive area or Vegetated Corridor

Open House Comments

- A3: Has been Promised for years and would be an incentive for dog owners and trail-walkers.
- The ramp for A4 is a great idea for the location where A3 begins. In addition to the ramp A3 would be preferred.

Segment B

SWG Segment Comments

- B1: Trail on street. No sensitive area or Vegetated Corridor encroachment.
- B1: Any reason with the eastern side of Wall Street isn't studied for this segment length? Could feel a little closer to nature/ higher quality development as opposed to being right up against industrial uses.
- B2: Likely to be most encroachment to sensitive area and Vegetated Corridor - Not preferred route.
- B2: B2 and B3 seem very comparable. B2 not having bridge could be a good cost saving - but is also an opportunity to interact with nature.
- B3: Within Vegetated Corridor and potential encroachments to stream, though further than B2 route. Vegetated Corridor already appear minimized due to existing development.
- B3: Able to Walk by creek. May be easier to have easement next to river from current property.
- B4: Trail on street. Continuation of B1 segment on northwest on SW Hunziker St - no alternative.

Open House Comments

- B1: Too many Vehicles at employee parking area.
- B1: I agree with this, it is the worst of the options. A signal or something would be required.

Segment C

SWG Segment Comments

- C1: Along already very narrowed Red Rock Creek and Vegetated Corridor due to existing development - Not preferred.

- C1: C1 and C2 comparable. I'd want to know more about the existing uses of these spaces by the prop owners - big trucks, loading, volume of parking lot activity etc.
- C1: This parallels the creek and driving area of large trucks from Knez buildings. Should be kept at top of slope in case of flooding, but this may put path alongside trucks.
- C1: C1 thru C2B - Safety concerns? Sensitive wetlands? Wildlife habitat. Homeless encampments in the wetlands?
- C1A: This route is very close to (or perhaps over) a creek. This could negatively impact function/wildlife of wetland by being too close to dams which need to be managed by beavers.
- C1A: Trail within outer edges of LWI wetland or just outside?
- C1A:Trimet has proposed a crossing over OR217 for their 'planned' light rail (Southwest Corridor) project in the general vicinity. The proposed light rail project was still in the NEPA (one's recollection). The project may have been on hold or on a pause or 'canceled'. No known status or schedule of either project cancellation or resume date). There should be some type of coordination between the proposed trail location and the 'then-proposed' light rail alignment. Also, the trail structure column locations should be placed where it would not preclude the flexibility of improvements to OR217 in the future. Contact ODOT Preliminary Design when the trail concept (column location) moves further beyond the idea at this general location.
- C1B: Trail crosses into LWI wetland but then connects to C3 outside of potential sensitive area.
- C1B: Less environmental concerns - still provides connection through wetland.
- C2: Likely no sensitive area or Vegetated Corridor; Preferred route to C1
- C2: Because of connection to C1 or C1A, this may less desirable or cause issues with wetland protection/mitigation
- C2: C1 and C2 comparable. I'd want to know more about the existing uses of these spaces by the prop owners - big trucks, loading, volume of parking lot activity etc.
- C2A: Trail crosses into LWI wetland, to then connect to outer wetland with C1A - Preferred route.
- C2B: Trimet has proposed a crossing over OR217 for their 'planned' light rail (Southwest Corridor) project in the general vicinity. The proposed light rail project was still in the NEPA (one's recollection) . The project may have been on hold or on a pause or 'canceled'. No known status or schedule of either project cancellation or resume date). There should be some type of coordination between the proposed trail location and the 'then-proposed' light rail alignment. Also, the trail structure column locations should be placed where it would not preclude the flexibility of improvements to OR217 in the future. Contact ODOT Preliminary Design when the trail concept (column location) moves further beyond the idea at this general location.
- C2B: Trail within LWI wetland and close to Red Rock Creek. Continues to be within sensitive area within entire segment - Not preferred.
- C2B: Possibly smallest impact of paths over wetland, along with C2. Still provides good viewing opportunities with much less disruption of wildlife.
- C3: Crosses 217 and remains on the outer edge of LWI wetland and/or Vegetated Corridor.
- C3: Trimet has proposed a crossing over OR217 for their 'planned' light rail (Southwest Corridor) project in the general vicinity. The proposed light rail project was still in the NEPA (one's recollection) . The project may have been on hold or on a pause or 'canceled'. No known status or schedule of either project cancellation or resume date). There should be some type of coordination between the proposed trail location and the 'then-proposed' light rail alignment. Also, the trail structure column locations should be placed where it would not preclude the flexibility of improvements to OR217 in the future. Contact ODOT Preliminary Design when the trail concept (column location) moves further beyond the idea at this general location.

- C5: Proposed entirely within LWI wetland except for small portion just before SW Dartmouth St - Not preferred.
- C5: This one seems like the most natural experience?
- C5: Looks like trail could be outside of floodplain/wetland. Also, near Title 13 Wildlife Area
- C5: Not feasible, trail towards Costco would need to go uphill which makes it not wheelchair accessible. No existing trail to use, very high cost to build new trail through designated wetland.
- C5: ODOT has plan(s) to make more improvements to OR217 including the interchange in the future. Any proposed trail alignment should be outside of the improvement 'envelope'. Also, any portion of the trail is proposed inside the ODOT ROW it should be designated as 'transportation' system, not a 'recreational' trail. It has to do with the implication in a NEPA process in future projects.
- C6: If connected to C9 at Walmart exit to Dartmouth (by Verizon store), users have minimal exposure on Dartmouth St. Pedestrian crossing needs to be established at entry/exit which should be feasible. Existing trail can be utilized.
- C6: Along the western development boundary of Walmart. Likely within some outer Vegetated Corridor and upland and some wetland and stream - Preferred to C5
- C7: Along the eastern development boundary of Walmart. Likely no sensitive area or Vegetated Corridor encroachment - Preferred to C5 & C6.
- C7: C7/C8/C9 seem like they all add an unnecessary crossing of ped/bike circulation with the Walmart Auto traffic. Would probably avoid pulling the segments this far to the east and reduce those circulation paths crossing as much as possible. I'd worry C7 would conflict with a future Light Rail corridor and need to be rebuilt/realigned at some point. And would perhaps be out of commission during construction.
- C7: Not feasible because of access to MHF project in C8.
- C8: Not feasible because of access to MHF project.
- C8: May be proposed within CWS WQP easement.
- C8: C7/C8/C9 seem like they all add an unnecessary crossing of ped/bike circulation with the Walmart Auto traffic. Would probably avoid pulling the segments this far to the east and reduce those circulation paths crossing as much as possible. I'd worry C7 would conflict with a future Light Rail corridor and need to be rebuilt/realigned at some point. And would perhaps be out of commission during construction.
- C9: Along tributary with potentially already significantly reduced Vegetated Corridor
- C9: Our proposal is to connect C9 to D1 at Walmart / Dartmouth Intersection, pedestrian crossing is needed at existing intersection. Connect D1 to C9 not using pedestrian sidewalk at Dartmouth Street but going towards WhichWich Sandwich place at 7500 SW Dartmouth St and use trail behind that building. Then connect C9 to C6. Existing trails behind 7500 and 7700 SW Dartmouth St can be utilized which minimizes cost.
- C9: C7/C8/C9 seem like they all add an unnecessary crossing of ped/bike circulation with the Walmart Auto traffic. Would probably avoid pulling the segments this far to the east and reduce those circulation paths crossing as much as possible. I'd worry C7 would conflict with a future Light Rail corridor and need to be rebuilt/realigned at some point. And would perhaps be out of commission during construction.
- C9 and C10: I don't love C10 and C9 – there are a lot of turning movements in and out of Costco and Walmart. But if that is needed to make a direct connection I understand.

- C10: Crosses wetland pond and Red Rock Creek. Looks like maybe built within existing road prism so no additional encroachments.

Open House Comments

- C1A: Connection to pre-existing bridge cuts cost and makes for less construction surrounding the section of roads.
- C6: Already existing and the connection to C1A feels natural.

Segment D

SWG Segment Comments

- D1: This should connect to C9 at Dartmouth / Walmart Intersection, pedestrian crossing needed at existing intersection. Connection to C9 should go along Walmart entry/exit on West side then turn West behind the WhichWich Sandwich Store.
- D1: Trail likely on outer edges of potential sensitive area, Vegetated Corridor, and upland – Preferred
- D1: Seems to take folks out of direction. I worry a crossing at Dartmouth in this location would be tough- so close to intersection.
- D2: Trail closer to sensitive area.
- D2: D2 through F5 unknown area to me
- D2: Would want to make sure there is safe ped crossing here as this could be a bit of a blind curve on Dartmouth.
- D3: Already in place. Just needs improvements.
- D3: I like D3 and D2 since they would be more direct than D1.
- D3: Trail within existing street. Least impactful for sensitive area and Vegetated Corridor.
- D4: Connector trail. No alternatives. Encroaches into sensitive area and Vegetated Corridor.
- D4: Only route option

Open House Comments

- D1: Safe as a bike alternative painted bike lanes on Dartmouth. D1 has better access.
- D1 is less impact, Dartmouth curves is a very fast area for motor vehicles.
- Could there be a crossing between D1 and D3 near WINCO?
- D1 connection to D4/ D3 would be very convenient for WINCO crossings as opposed to crossing around.

Segment E

- E1: this potential the best part of red rock restoration - the hidden gem of Tigard is this specific area (or E2) - to drivers its just a wooded area. As a trail - it will be embraced.
- E1: Potential wetland encroachments.
- E1: I like E1 better than E2 simply because it would connect better to D4.
- E1: Generally, more direct and eliminates the eastern and western out of direction travel.
- E2: Don’t really like that this adds some out of direction travel.
- E2: Not likely to propose encroachments to sensitive areas, and likely to minimize encroachments to Vegetated Corridors - Preferred alignment. E2: to drivers its just a wooded area. As a trail - it will be embraced.

Segment F

SWG Segment Comments

- F1: Second part of red rock restoration for success - the other part of the hidden gem in Tigard!
- F1: Looks within existing CWS WQP easement and likely outer Vegetated Corridor
- F2: Looks likely to reduces encroachment to Vegetated Corridor - Preferred alignment.
- F2: F1 and F2 seem very comparable.
- F3: quite a bit of out of direction travel length. Adjacency to 217 and on ramp provides a lesser quality of the trail environment.
- F3: Steep slopes mapped and likely significant sensitive area and Vegetated Corridor potential encroachments.
- F3: ODOT has a planned roadway 'envelope' along I-5 for future improvements, which is beyond the current pavement and slope. Any proposed trail alignment should be considered outside the planned footprint. Also, any portion of the trail is proposed inside the ODOT ROW it should be designated as 'transportation' system, not a 'recreational' trail. It has to do with the implication in a NEPA process in future projects around OR99W or interchange.
- F3: would be the better ped experience. However, I'd defer to others from ODOT that are aware of future projects. My question would relate to certainty. Or is the work reasonably likely to occur, or are we thinking – 'just in case' we need the land someday. I believe the city limits is right around the f5 alignment. Not sure if that makes a difference though.
- F4: Likely to limit sensitive area and Vegetated Corridor encroachments. Looks to stay near the natural resource for user experience.
- F4: Nice and direct. Could be some good cost savings including this in a street profile and already existing ROW. I don't recall, but I believe this is an unimproved road. This is east of Tigard in City of Portland jurisdiction, correct?
- F4: Trimet has proposed a portion of OR99W in the vicinity of the (I-5/OR99W) interchange for their 'planned' light rail (Southwest Corridor) project. The proposed light rail project was still in the NEPA (one's recollection). The Trimet project may have been on hold or on a pause or 'canceled'. No known status or schedule of either project cancellation or resume date). A portion of this proposed trail would be in the Trimet proposed footprint. Also, any portion of the trail is proposed inside the ODOT ROW it should be designated as 'transportation' system, not a 'recreational' trail. It has to do with the implication in a NEPA process in future projects.
- F5: Furthest from potential sensitive area and Vegetated Corridor.
- F5: how does the substation access work?
- F5: Trimet has proposed a portion of OR99W in the vicinity of the (I-5/OR99W) interchange for their 'planned' light rail (Southwest Corridor) project. The proposed light rail project was still in the NEPA (one's recollection). The Trimet project may have been on hold or on a pause or 'canceled'. No known status or schedule of either project cancellation or resume date). A portion of this proposed trail would be in the Trimet proposed footprint. Also, any portion of the trail is proposed inside the ODOT ROW it should be designated as 'transportation' system, not a 'recreational' trail. It has to do with the implication in a NEPA process in future projects.

Open House Comments

- F2: Big Rigs using engine breaks are very loud. (I-5 SB) Too loud, would raise stress levels.

General Comments/Questions:

- How much of Tigard will be preserved?

- What is the trail width are we mixing modes? Bikers + people walking?
- I want to be above the water so I can see the Beavers!
- Protect all wildlife habitat.
- A lot of homeless people live on 72nd. They should be left alone + not cleared out to build a trail.
- Leave 72nd homeless people alone unless you plan on giving them all homes, they can afford.
- I tend to prefer the trail locations that are outside of the roadway (i.e. not just a sidewalk). The times I might prefer a sidewalk is where it's wide and part of an urban design strategy to enliven an area.

Follow-Up Questionnaire Results:

After participating the in meeting or reviewing the PowerPoint that was emailed prior to the meeting, is there anything that changed for you since SWG No. 1?

- Yes, see the logic of D2 clearly.
- I am still worried about the unwanted traffic that this will bring to and around our building and the safety of some of the routes, but the overall plan is growing on me.
- Nothing substantial

What are your preferred alignment segments?

SEGMENT A

Segment A	Preferred	Comment
A1	|	
A2	||||	Good to meet ADA grades and creates a fine neighborhood loop. Seems like more direct route to dog park, shorter A1 ramp. Easy and most budget friendly!
A3	||	

- A1+A2+A3 = These all look good to us.

SEGMENT B

Segment B	Preferred	Comment
B1+B4	IIII	On-street doesn't impact resource area, B3 would be second choice Easy and most budget friendly but can an option be the old train line between the buildings north of B4 which would put it in direct alignment with B1?
B2	II	Keeps the trail off of sidewalk and lines the trail up well with C2. Provides views of the creek.

B3		B3 seems like it will be more difficult to exist safely and affordably.

SEGMENT C

Segment C	Preferred	Comment
C1A	|||	C1A not preferred due to wetland, unlikely TriMet project will happen in time. C6 is existing, C10 connects to preferred D alignment.
C2	||	
C2B	|||	
C3	||||	I think C2 puts too many people in harms way and severely effects business operations for all businesses along C2. The owner of that road needs to be involved in this process.
C5	||	I disagree with eliminating C5 as it serves a more direct Transportation route. I don't think it has the degree of wildlife impact because much of that route is elevated to meet the grade over 217.
C6	|||	
C9	||	
C10	|	

- View of natural area while avoiding sensitive areas

SEGMENT D

Segment D	Preferred	Comment
D1		
D2+D3	IIIII	Aligns with traffic light at Dartmouth. Keeps the trail off of sidewalks. Provides a glimpse of the creek system and uses an already secured easement. This looks like the best route that achieves the opportunity to engage with nature.
D3	I	Existing trail, aligns well with D4

SEGMENT F

Segment D	Preferred	Comment
F1	III	Good link to CPAH. Easier to line up with lower segment keeping trail off of sidewalk. Seems like this is the most logical route.
F2	II	Ease of permitting, less encroachment in sensitive areas, more direct routes, poor user experience along F3 due to highway
F3	II	F3 the only option that can meet ADA grade requirements. Good trail experience through woods.
F4	I	
F5	I	

Were there questions you wanted to ask the design team?

- I strongly believe the C5 route combined with a neighborhood loop link included in our upcoming Trails Master Plan update would better serve the area. A straight off sidewalk transportation link with easy access the adjacent commercial routes would lower the conflicts with rec users and commuters.
- Can the Hunziker route be moved to the old train line which would put the alignment straight in the B1 route to the dog park.

What information or materials would help you understand a segment further?

- Nothing but the D2 drawing was extremely helpful.
- What is the timeline for actual construction and budget?
- For elevated and new-build pathways, elevation, width, material, etc. would be helpful to know to consider impacts.

Do you have any particular comments?

- Good work so far....would really like us to focus on a continuous transportation-oriented route off of sidewalks and busy roadways. Want to make sure we can meet curves with radius under 75 feet except up in the "F" routes where that will be impossible to do and make ADA grades.
- Can we please reach out to the owners of the 8005 facilities so we can understand the impact to their business and the traffic issues they feel this route will have? Also, the Hunziker Road is private property so I think it is extremely important to get them onboard sooner than later.

Follow-Up One on Ones: Key Takeaways

ODOT: Glen Bolen, Canh Lam, Scott Turnoy, Katie Gillespie

- Conversation began with a focus on Segment C and specifically some concerns with C5. The widening of Hwy 217 is on the RTP (non-funded at this time).
- When designing an overcrossing of Hwy 217 try to have a single span structure or if you do need bridge pier you will need to consider the taper on either side for about a mile in each direction.

- With the future widening of Hwy 217 there may need to be some redesign considerations if C5 moves forward. This widening onto 99W will include an auxiliary lane and reconfiguration of the off ramp.
- ODOT requested a formal write up of preferred alignment segments planned for the RRCT that impact ODOT property.
- It was directed to the team to ensure this is a transportation system vs. recreational trail designation. This could allow for greater opportunities for funding and this would avoid any 4f/6f resources.
- It was expressed that if C5 were to move forward it could be very complicated to construct the bridge in this area.
- ODOT recalls a property owner within C5 who has requested no development within this area.
- It was confirmed that the vertical clearance for Hwy 217 is 17'6".
- Segment F is hard to comment on for segments F3, F4, F5 as they are not sure what SW Corridor will look like.
- ODOT voiced a concern with Segment F3 as it is within a future staging area for the SW Corridor and/or a future paving project of I-5.
  - ODOT stated they would look into providing boundary lines.
  - It was noted that on the non-funded RTP it does have the widening of I-5 southbound.
  - If F3 were to advance there is a chance that the trail will be impacted.
  - F3 will require a safety enhancement like a jersey barrier along I-5 on ramp.
- ODOT will be installing variable speed signs over I-5 possibly within this area.

Jilian Saurage Felton and Rachel Duke, CPAH

- Voiced concerns in regard to segment F1 in relation to the CPAH building. They have ground floor tenants and are worried about their privacy with the trail being so close They requested that the design team provide examples of where a trail is close to residential.
- There is also concern with possible trail lighting and being too bright for these ground floor residences.
- They shared that this facility is federally funded and there are agreements within the environmental documents that need to be considered/researched moving forward (NEPA, NOAA, USACE, HUD).
- They also noted the agreement with CWS and their requirements within this contract. This agreement is held with the LLC owner, Boston Financial). This owner is only invested for another 15 years.

Nik Engel and Shila Kim

- Surprised with C5 being the preferred option. Concerned with the costs to construct, proximity to Hwy 217, and seems slightly isolated which would open up greater opportunities for homeless camps.
- Voiced preference towards C6. Building out an existing trail, connectivity to goods and services, feels like a safer route.
- Possibly consider a hybrid of C5 and C6. Use the existing C6 alignment and then construct a trail crossing through the natural environment to connect with the Dartmouth crossing and the D2 trail segment.
- Trail amenities are very important throughout the entire trail, not specific to segment C. Would like to see adequate lighting to help address the security aspect of trail safety.

David Underwood (PGE)

- Seeking an easement to the city along the south side of substation for trail along with partial use of their access road.

- There could be a need for a barrier or additional separation (landscaping, fence, etc.) along the substation fencing.
- Waiting to hear back if the substation has any intentions on expansion.
- When designing the structure at A1, need to keep in mind the clearance needs from the wires.

SWG #3

In addition to six members of the project team, ten participants attended the third Stakeholder Working Group meeting either virtually or in person at the City of Tigard. The project team opened the meeting by reminding participants of community agreements and reviewing the Fist-to-Five process—a consensus-based voting approach that allows for a range of agreement. Then, in preparation for the voting, the team presented on the preferred alignment segments with criteria review. Participants voted on seven alignment alternatives with six segments confirmed. Segment C6 drew concerns so the design team met with members who had expressed concerns after the meeting ended. Drawing on this feedback, they reworked the proposal to achieve consensus. Throughout the process, one member of the design team took transparent notes so that everyone's voice could be heard and documented.

SWG #4

The final Stakeholder Working Group meeting was held virtually. Five members of the project team joined nine participants to review the preferred alignment segments. The project team then explained what the implementation timeline would look like and the costs of each segment. One important component of the presentation included highlighting the segments that changed because of SWG feedback (e.g. A2, C2, C6, F2). After the presentation, the team opened the floor to hear from participants about the working group experience. Participants mentioned the responsiveness of the project team and City staff to concerns, especially about user safety. They appreciated hearing responses to their questions in real time and being able to discuss the trade-offs of certain options. One agency planner noted how the process had increased his understanding of what the public really wants. The meeting ended by inviting the members to join the final public workshop and thanking them for their valuable contributions to shaping the Red Rock Creek Trail.

Public Workshop No. 2

The final public meeting celebrated the many voices that contributed to establishing preferred trail alignments. The fifty attendees could see how the trail might look in their neighborhoods and near their businesses. Maps, visualizations, and renderings of each final alignment section was displayed on easels. The project team even staked out a 12-foot wide trail section adjacent to the restaurant, giving attendees a sense of what the actual trail would look like. One business owner observed that while he was initially hesitant about the trail project he felt like his voice was heard throughout the process, resulting in a trail alignment that made sense for the area and that he personally would use.

Appendix B: Existing Conditions Report



Red Rock Creek Trail Alignment Study
Existing Conditions Report

Submitted to:

ODOT
Katie Gillespie
123 NW Flanders Street
Portland, OR 97209

Prepared by:

Otak, Inc.
Amanda Owings
808 SW Third Avenue, Suite 800
Portland, OR 97204

March 24, 2023

Project No. K22136/20291

TABLE OF CONTENTS

Page

Introduction 1
Project Background 1
Project History 1
Public and Private Land Use 3
Physical Topography 5
Transportation Facilities 5
Roads 5
Bicycle and Pedestrian Facilities 8
Transit Facilities 8
Railroad Ownership & Operations 11
Utilities 11
Public Utilities 11
Franchise Utilities 11
Hazardous Materials 12
Historic & Cultural Resources 12
Historic Resource Review 12
Archaeological Review 12
Recommendations 14
Wetlands and Sensitive Lands 16
Hydrology & Floodplains 18
Stormwater Drainage 18

TABLES

Table 1. Roadway Characteristics 5
Table 2. Historic Resources In or Adjacent to the Study Area 15

FIGURES

Figure 1. Project Overview 2
Figure 2. Existing Zoning 4
Figure 3. Road Classification Map 7
Figure 4. Existing Bike and Pedestrian Facilities 9
Figure 5. Transit Routes 10
Figure 6. Historical Resource Study Area 13
Figure 7. Wetlands and Sensitive Lands 17
Figure 8. Hydrology and Drainage 19

Introduction

Project Background

Red Rock Creek in east Tigard, flows west from I-5/Hwy 99W toward SW Hunziker Street, draining to Fanno Creek and the Tualatin River watershed. Currently degraded due to decades of development impact, Red Rock Creek is undergoing streambank enhancement and daylighting parts of the stream to improve ecological function within the area known as the Tigard Triangle District (Tigard Triangle). Recognizing the significant potential of Red Rock Creek, the City of Tigard intends to establish a regional-style trail centered around the established greenway that will provide a much-needed transportation option, a safe place to walk and bike, and allow residents to experience nature. The proposed two-mile long Red Rock Creek Trail (RRCT) will provide active transportation options in the urbanizing Metro-designated Town Center area of Tigard and overcome significant barriers to connectivity within the area.

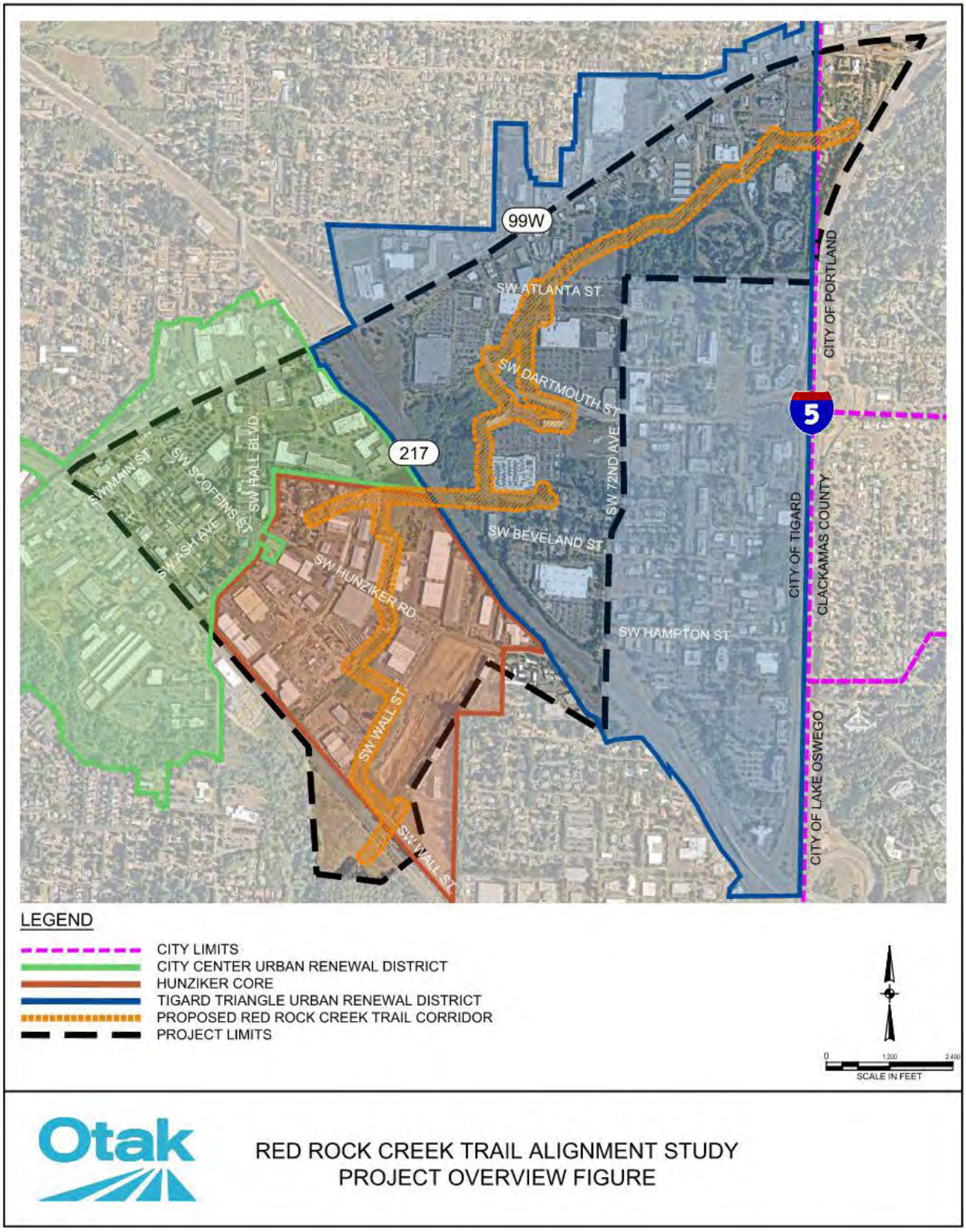
Project History

The RRCT project has emerged as a community priority and is identified in numerous studies and plan documents. In 2014, the City of Tigard Strategic Plan first identified the RRCT project as a “new active transportation spine” safely linking the Tigard Triangle, Downtown, adjacent neighborhoods, and transportation networks. The RRCT project was also noted as a key project in the Tigard Triangle Urban Renewal vision and a critical component of an equitable and accessible urban neighborhood. In 2019, the City of Tigard applied for Regional Flexible Funds through Metro to prepare an alignment study to develop a preliminary design and identify easement and capital funding requirement to construct the RRCT project. The completed RRCT alignment study project will create the framework for funding and final design for an important active transportation facility in this rapidly developing urban district.

Jurisdictional Boundaries

The study area is bounded by I-5 on the east, Pacific Highway 99W on the north, and Fanno Creek on the south. Highway 217 traverses the southwestern portion of the study area, see Figure 1. Fully within City of Tigard limits, the study area contexts includes the City of Portland Southwest Urban Trail network to the north and east, the Tigard-Lake Oswego Trail to the southeast, and the Fanno Creek Trail to the southwest. Red Rock Creek is fully within Washington County; however, the northeast portion of the study area at the intersection of Highway 99W and I-5 is considered within Multnomah County. The future Southwest Corridor Light Rail project will provide a high-capacity transit link between the Tigard Triangle and Portland and Tualatin. The project area includes the Tigard Triangle Urban Renewal and the Hunziker Core special districts.

Figure 1. Project Overview



Public and Private Land Use

The Tigard Triangle area underwent a master planning process in 2015, resulting in zone changes, economic development plan, and a series of public improvements identified in the various infrastructure plans within the Comprehensive Plan. (Figure 2)

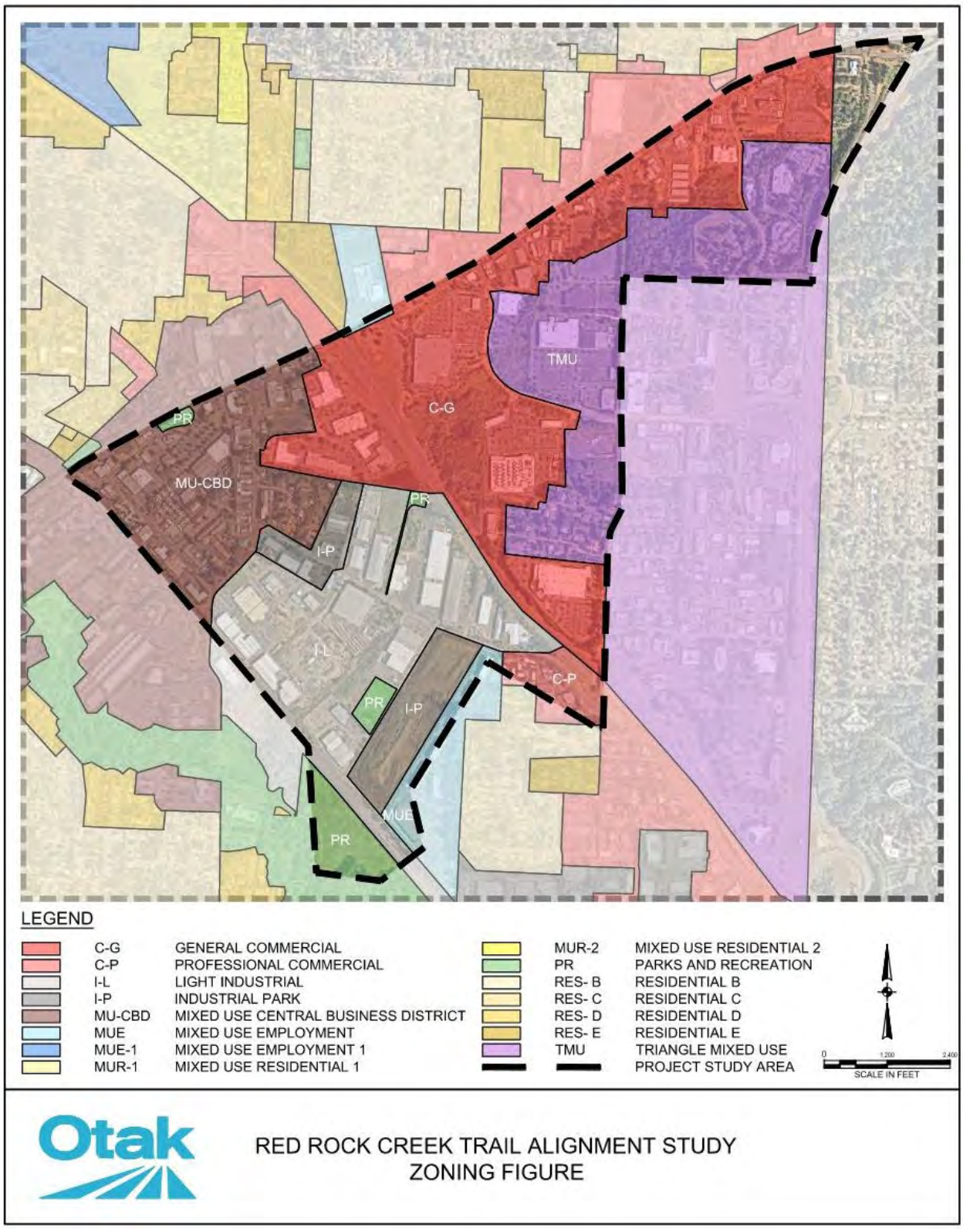
Within the Tigard Triangle, the existing development pattern consists of primarily suburban land uses including large commercial retail buildings, office buildings, multi-family residential, and some remaining single-family units. The west side is zoned General Commercial; the east side is zoned Triangle Mixed Use (TMU). TMU is implemented through the City's "lean code" targeted at facilitating development and providing pedestrian-friendly areas.

South of Highway 217, the properties along SW Hunziker Street are developed with large warehouse and manufacturing facilities, approximately 5–6-acre parcels zoned as light industrial and industrial park. Red Rock Creek flows through culverts and constrained topography between buildings in this area. Immediately adjacent and east of SW Wall Street, the land uses are identified as mixed-use employment and residential. Within this segment is the 2.5 acre Potso Dog Park, maintained by City of Tigard parks and recreation.

Within the study area boundaries, the following zoning definitions apply:

- Tigard Mixed Use (TMU): Intended to be an active, urban, multimodal, and mixed-use district that accommodates a variety of housing options and uses, promotes pedestrian-oriented development, and limits new auto-oriented development.
- General Commercial: Designed to accommodate a full range of retail, office, and civic uses with a citywide and even regional trade area with limited residential use.
- Light Industrial: The I-L zone provides appropriate locations for general industrial uses including, but not limited to industrial services, manufacturing and production, research and development, warehousing and freight movement, and wholesale sales activities with few, if any, nuisance characteristics such as noise, glare, odor, or vibration.
- Industrial Park: The I-P zone provides appropriate locations for combining light manufacturing, office, and small-scale commercial uses, such as restaurants, personal services, and fitness centers, in a campus-like setting with no nuisance characteristics such as noise, glare, odor, or vibration.
- Mixed use Employment: Designed to apply to areas where employment uses such as office, research and development, and light manufacturing are concentrated. Commercial and retail support uses are allowed but are limited, and residential uses are allowed that are compatible with the employment character of the area.
- Parks and Recreation: This zone applies to City-owned parks, open space, and recreational facilities.

Figure 2. Existing Zoning



Physical Topography

This area of Tigard is gently sloping west/southwest from I-5 to Fanno Creek. The RRCT route will parallel the creek centerline for the majority of the alignment with the exception of roadway crossings. The trail drops a total 225 feet from its highest point near Hwy 99W/I-5 to its low point near Fanno Creek. Significant changes in elevation occur at the Highway 217 crossing and where the trail crosses the railroad tracks adjacent to SW Wall Street.

Transportation Facilities

The City has developed the Tigard Triangle Urban Renewal Plan (URP) and in that plan outlined a goal for transportation, which states, “Provide a safe and effective multimodal transportation network that provides access to, from, and within the Area and supports mixed-use and pedestrian-oriented development.” Currently the Tigard Triangle has limited options regarding connectivity for cars, pedestrians, and bikes. The URP has identified future projects to increase access and connectivity to and from the Tigard Triangle. Such projects include but are not limited to: New Hwy 217 Overpass which will extend Beveland Street, extend 74th Ave south from Highway 99W to Hermoso Way or Beveland Street, and to extend Atlanta Street from 69th Street to Dartmouth Street. These projects will meet the City’s goal for creating connectivity within the Tigard Triangle.

Roads

The roadways within this area are primarily City of Tigard right-of-way; highways and the interstate are under Oregon Department of Transportation (ODOT) jurisdiction. The Tigard Triangle’s existing roadway infrastructure consists of one main arterial road (72nd Avenue) with collector roads bringing traffic from the local neighborhoods, businesses, and the surrounding highways and interstate, see figure 3. Below is a summary table of the classified roads in the study area.

Table 1. Roadway Characteristics

ROADWAY CHARACTERISTICS								
Road	Functional Classification	2019 Annual Average Daily Traffic (ADT)	Posted Speed (mph)	Turn Lanes	Travel lanes	Bike Lanes	On-Street Parking	Sidewalks
Pacific Highway (OR 99W)	Principal Arterial	50,000	35	1	4	1 (WB)	No	Partial both sides
72nd Avenue	Arterial	4,000 to 14,000	30	0-1	2	Partial	No	Partial both sides
Bonita Road	Arterial	17,500	35	0-1	2	2 Intermittment	No	Partial both sides
Hall Boulevard	Arterial	13,400	35	0-1	2	2 Intermittment	No	Partial both sides
68th Parkway	Collector	4,000 to 12,500	35	1	2	2	No	Partial both sides
68th Avenue	Collector	4,000 to 12,500	30	1	2	2	No	Partial both sides
Atlanta Street	Collector	13,000	25	0	4	No	No	Both Sides
Dartmouth Street	Collector	4,000 to 13,000	35	0-2	4	2	No	Partial both sides
Hunziker Road	Collector	4,00 to 12,500	35	0-1	2	2 Intermittment	No	Partial both sides
Wall Street	Collector	<4,000	25	1	2	2	No	Both Sides
Beveland Street	Neighborhood	4,000 to 12,500	25	0-1	2	No	Partial	Partial both sides

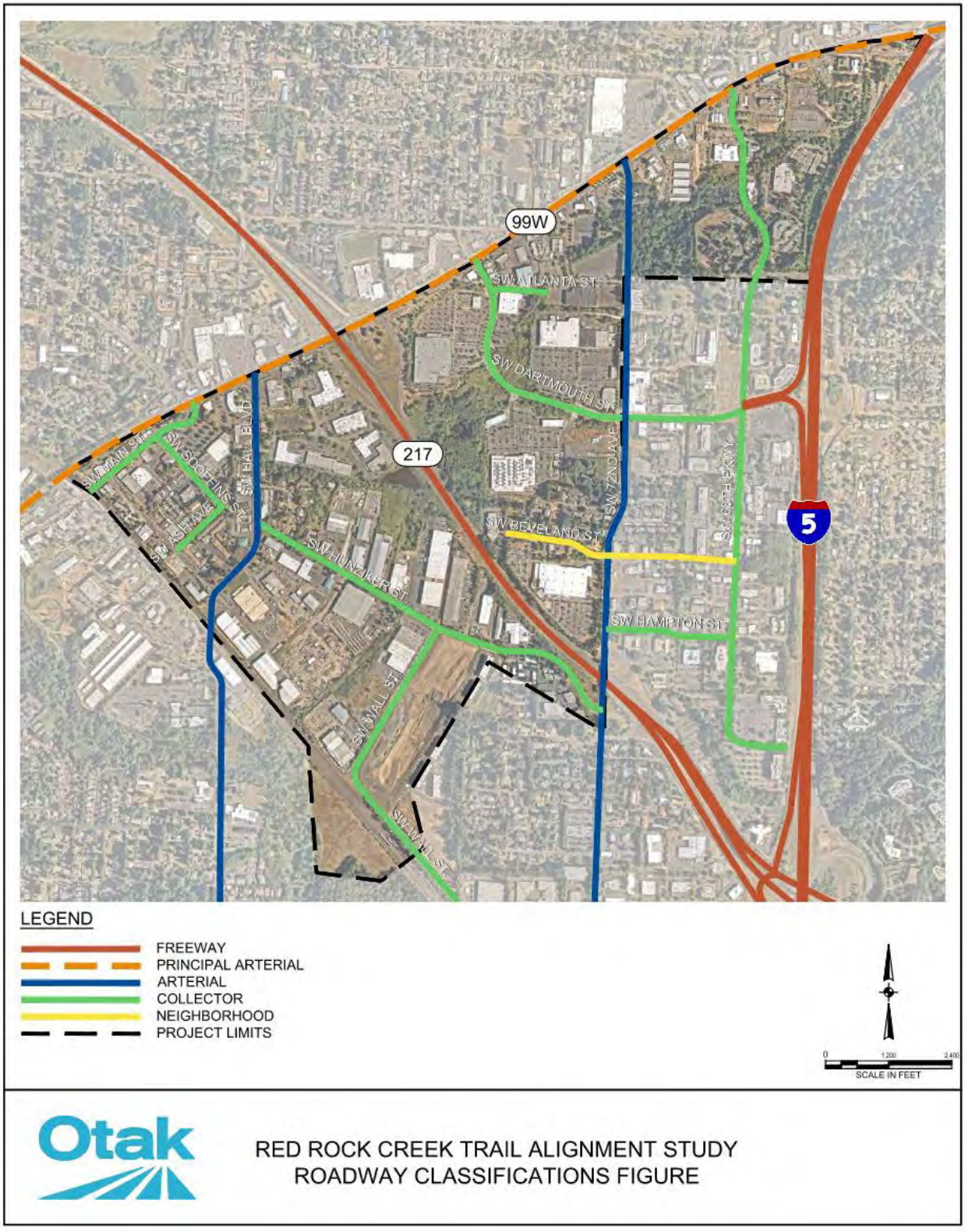
The Red Rock Creek Trail will encounter a number of road crossings. The roads of highest significance are: 64th Avenue, 68th Parkway, 72nd Avenue, Dartmouth Street, Hunziker Street, and Wall Street. These are the main roads the trail will be crossing. A description of each significant roadway are:

- 64th Avenue is a neighborhood road running generally north-south with an east-west portion at its southern-most point. 64th Avenue has portions of asphalt pavement and gravel surfacing. This road leads to a power substation which will be a major constraint due to steepness and unimproved conditions. The topography in this area, including sharp changes in grade along the roadway, will make complying with the Americans with Disabilities Act’s (ADA) accessibility requirements challenging.

- 68th Parkway is a collector road running generally north-south that is paved with asphalt. This road has numerous horizontal curves which could cause safety concerns with site distance and trail users crossing the road.
- 72nd Avenue is an arterial road running generally north-south that is paved with asphalt. This is the busiest road in the Tigard Triangle and has partial sidewalks and bike lanes throughout the length of road, but neither exist where the trail is planned to cross. The city is planning improvements along 72nd Avenue and those improvements will have to be taken into consideration for the trail design. Grade could be an issue in this area, which will require creative solutions to maintain ADA conforming design.
- Dartmouth Street is a collector road running generally east-west that is paved with asphalt. Dartmouth Street provides access to the large commercial business in the Tigard Triangle. Autozone and Costco are the two businesses closest to where the trail is planned to cross. This is currently a signalized intersection, user safety from vehicular traffic will be a main concern on this portion of the trail.
- Hunziker Road is a collector road running generally east-west paved with asphalt just southwest of the Tigard Triangle. Dartmouth Road provides access between Hall Blvd and 72nd Avenue which are both arterial roads. Hunziker Road runs through mainly commercial industrial areas and has a high volume of heavy truck traffic.
- Wall Street is a collector running generally north-south that is paved with asphalt. Wall Street is a road providing local access to housing, parks, and office buildings. The biggest concern in this area will be how to provide access to the proposed bridge crossing over the existing train tracks.

The city has developed “Streetscape Design Plan: Tigard Triangle Strategic Plan Implementation” published December of 2016. The three main principles this plan outlines for its urban design framework is to provide safe and effective multimodal transportation access to and from the Tigard Triangle, integrate land use and transportation planning to ensure a vibrant town center, and build upon unique characteristics that currently exist in the Tigard Triangle.

Figure 3. Road Classification Map



Bicycle and Pedestrian Facilities

Sidewalks

Throughout the Tigard Triangle, streets range from no sidewalk, one side of sidewalk, and both sides having sidewalks. The mixture is evenly split as confirmed by Figure 3-18 from Tigard's Transportation Systems Plan. Notably, 72nd Avenue does not have sidewalks at the initial trail crossing location and 68th Parkway and Dartmouth Street have sidewalks on both sides at the initial trail crossing locations. Refer to Figure 4 for more details, including existing trail facilities.

Bike Network

The bike network throughout the Tigard Triangle varies from dedicated bike lanes to a shared lane on a high traffic through street. Dartmouth Street leading into 68th Avenue has dedicated bike lanes and appear to be the easiest and safest way to access the Tigard Triangle traveling in an east-west direction. Apart from a small section in the middle of 72nd Avenue with bike lanes, the majority of the road is a shared lane on a high traffic road. While this route is the most direct way to travel north-south inside of the Tigard Triangle, it does not appear to be the safest. 68th Parkway/68th Avenue is a safer alternative to 72nd Avenue in terms of volume of traffic, but it only has bike lanes for about half its length. Refer to Figure 4 for more details.

Transit Facilities

Western Express Service (WES) Commuter line

The WES line is a commuter rail line serving Beaverton, Tigard, Tualatin, and Wilsonville. Through the area of study, the WES line runs Northwest-Southeast, parallel with Hwy 217. In Tigard the WES station is located downtown on Commercial Street, just a half block south of Main Street.

Bus routes

There is limited bus service within the Tigard Triangle. TriMet's 96 bus route runs north-south along 68th Avenue then uses Beveland Street and Hampton Street as turnaround, providing access to the 78 and 38 bus routes at the intersection of 72nd Avenue and Hwy 217. The 12, 64, and 94 routes run along Hwy 99W.

Light Rail

There is not currently light rail servicing the Tigard Triangle. The Southwest Corridor Plan was developed in 2018 to deliver a light rail corridor to Tigard and points south. Two stops are planned within the study area:

- 68th Avenue Station
- Hall Boulevard Station

A third station, the Elmhurst Station, is located east of 72nd Avenue in the Tigard Triangle. Refer to Figure 5 for transit routes.

Figure 4. Existing Bike and Pedestrian Facilities

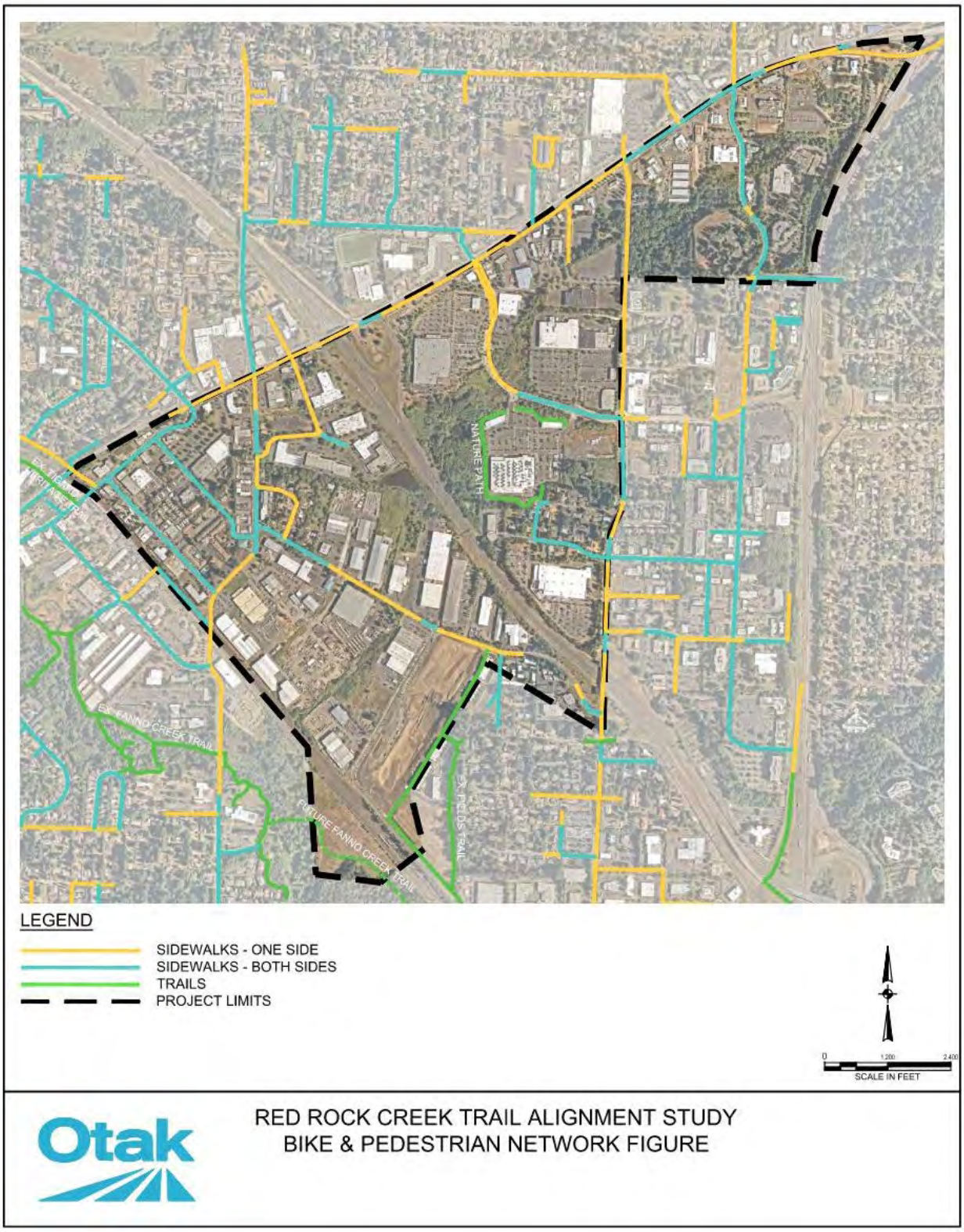
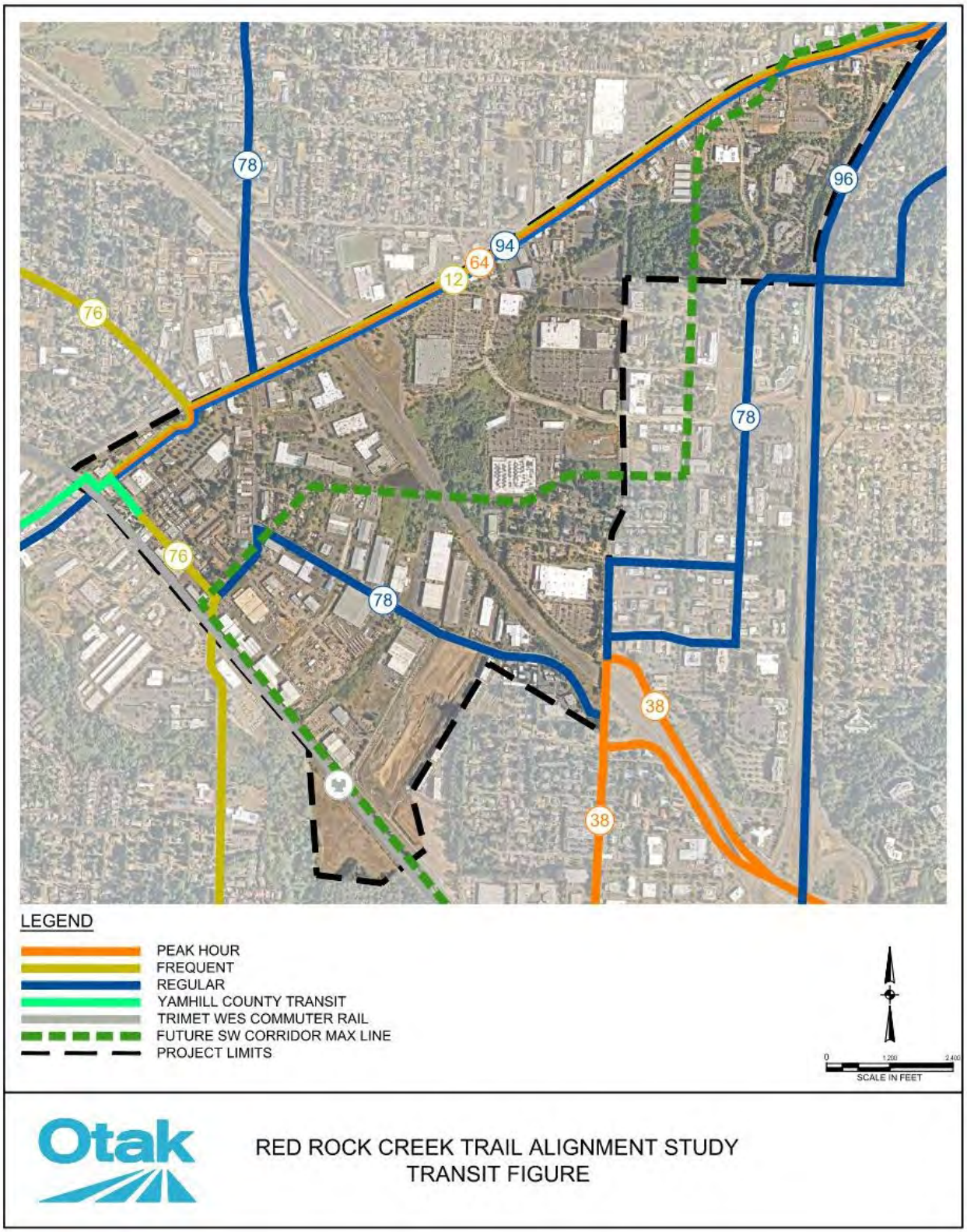


Figure 5. Transit Routes



Railroad Ownership & Operations

The rail right-of-way through the rail yard is owned by the Portland and Western Railroad, a subsidiary of the Genesee and Wyoming Railroad (GWRR). TriMet operates the Westside Express Service (WES) corridor on the tracks on the west side of the rail yard where they have a series of tracks for sorting, storing, or loading and unloading rail vehicles. TriMet is currently in the preliminary design phases of the Southwest Corridor light rail extension, which positions the light rail along the east side of this railroad right-of-way, and it is anticipated that the TriMet will want to purchase a segment to support this alignment. Currently, the nearest crossings of the railroad in this area are at-grade crossings at Hall Boulevard to the west and Bonita Road to the east. The underlying railroad is a typical switchyard configuration with multiple tracks.

The proposed trail crossing would encompass an overhead bridge crossing spanning across the rail right-of-way. The design will meet the latest edition of the GWRR Public Project Manual. Coordination with rail providers and ODOT Rail will require an ODOT Rail Order Application with exhibits showing the bridge structure with clearances, dimensions, and locations. The ODOT Rail process from start to finish typically takes 6-12 months.

Utilities

Public Utilities

Water

Tigard residents and businesses are served either by The City of Tigard or Tualatin Valley Water District (TVWD), both of which provide water from the Clackamas River. The Tigard Triangle falls into the TVWD's Service area. There is a TVWD water main that runs from water storage towers near the intersection of 67th Avenue and Baylor Street. This main runs west on Baylor Street, south on 68th Avenue, then east on Beveland Street until it crosses Hwy 217.

Sanitary Sewer

The sanitary sewer system is owned and operated by the City of Tigard. There is a sanitary sewer main that runs along Red Rock Creek and appears to service a large portion of the Tigard Triangle. While this sanitary main should not be anticipated to conflict with the trail construction, it is something to consider, especially in places where large cuts in grade could take place.

Storm Sewer

The stormwater sewer system is owned and operated by the City of Tigard, which partners with Clean Water Services (CWS) for stormwater permitting. There are stormwater mains running along all streets that cross Red Rock Creek. With Red Rock Creek being the main outfall for most of the Tigard Triangle, the trail will cross multiple storm sewer outfalls that will need to be accommodated in the design.

Franchise Utilities

Based on making phone calls with utility providers and requesting information through the Oregon Utility Notification Center, we have identified the following utility providers within the study area:

- Portland General Electric (PGE): owns parcels of land within the study area.
- NW Natural Gas
- Tualatin Valley Water District
- MCI
- Comcast Cable
- Ziply Fiber
- Washington County LUT
- Verizon

Hazardous Materials

Based on the review of environmental and historical records and previous investigations seven environmental conditions were identified, involving a former foundry business, transformer site, lumber distribution and manufacturing facilities, building material facility, railroad, and a construction/sheet metal facility. Sites of concern are located adjacent to the project corridor at the SW Hunziker crossing, the railroad crossing, and the PGE Substation located at the end of SW 64th Avenue. Contaminants of concern include petroleum hydrocarbons, polyaromatic hydrocarbons, metals, polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs).

Recommendations for the project corridor include a Phase II Environmental Site Assessment, performed at the foots of the pedestrian bridges, and a surface soil sampling event, performed along the trail segments to determine disposal and excavation and provide for construction worker safety.

Historic & Cultural Resources

Historic Resource Review

There are 35 potential historic resources (buildings, structures, objects, and sites at least 45 years of age, i.e., constructed before 1978) on parcels overlapped by or adjacent to the study area (Table 2 and Figure 6). Fourteen of these (HR-1 through HR-14) have been previously inventoried and evaluated for other projects. The remaining 21 resources (HR-15 through HR-35) were identified by reviewing construction dates available in Washington County's Intermap Geographic Information System (GIS) and the City of Portland's Portland Maps GIS. These 21 resources have not been inspected in the field, and their National Register of Historic Places (NRHP) eligibility will need to be evaluated if the project will overlap or abut those parcels. Modern construction (buildings, structures, objects, and sites built less than 45 years ago, i.e., 1978 or later) is unmarked Figure 6. No further work is required for modern construction.

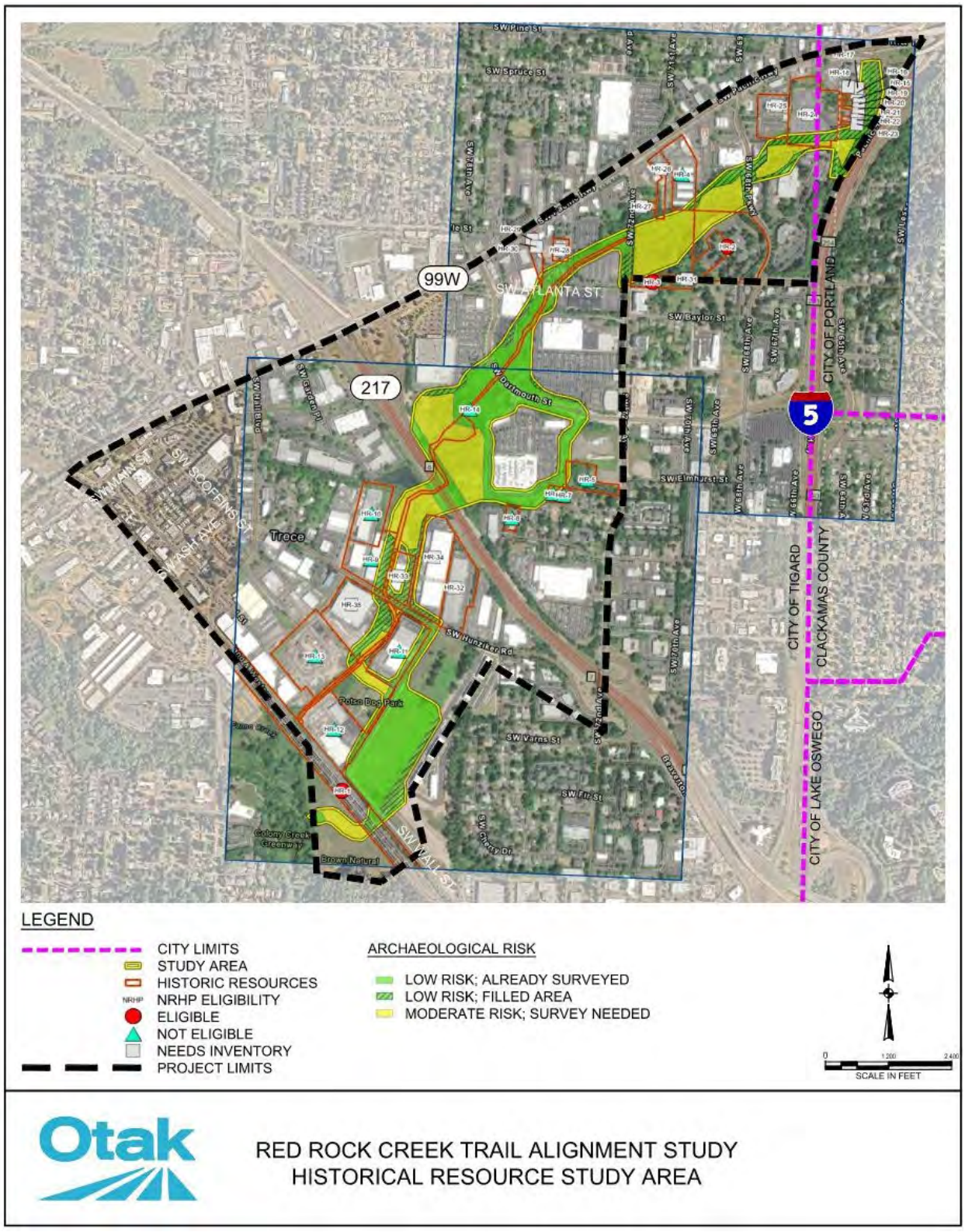
Archaeological Review

Records were reviewed to determine whether cultural resource surveys have been previously conducted and if previously recorded archaeological resources were present in or near the study area. The team reviewed records utilizing the Oregon Archaeological Records Remote Access system maintained by State Historic Preservation Office (SHPO), materials in the AINW library, and other historic maps and documents. Twenty-three cultural resource studies have been conducted on lands overlapping or adjacent to the study area. Not all of these previous studies conducted a full archaeological survey, including shovel testing, within the study area. No archaeological resources have been previously recorded within the study area. Small archaeological resources have been previously recorded near the study area and suggest that there is a moderate probability of encountering an archaeological resource along the proposed trail alignments.

Previously surveyed areas that did not encounter archaeological resources are considered low risk with respect to the proposed RRCT project's likelihood of encountering archaeological resources. These areas are indicated in green in Figure 6. Additionally, paved or filled areas within the study area are considered low risk for encountering archaeological resources if the proposed trail will not impact native soil, and these are shown in green with black hatching in Figure 6.

Unpaved and unfilled areas that have not been previously surveyed for archaeological resources, or where previous studies have recommended shovel testing, are indicated in yellow in Figure 6. These areas have moderate risk of having an archaeological resource. Moderate-risk areas are adjacent to the creek northeast and southwest of SW 68th Parkway, in the wetlands northeast and southwest of the Beaverton-Tigard Highway (OR-217), between SW Hunziker Road and Potso Dog Park, and south of the Portland and Western Railway.

Figure 6. Historical Resource Study Area



Recommendations

Historic resources that are overlapped by or adjacent to the project's Area of Potential Effects (APE) would be inventoried as part of a historic baseline study to meet ODOT review, which would include recommendations of eligibility for listing in the NRHP. For resources that ODOT concurs are not eligible for listing in the NRHP, no further cultural resources work would be needed.

For historic resources that are likely to meet the minimum requirements to be eligible for listing in the NRHP, ODOT would require a Determination of Eligibility. If the project cannot avoid eligible resources, ODOT will require a Finding of Effect. The project alignment appears to cross the parcels of NRHP-eligible historic resources, but it is possible that there will be no adverse effect on those resources. Adverse effects would require mitigation. For eligible resources, the project would need to consider potential use under Section 4(f). The NRHP-eligible railroad is likely exempt from consideration as a Section 4(f) resource.

Portions of the study area have low risk for archaeological resources because they were previously surveyed and found no resources, or because the proposed trail will not impact native soil. These areas will need baseline-level study within the APE to meet ODOT review but Phase I subsurface archaeological survey is not recommended.

For unpaved and unfilled areas that have not been previously surveyed for archaeological resources, an archaeological survey with shovel testing (a Phase I study) is recommended within the APE. Identified archaeological resources would be recorded with SHPO. Before Phase I survey can be conducted on publicly owned land, the cultural resource consultant will need to obtain a SHPO permit. If archaeological resources are identified their eligibility for listing in the NRHP will need to be evaluated, which may require a Phase II study. It is possible that the project will have no effect or no adverse effect on eligible archaeological resources. Adverse effects would require mitigation.

Table 2. Historic Resources In or Adjacent to the Study Area

HR-#	Resource	Year Built	NRHP Eligibility
1	Southern Pacific Railroad, Tigard Branch	1910	Eligible
2	Oregon Education Association	Circa 1968	Eligible
3	11530 SW 72nd Ave	Circa 1920	Eligible
4	11552 SW Pacific Hwy	Circa 1958	Not Eligible
5	12265 SW 72nd Ave	Circa 1959	Not Eligible
6	7475 SW Hermoso Way	Circa 1965	Not Eligible
7	7435 SW Hermoso Way	Circa 1965	Not Eligible
8	7615 SW Beveland Rd	Circa 1960	Not Eligible
9	8185 SW Hunziker Rd	Circa 1973	Not Eligible
10	8195 SW Hunziker Rd	Circa 1973	Not Eligible
11	7940 SW Hunziker Rd	Circa 1963	Not Eligible
12	7920 SW Hunziker Rd	Circa 1972	Not Eligible
13	8200 SW Hunziker Rd	Circa 1958	Not Eligible
14	Red Rock Creek	Circa 1945	Not Eligible
15	11605 SW 64th Ave	1939	Needs Inventory
16	1151 SW 64th Ave	1955	Needs Inventory
17	11543 SW 64th Ave	1955	Needs Inventory
18	11547 SW 64th Ave	1955	Needs Inventory
19	11615 SW 64th Ave	1944	Needs Inventory
20	11625 SW 64th Ave	1944	Needs Inventory
21	11635 SW 64th Ave	1944	Needs Inventory
22	11645 SW 64th Ave	1939	Needs Inventory
23	11705 SW 64th Ave	1949	Needs Inventory
24	West Portland Substation	Circa 1960	Needs Inventory
25	11460 SW Pacific Hwy	1976	Needs Inventory
26	11564 SW Pacific Hwy	1952	Needs Inventory
27	11240 SW 72nd Ave	1930	Needs Inventory
28	11632 SW Pacific Hwy	1974	Needs Inventory
29	11654 SW Pacific Hwy	1955	Needs Inventory
30	11654 SW Pacific Hwy	1977	Needs Inventory
31	11515 SW 70th Ave	1930	Needs Inventory
32	7895 SW Hunziker Rd	1978	Needs Inventory
33	8015 SW Hunziker Rd	1972	Needs Inventory
34	8005 or 8009 SW Hunziker Rd	1966	Needs Inventory
35	8100 SW Hunziker Rd	1978	Needs Inventory

Wetlands and Sensitive Lands

The undeveloped lands along the RRCT study area are to a large extent constrained by wetlands and waterways. These resources pose varied challenges to not only path placement from a logistical standpoint, but also require the balancing of public benefits from increased pedestrian and bicycle connectivity with those of wetland protection, water quality, and wildlife habitat. Though the upper and lower segments of the proposed trail will likely avoid wetland or vegetated corridor impacts, the alignment segments from the railroad tracks at Wall Street north to the row of properties along 64th Avenue will need to be carefully planned and constructed in order to minimize impacts to wetlands, Red Rock Creek, and their regulated vegetated corridors (VC)(See Figure 7).

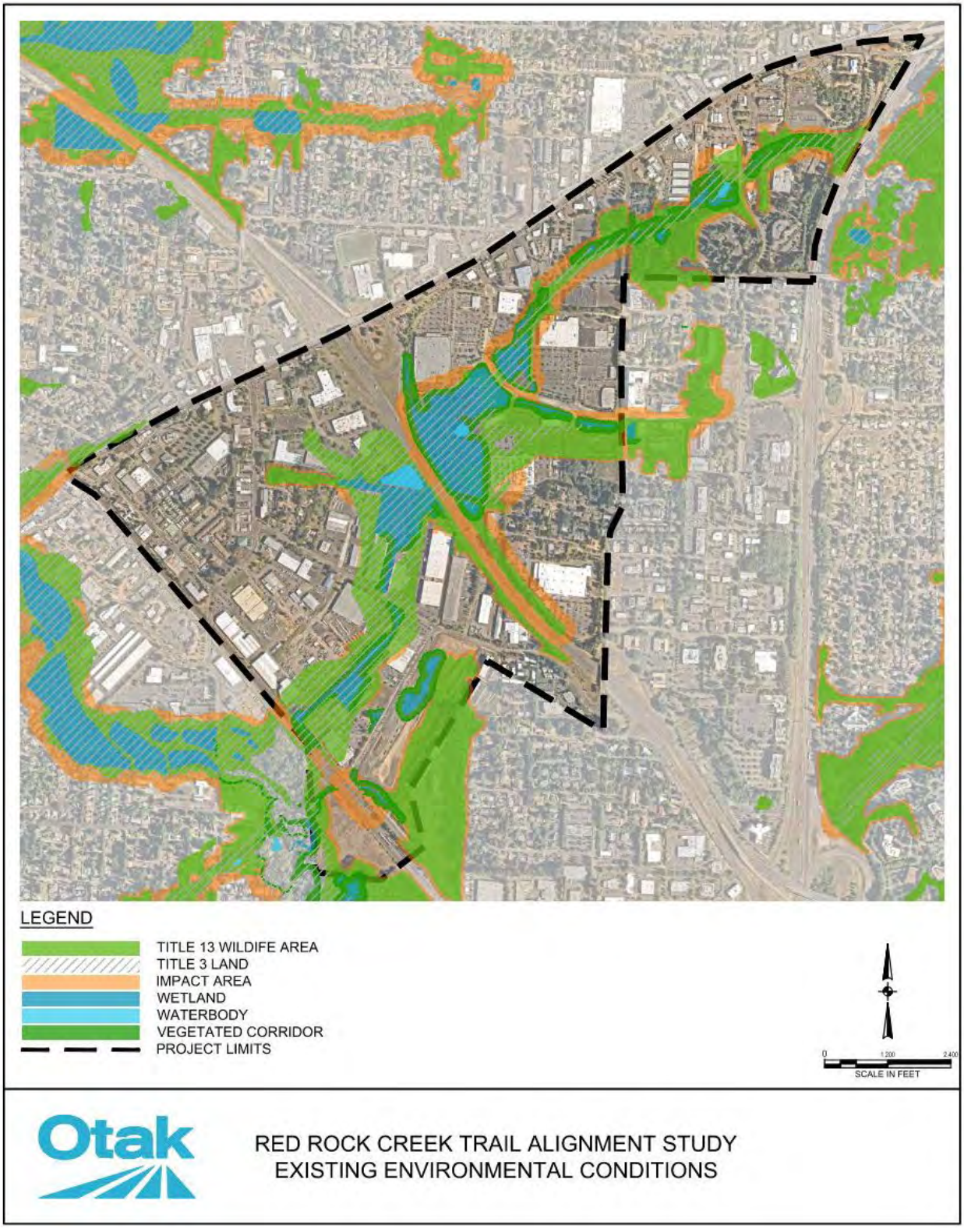
Red Rock Creek is the primary stream system within the project area. Numerous adjacent wetlands are also present along the stream system. The wetland locations are based on topographic changes and changes from observed hydric soils and hydrology to soils where no hydric indicators or hydrology were observed. Dominant plant species within the wetlands and along the creek include Oregon ash (Fraxinus latifolia, FACW), red alder (Alnus rubra, FAC), black cottonwood (Populus balsamifera, FAC), Western red cedar (Thuja plicata, FAC), Sitka willow (Salix sitchensis, FACW), Pacific willow (Salix lasiandra, FACW), red osier dogwood (Cornus alba, FACW), English hawthorn (Crataegus monogyna, FAC), Douglas hawthorn (Crataegus douglasii, FAC), Douglas spirea (Spirea douglasii, FACW), snowberry (Symphoricarpos albus, FACU), Himalayan blackberry (Rubus armeniacus, FAC), field meadow foxtail (Alopecurus pratensis, FAC), fringed willowherb (Epilobium ciliatum, FACW), Canada thistle (Cirsium arvense, FAC), creeping buttercup (Ranunculus repens, FAC), little western bittercress (Cardamine oligosperma, FAC), garden bird's-foot-trefoil (Lotus corniculatus, FAC), lamp rush (Juncus effusus, FACW), reed canarygrass (Phalaris arundinacea, FACW), and slough sedge (Carex obnupta, OBL).

To simplify environmental permitting, avoidance of the natural resources in the project corridor would be ideal but as noted above, would also be difficult given existing conditions within the areas available for trail development. Identified resources include the main stem of Red Rock Creek, which enters the project area west of 64th Avenue. Lands adjoining Red Rock Creek and extending outward from the channel itself often include wetlands. Both the creek and wetlands are protected by VC regulated by both Clean Water Services (CWS) and the City of Tigard. Additionally, wetlands in the project corridor that are identified on the Local Wetland Inventory are all Locally Significant at the City level and as a result are protected to a higher degree than unmapped wetlands.

As the avoidance of natural resources along the project corridor is not possible unless the full path alignment were to be proposed along and within the footprint of existing developed areas, minimization of impacts will need to be the project focus. Minimization will also not only result in a decrease in direct or indirect impacts to the resources themselves, but minimization of impacts will also provide a framework for project applications to the various public agencies that will be required to review, and issue permits and approvals for the future trail. Permits for any impacts to wetlands or waterways will be required from both the Oregon Department of State Lands (DSL) and US Army Corps of Engineers (Corps). Permits for any impacts to VC will be required from both CWS and the City.

From the regulatory perspective, avoidance of resource impacts is preferable to impact, with minimization of impacts to be shown where avoidance is not possible. As such, alignment options that utilize existing sidewalks or other developed lands will always be the simplest option to justify. As complete avoidance of the natural resource areas may not always be possible, or even desirable, minimization of impacts will need to be considered. This will include the analysis of path alignments, trail type (at-grade vs boardwalks vs bridge), and trail width, as well as the placement or need for amenities such as overlooks or path lighting.

Figure 7. Wetlands and Sensitive Lands



Hydrology & Floodplains

Red Rock Creek's headwaters fall within the City of Portland, and it flows from the flanks of Mt. Sylvania southwest into Fanno Creek, which is a tributary to the Tualatin River. The majority of the 1,042-acre drainage basin is within the City of Tigard, see Figure 8. There are no named tributaries flowing into Red Rock Creek and its flow inputs are comprised almost entirely of stormwater discharge. Because the watershed is highly developed and impervious, the stream is flashy and erosive. In the upper reaches, the creek flows through steep terrain, often in ravines that are deeply incised. Once the creek reaches the wetland and beaver ponds located just upstream of SW Dartmouth Street the stream's longitudinal slope flattens. Eroded soils from the steep reaches are deposited in the flat reaches, where they block culverts and fill wetlands.

The mapped FEMA 100-year floodplain extends from Fanno Creek up to SW Dartmouth Street, encompassing the flatter portions of Red Rock Creek. There is a floodway along Fanno Creek, but no floodway on Red Rock Creek. Trail construction within the 100-year floodplain will require balanced cut and fill to ensure there is no rise in the 100-year flood elevation. If the project does increase the 100-year flood elevation, a Letter of Map Revision (LOMR) will be required.

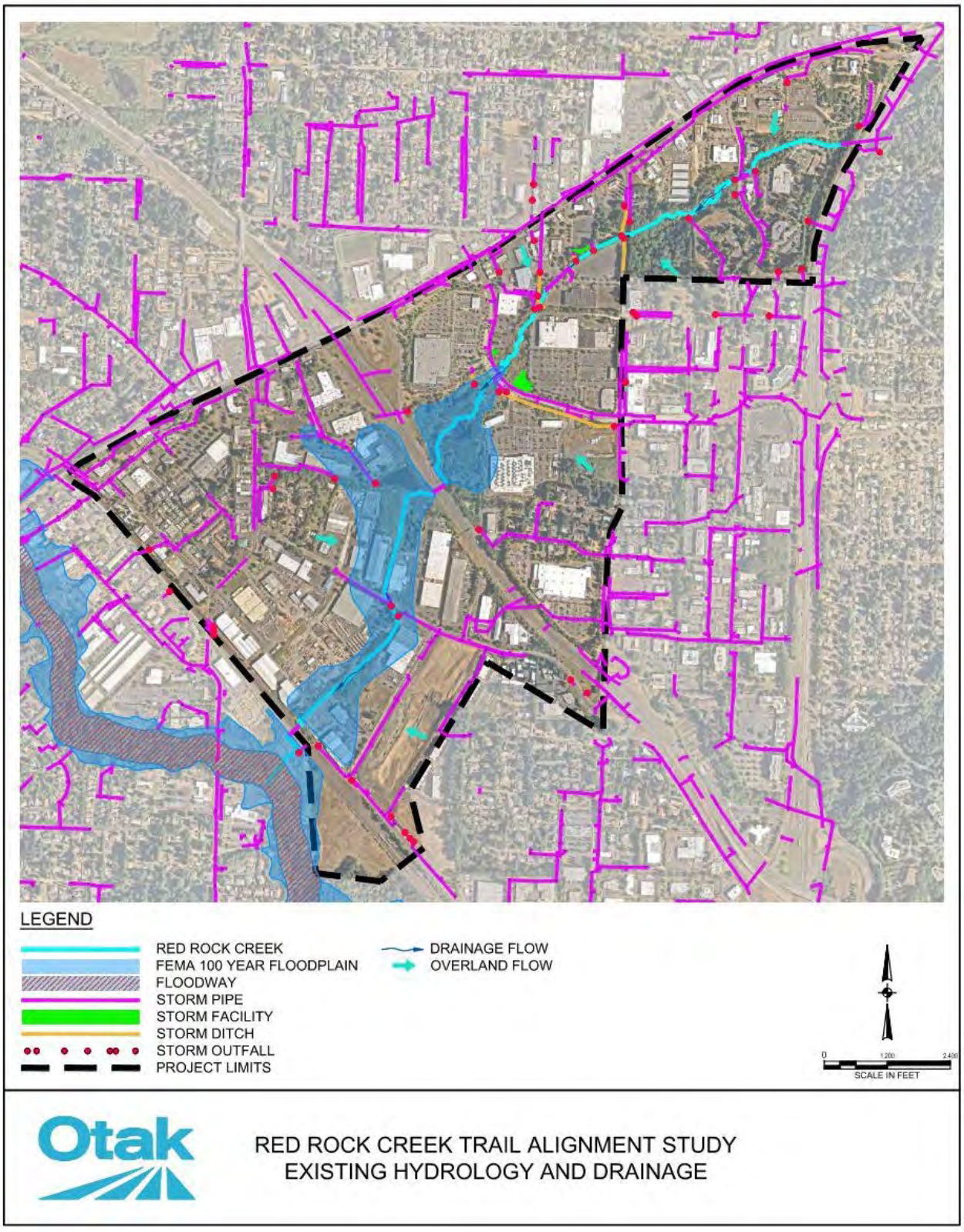
Stormwater Drainage

The City of Tigard adopted a Red Rock Creek Regional Stormwater Strategy (RRCRSS) that has been approved by CWS. The RRCRSS enables development and redevelopment that occurs within the Tigard Triangle to develop and manage a funding mechanism for enhancing the Red Rock Creek stream corridor instead of providing onsite detention to meet CWS hydromodification requirements, see Figure 8. On-site water quality treatment is required for any new or replaced impervious area (including the trail if its surface is impervious). In locations where the trail is in or adjacent to the VC, CWS allows use of the vegetated corridor as a filter strip for water quality treatment.

The City of Tigard is currently designing the first phase of the stream enhancement project, which runs from Crystal Lake upstream to SW 72nd Avenue. The stream enhancement design will be coordinated with the trail design, including replacement and enhancement of all stormwater outfalls and piping a major outfall from Highway 99W that reaches the creek at the end of SW Atlanta Street, In the reach between SW Atlanta Street and SW 72nd Avenue the stream enhancement design will include grading in the base for the trail.

There are a few existing water quality ponds and swales located adjacent to the creek that will need to be protected in the trail design. The creek flows beneath road crossings through culverts of unknown condition; however no culverts are anticipated to be replaced as a result of the future trail project.

Figure 8. Hydrology and Drainage



Appendix C: Alternatives Analysis Report

Memorandum

To:	Gary Pagenstecher, City of Tigard
From:	Amanda Owings, PE, Otak Inc.
Copies:	Stakeholder Working Group
Date:	December 11, 2023
Subject:	RRCT: Alternatives Analysis Memorandum
Project No.:	20291

An early task in the Red Rock Creek Trail (RRCT) Alignment Study was to provide reasonable alignments, achieving a continuous trail starting from the south at the Fanno Creek Trail near Tigard Library and ending in the north where Hwy 99W and I-5 intersect.

Each alignment alternative was evaluated using the following evaluation criteria that was drafted and agreed upon by the City of Tigard, ODOT, and the consultant team and supported by the Stakeholder Working Group (SWG). Using the criteria as well as local knowledge of the study area, the RRCT Alignment Study actively involved key stakeholders, Tigard Triangle residents, and underrepresented populations. It provided many opportunities for the community to engage with the trail siting through a public workshop, a web-based survey, two listening sessions, and a consensus-based stakeholder working group.. This memorandum describes the evaluation criteria, the six segments and alignment alternatives within each, and the evaluation process.

The engagement strategy embedded equity engagement in every stage and intentionally built on past efforts within the Tigard Triangle and across the region by Metro, especially the 2021 Metro Walking-Biking Trails Engagement project with Black, Indigenous, and people of color. Historically underrepresented groups were involved early in the process so that their insights shaped the survey questions, workshop format, and stakeholder agendas. The Tigard Triangle target population included residents receiving housing assistance, Spanish-speaking residents, and seniors. We concentrated our efforts on engaging with these priority populations early and consistently partnering early on with Unite Oregon and Community Partners in Housing. The two listening sessions at the Fields and Red Rock Commons apartments in February provided valuable insight into the hopes and concerns of local residents about the trail. These notes formed the basis for the survey questions and agenda topics for the first SWG meeting.

Initial Trail Alignment Alternatives

The study area was divided into six segments to better organize and evaluate these areas at an appropriate design scale. Thinking ahead toward construction, segments were assembled to begin and end at an established access point (roadway or trail). This way, segments could be constructed individually as opportunities arose and trail users would never encounter a dead-end, see Figure 1.

- Segment A: Fanno Creek Trail to Potso Dog Park
- Segment B: Potso Dog Park to SW Hunziker Rd
- Segment C: SW Hunziker Rd to SW Dartmouth St
- Segment D: SW Dartmouth St to SW 72nd Ave
- Segment E: SW 72nd Ave to SW 68th Parkway
- Segment F: SW 68th Parkway to Hwy 99W

The design team drafted a series of trail alignment alternatives based on local knowledge of the study area, field observations, technical analysis, and feedback from city staff. The alignment alternatives looked at sensible on-street and off-street options, with safety as a priority at roadway crossings. Existing recreation trails were considered for use as the trail alignment or proximity for connections. Where possible, the design team drafted alignments that approached or crossed Red Rock Creek to allow trail users to interact with nature. In all cases, alignments avoided buildings or large property acquisitions. This effort produced 32 alignment alternatives.

Once alignment alternatives were drawn and a description written to highlight the intended location and termini, the design team presented the 32 alignments to the public at the first workshop and the SWG meeting #1 (Figure 1 and Table 1).

Figure 1. Alignment Alternatives Diagram – All Segments

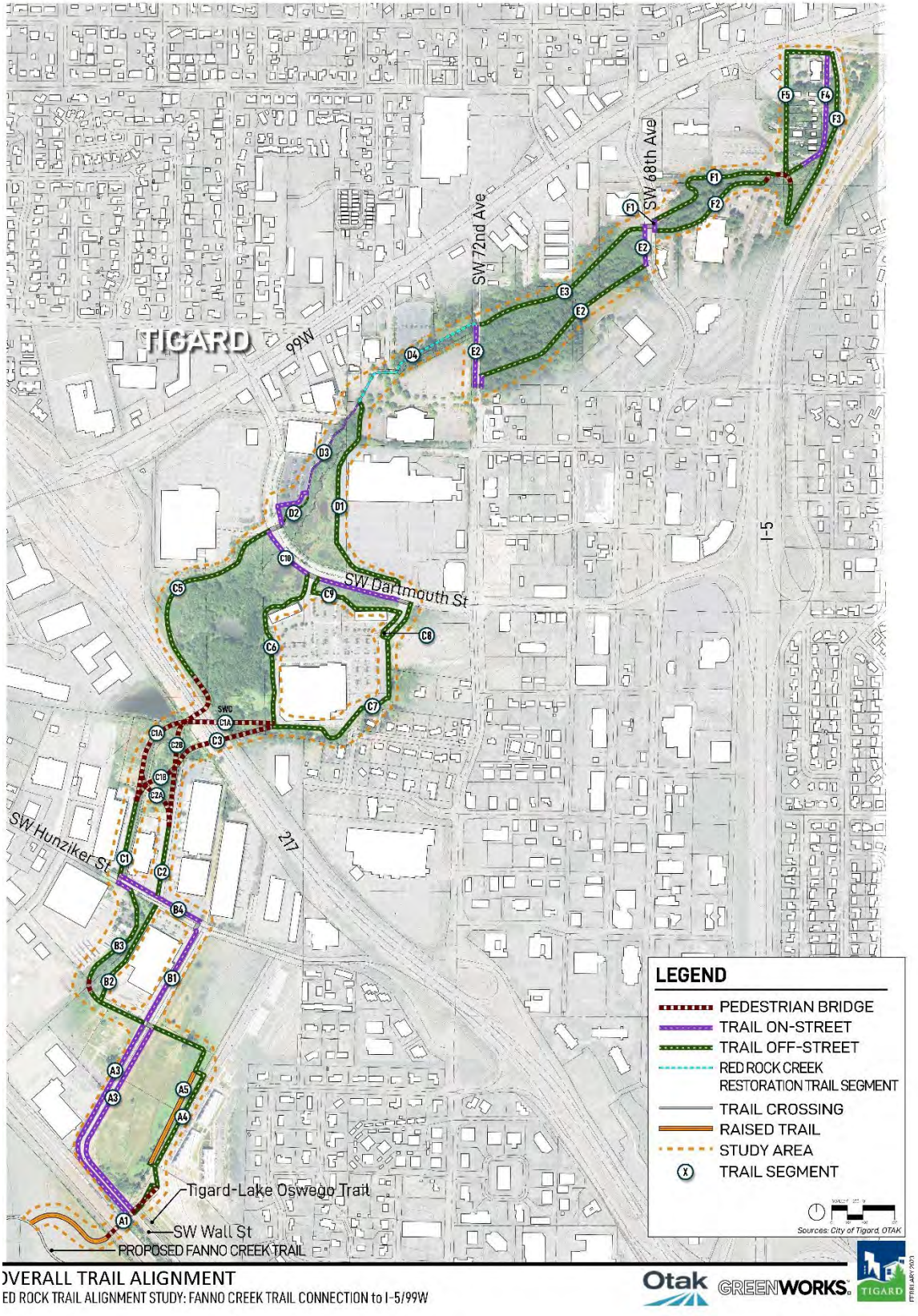


Table 1. Alignment Alternative Descriptions

Segment Number	Segment Description
Segment A: Fanno Creek to north side of Potso Dog Park	
A1	Trail connection to Fanno Creek Trail. Ramp up to structure crossing the railroad and connection on Fields property. Trail on-street (driveway) to connect at SW Wall St.
A2	From Fields property driveway, continues on-street/sidewalk along the north and east side of Wall St toward Potso Dog Park, mid-block crossing of SW Wall St.
A3	Trail on-street through parking lot of Fields Apartment property, down a new stairway; trail at-grade through "Wall St Central" property toward Potso Dog Park, mid-block crossing of SW Wall St.
A4	Long ramp structure down to grade within the “Wall St South” property; trail at-grade through “Wall St Central” property toward Potso Dog Park, mid-block crossing of SW Wall St.
Segment B: Potso Dog Park to SW Hunziker Rd	
B1	Trail on-street along west side of SW Wall St to SW Hunziker Rd. Cross to north side of SW Hunziker Rd. Trail on-street west to creek crossing.
B2	Trail is along north side of Potso Dog Park, then turns north along east side of creek to SW Hunziker Rd.
B3	Trail is along north side of Potso Dog Park, cross the creek on structure, then turns north along west side of creek to SW Hunziker Rd.
B4	Trail is on-street along north side of SW Hunziker Rd between SW Wall St and commercial driveway north of creek.
Segment C: Crossing Highway 217	
C1	Trail is adjacent to existing private drive (or possibly boardwalk) along west side of creek. Creek is within a narrow piece of right-of-way between commercial buildings.
C1a	From C1, trail uses elevated structure, ramps up to connect with proposed SW Corridor (SWC) bridge to cross Hwy 217. Ramp down to connect at-grade at SW corner of Walmart property.
C1b	From C1, crosses the creek easterly, connects to C3 crossing.
C2	Trail is adjacent to existing private drive between existing commercial buildings.
C2a	From C2, crosses creek westerly, connects and continues on C1a crossing.
C2b	From C2, trail crosses creek easterly. Cross Hwy 217 on new alignment, north of SWC bridge.
C3	Cross 217 south and below SWC bridge (new, separated south crossing). Connects at-grade to SW corner of Walmart property.
C5	Trail is along north side of Hwy 217. Trail travels east along base of Costco property embankment. Short connection to Costco/Dartmouth intersection.
C6	Starting at SW corner of Walmart property, utilize existing trail along the west side of building, north of west accessory building to Walmart/Dartmouth-west intersection.

Segment Number	Segment Description
C7	Starting at SW corner of Walmart property, utilize existing Walmart trail on south side of building. New trail along eastern perimeter of parking lot to Walmart-east driveway.
C8	Trail is along Walmart driveway, utilizes Walmart/Dartmouth-east intersection to cross to north side.
C9	Trail utilizes existing trail behind accessory buildings in the Walmart parking area. On-street trail along south side of SW Dartmouth St between Walmart/Dartmouth-west intersection and Walmart/Dartmouth-east intersection, crossing to north side.
C10	Trail is on-street along south side of SW Dartmouth St between Walmart/Dartmouth-west intersection and Costco/Dartmouth intersection.
Segment D: Costco Driveway to SW 72nd Avenue	
D1	Trail utilizes Winco parking lot to travel north. Crosses retaining wall barrier near existing theater site, connects to trail construction at SW 74th Ave (part of the streambank enhancement project).
D2	Provides an in-line connection through sensitive lands.
D3	Existing trail along AutoZone property parking area.
D4	Trail alignment complete. Trail to be graded by streambank enhancement project, SW 74th/Atlanta St to SW 72nd Ave. Paving to occur with future project.
Segment E: SW 72nd Avenue to SW 68th Parkway	
E1	Mid-clock crossing at SW 72nd Ave. Enter wooded area following north side of creek toward SW 68th Parkway. Mid-block crossing at SW 68th Parkway just south of Extra Space Storage driveway.
E2	Trail is on-street along west side of SW 72nd Ave; cross at proposed intersection of SW 72nd / SW Atlanta St. Enter wooded area along south side of creek toward SW 68th Parkway. Trail is on-street on west side of SW 68th Parkway. Mid-block crossing at SW 68th Parkway just south of Extra Space Storage driveway.
Segment F: SW 68th Parkway to I-5/Barbur Boulevard Intersection	
F1	Trail is on-street with short connection at SW 68th Parkway. Enter wooded area north side of creek, behind CPAH's Red Rock Creek Commons apartment building. Switchback N/NE to travel along south side of PGE substation property. Cross creek to the east with structure.
F2	Enter wooded area south side of creek. Follow contour east along Tigard Business Center/Comcast property.
F3	Switchback trail toward ODOT/I-5 property. Travel along I-5 right-of-way north toward Barbur/SW 64th Ave/I-5 signalized intersection.
F4	Interim use of SW 64th Ave ROW to connect to Hwy 99W/Barbur (currently, gravel; not ADA accessible).
F5	Interim use of SW 65th Ave ROW to connect to Hwy 99W/Barbur (currently unimproved; not ADA accessible).

Response to the Engagement Process

The design team met with the SWG to discuss what are the kinds of things that should affect the trail location and to identify the key values the preferred trail alignment needs to encompass. Through small group discussions, key values emerged. As residents had also ranked values in the community web-based survey, listening sessions, and public workshop, the design team gained broad insight into public thought. Throughout the SWG discussions, the values most often expressed were safety, user experience, accessibility to all, and property protection. Public comments had some overlap with what was shared by the SWG. The top three key values were users' safety, enjoyment of the outdoors, and preservation of the ecosystem. The design team took all of these into consideration when choosing the preferred alignment.

When it came to choosing the trail location within each segment, members stated that the trail location and design should focus on:

- design features that allow for safe use of multi-modal activity
- access to nature
- restricting access to homeless people came up as a way to keep the trail available to other trail users
- preservation of the ecosystem and of private property
- providing connections currently missing between businesses, destinations, housing, and other trails
- utilize existing trails/sidewalk when possible

Trail Alignments Evaluation Criteria

The following set design criteria were developed to provide a base of expectations and guidelines to follow when assessing the alignment alternatives. The design criteria for the trail alignment study are listed below.

USER EXPERIENCE
Ensure all users are comfortable, feel secure, are provided equal access, and have the opportunity to engage with nature while using the trail.

ENVIRONMENTAL IMPACTS
Protect natural areas by minimizing impacts to floodplains, wetlands, Tigard Significant Wetlands, and vegetated corridors.

CONNECTIVITY / CONTINUITY
The alignment is designed in a route that connects users to key destinations. The route is not circuitous or causes out-of-direction travel but has a smooth, intuitive route.

PERMITTING
The design is likely to pass the permitting process.

COST, CONSTRUCTABILITY & FUNDING
Project cost is feasible and not prohibitive of progress; project is likely to receive funding and financial support.

PROPERTY OWNERSHIP
Minimally impact adjacent properties and minimize need of property purchase and/or easements.

SAFETY & SECURITY
Provide a safe and welcoming trail experience for all users designed with clear sightlines, emergency access, and minimal hiding places.

COMMUNITY SUPPORT
Alignment is supported by the public, community, and adjacent businesses.

Using the criteria, a decision matrix with further developed descriptions and scoring was used to evaluate each alternative by both the SWG and public at the first public meeting. Scores for the criteria were defined as:

- -1 – when it impacts the criteria negatively
- 0 – either meets nor impacts criteria
- 1 – meets criteria

Table 2 shows the results of the matrix that was completed by the SWG and members of design team experts.

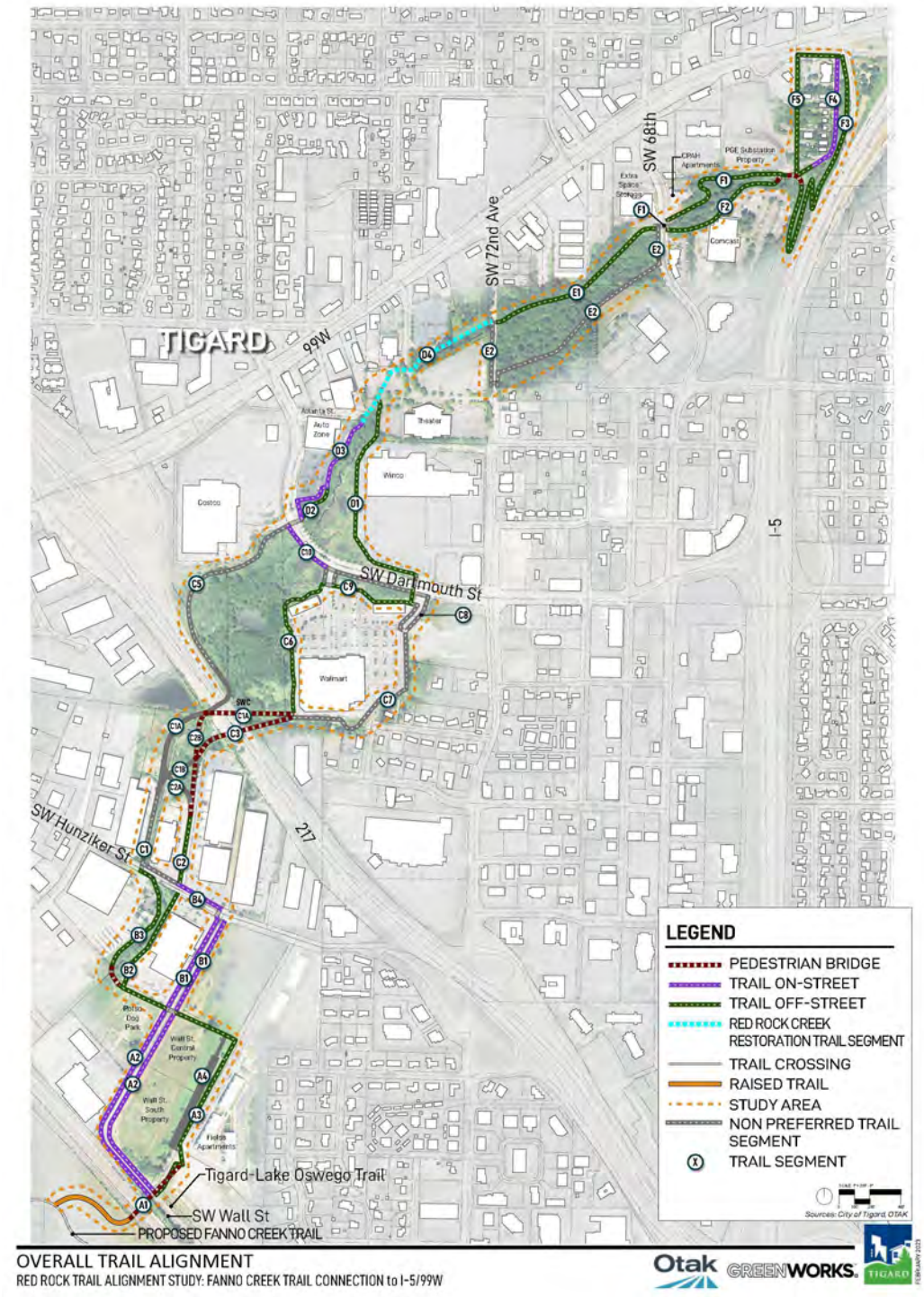
Table 2. Scoring Table Results

DESIGN CRITERIA	TRAIL SEGMENT ALTERNATIVES	A1	A2	A3	A4	B1	B2	B3	B4	C1	C1A	C1B	C2	C2A	C2B	C3	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	E1	E2	F1	F2	F3	F4	F5
	1: USER EXPERIENCE*	11	5	9	11	-6	12	9	1	3	8	8	3	8	11	8	9	11	2	5	10	2	11	9	14	14	8	2	6	11	-3	0	6
	Ensure users feel comfortable	4	2	4	4	-3	4	3	0	1	2	2	2	2	3	2	1	3	1	2	3	-1	3	3	4	5	3	1	1	4	-3	0	2
	Ensure users feel secure	4	2	2	4	-1	2	1	1	1	2	2	3	2	3	2	3	3	1	2	3	1	3	1	5	3	1	-1	1	2	0	0	2
	Ensure all users have an equal opportunity to engage with nature	3	1	3	3	-2	6	5	0	1	4	4	-2	4	5	4	5	5	0	1	4	2	5	5	5	6	4	2	4	5	0	0	2
	2: CONNECTIVITY/CONTINUITY	6	7	9	9	5	5	6	6	5	4	4	6	6	6	6	6	5	2	1	3	3	5	8	9	9	7	-3	7	6	0	4	4
	Provide frequent/intuitive connections for access	2	4	4	4	3	1	2	3	2	1	1	3	3	2	2	1	1	0	-1	1	0	2	4	3	3	1	-2	1	3	-1	0	1
	Provides continuous route	4	3	5	5	2	4	4	3	3	3	3	3	3	4	4	5	4	2	2	2	3	3	4	6	6	6	-1	6	3	1	4	3
	3: ENVIRONMENTAL IMPACTS	18	20	16	16	16	-6	-4	21	-13	-4	8	15	-8	6	10	-4	15	22	18	20	10	16	-2	15	5	14	18	8	10	14	19	8
	Minimize impacts to floodplains	5	5	4	4	4	-1	-2	5	-4	-1	-1	3	-2	1	4	2	0	6	4	4	1	4	0	5	5	5	4	5	3	4	4	2
	Minimize impacts to wetlands	5	5	4	4	4	-3	-2	5	-3	-1	3	3	-2	1	2	-2	5	6	5	6	4	6	-2	5	1	6	6	3	3	6	6	2
	Minimize impacts to Tigard Inventoried Wetlands	5	5	4	4	4	1	-2	4	-3	-1	3	3	-2	1	0	-2	5	4	4	4	1	5	-2	2	2	2	4	3	3	4	4	2
	Minimize impacts to vegetated corridors	3	5	4	4	4	-3	2	7	-3	-1	3	6	-2	3	4	-2	5	6	5	6	4	1	2	3	-3	1	4	-3	1	0	5	2
	4: EASE OF PERMITTING:	1	6	5	5	2	-3	-2	4	-3	-3	-3	5	-3	0	2	-2	0	3	2	4	3	-3	-3	5	-2	-1	-2	0	2	-2	2	4
	The design should pass the permitting process with ease	1	6	5	5	2	-3	-2	4	-3	-3	-3	5	-3	0	2	-2	0	3	2	4	3	-3	-3	5	-2	-1	-2	0	2	-2	2	4
	5: COST, CONSTRUCTABILITY & FUNDING	6	11	7	7	5	8	3	6	4	1	3	8	0	0	5	9	9	3	3	6	3	4	-1	13	13	11	6	10	7	6	6	3
	Project cost is feasible	-1	4	2	2	2	2	3	0	2	1	0	0	2	-1	-1	0	3	3	1	1	2	1	0	-1	3	3	2	1	2	2	2	2	1
	Project cost is not prohibitive of progress	3	4	2	2	2	2	1	2	1	-2	0	2	-1	-1	0	3	3	1	1	2	1	2	1	5	5	4	2	4	2	2	2	1
	Project is likely to receive funding and financial support	4	3	3	3	1	3	2	2	2	3	3	4	2	2	5	3	3	1	1	2	1	2	1	5	5	5	3	4	3	2	2	1
	6: PROPERTY OWNERSHIP	5	8	4	2	2	4	-2	6	-4	2	2	-2	0	0	4	9	6	-2	-1	4	2	2	4	6	5	3	-4	2	2	-2	6	2
	Minimal impact to adjacent properties	3	4	2	2	1	2	-1	3	-2	2	2	1	1	1	4	6	3	-1	-1	3	1	2	-2	4	4	3	-2	3	3	-1	3	1
	Minimal need of property purchase and/or easements	2	4	2	0	1	2	-1	3	-2	0	0	-3	-1	-1	0	3	3	-1	-2	1	1	0	2	2	1	0	-2	-1	-1	-3	3	1
	7: SAFETY & SECURITY	17	15	13	14	7	9	1	8	2	8	11	3	9	14	9	4	12	9	8	11	7	15	13	24	13	9	3	3	13	-5	13	5
	Provide a safe trail experience for all users	4	2	2	3	1	4	0	1	0	3	4	1	4	5	4	2	3	1	1	2	1	3	4	5	2	3	1	2	3	2	2	0
	Provide a welcoming trail experience for all users	4	1	2	3	-3	4	2	0	-1	4	4	-1	3	4	3	2	3	1	0	2	1	3	4	3	5	3	0	2	2	-3	1	1
	Clear sight lines	5	4	3	3	3	1	0	2	1	3	3	1	3	4	3	3	3	2	2	2	2	3	2	5	3	3	2	0	3	0	3	2
	Emergency access	1	4	3	2	3	-1	-1	3	0	-2	0	0	-2	-1	-2	-2	3	4	3	4	2	3	1	6	2	0	0	-1	2	-3	4	1
	Minimal hiding places	3	4	3	3	3	1	0	2	2	0	0	2	1	2	1	-1	0	1	2	1	1	3	2	5	1	0	0	0	3	-1	3	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8: COMMUNITY SUPPORT	6	2	4	4	-2	2	2	-2	0	-1	-1	-2	-1	1	2	2	4	-2	-2	0	-2	2	4	6	4	2	1	2	2	0	2	2
	Alignment is supported by the community	3	1	2	2	-1	1	1	-1	0	-1	-1	0	-1	0	1	1	2	-1	-1	0	-1	1	2	3	2	1	1	1	1	0	1	1
	Alignment is supported by adjacent businesses	3	1	2	2	-1	1	1	-1	0	0	0	-2	0	1	1	1	2	-1	-1	0	-1	1	2	3	2	1	0	1	1	0	1	1
	TOTAL	70	74	67	68	29	31	13	50	-6	15	32	36	11	38	46	33	62	37	34	58	28	52	34	92	61	53	21	38	53	8	52	34

Alternative Analysis Refinement

Based on the initial scoring, the alignments were further refined in SWG meeting #2 and represented in Figure 2. They were evaluated by technical consultants to assess the feasibility of each potential segment. Alignments that were obviously not feasible were omitted; others were retained to study in further detail.

Figure 2. Alignment Alternatives Diagram – Refined



With this information the design team reviewed the remaining options and developed the following pros and cons for the segments that still had more than one option remaining. Segments A and E did not require further evaluation as the SWG reached early consensus on these alignment alternatives.

Segment B

B1+B4

Criterion	Pros	Cons
User Experience		Low user experience being along roadway Does not connect with nature
Connectivity/Continuity	Existing, visible route	
Environmental Impacts	Does not impact wetlands, vegetated corridors	
Permitting	No additional permits needed	Two 90-degree turns slowing continuous flow
Cost	Very low cost (short term)	
Property Impact	Very low impact to property owners (short term)	Widening sidewalk to 12-ft impacts redevelopment of property (long term)
Safety & Security	Opportunity to enhance crosswalk on SW Hunziker Rd Accessible by emergency services	Driveway conflicts
Community Support	SWG Support	

B2

Criterion	Pros	Cons
User Experience	More interesting user experience, quiet surroundings Connects with nature, close to the creek centerline	
Connectivity/Continuity	Connects to Potso Dog Park	Two 90-degree turns slowing continuous flow
Environmental Impacts		Impacts to vegetated corridor Impacts to wetland
Permitting		Complex permitting situation
Cost		Elevated structure or alternative mitigation
Property Impact		Impacts private property, reducing parking lot May impact future development area
Safety & Security		
Community Support	No conflicts with vehicles	Less accessible by emergency services

Segment C

C2B+C1A

Criterion	Pros	Cons
User Experience	Comfortable, separated from vehicles Connects with nature	C1A: adjacent to light rail Steep elevation change to reach SWC structure
Connectivity/Continuity	Soft curves, continuous route	
Environmental Impacts		Impacts vegetated corridor Impacts floodplains, wetlands
Permitting		Complex permitting situation
Cost	C1A: Potential shared cost with SW Corridor	C1A: Elevated structure down to Walmart trail system C2B: Elevated structure across Red Rock Creek C2B: Elevated structure up to reach SWC structure
Property Impact		C1A: 2 properties C2B: 2 properties
Safety & Security		Less accessible by emergency services
Community Support	Community member Support	SWC not yet supported by voters

C2B+C3

Criterion	Pros	Cons
User Experience	Less elevation change to reach structures Connects with nature	
Connectivity/Continuity	Soft curves, continuous route Easy connection to Walmart trails	
Environmental Impacts	Less impact to vegetated corridor Minimized impact to floodplains, wetlands	Impacts vegetated corridor Impacts floodplains, wetlands
Permitting		Complex permitting situation
Cost		C2B: Elevated structure to reach C3 C3: Elevated structure to cross Hwy 217
Property Impact		5 properties
Safety & Security		
Community Support	SWG Support	

Segment D

D1

Criterion	Pros	Cons
User Experience		Adjacent to existing parking lot
Connectivity/Continuity		Creates slightly out of direction travel
Environmental Impacts		Slight impact due to creek crossing
Permitting		Low amount of permitting for stream crossing and impacting vegetated corridor
Cost		Small structure crossing Red Rock Creek New trail along existing Winco parking area
Property Impact		2 properties Removes existing parking area
Safety & Security		Sight lines obscured from one end to the other
Community Support	Community member support for access to shopping	

D2+D3

Criterion	Pros	Cons
User Experience	Immediately adjacent to creek, nature	Adjacent to existing parking lot
Connectivity/Continuity	Multiple connection points Shorter connection to Walmart trails	
Environmental Impacts	None. Existing trail	D2: Slight impact due to creek crossing
Permitting	None. Existing trail	D2: Low amount of permitting for stream crossing and impacting vegetated corridor
Cost	None. Existing trail	
Property Impact	1 property	
Safety & Security	Users feel secure with multiple exit points Accessible by emergency services	
Community Support	SWG support	

Segment F

F4

Criterion	Pros	Cons
User Experience		Low user experience being along roadway Noise from I-5 Steep grade, challenge to meet ADA accessibility
Connectivity/Continuity		Challenging connection from SW 64th Ave to signal at Hwy 99W Route not as intuitive Slight out of direction travel
Environmental Impacts	None	
Permitting	None	
Cost		Moderate cost to install landing spaces or switchbacks
Property Impact	Primarily within public right-of-way	2-4 properties Impacts to SWC alignment along Coronado St.
Safety & Security	Accessible by emergency services Sight lines clear	Low-volume roadway crossing
Community Support	SWG support	

F5

Criterion	Pros	Cons
User Experience	Comfortable, separated from vehicles Connects with nature	Steep grade, challenge to meet ADA accessibility
Connectivity/Continuity	Connects with nature Proximity to future transit station Less out-of-direction travel to Hwy 99	Slight out of direction travel
Environmental Impacts	Least impact to sensitive areas	
Permitting	None	
Cost		Install landing spaces or switchbacks, retaining walls
Property Impact	Primarily within public right-of-way	2 properties Impacts to SWC alignment
Safety & Security	Sight lines clear from one end to the other.	Not accessible by emergency services Low-volume roadway crossing
Community Support		

Additional Refinement

As the design team met with the technical disciplines and stakeholders, Segment C6 was further defined and a new alignment alternative was developed and presented to the City. One key concern was the bifurcation of the natural area as shown in Figure 3.

The city staff held an internal meeting prior to presenting to the SWG to review the alignment alternatives and to ensure that they met the goals of the City and its community. Through the refinement process and direction from the city, the design team modified alignment C6 to utilize more of the Walmart property perimeter trail and traverse the outer edge of the Crystal Lake wetland area along the southwest edge of SW Dartmouth St. as shown in Figure 4.

Figure 3: C6. Crossing the Natural Area



Figure 4: C6. Using Perimeter of Natural Area



The refined alignment alternatives were presented at SWG meeting #3, hosted at City Hall for in-person participation. The SWG engaged in a large group discussion to evaluate the remaining alignment alternatives and what might be needed from the design team to help reach consensus. The group concluded that additional visualizations and consideration for the natural environment would be needed.

In addition to the Stakeholder Working Group Meetings, the design team held 30-minute one-on-ones with key stakeholders and members of the community that helped refine the alignments to meet the needs of the community and the future trail users. From the one-on-ones, the following are key takeaways that influenced the alignments:

- ODOT noted two future projects that could impact C5 and F5 segments. ODOT plans to widen Hwy 217 in the near future which would push C5 further into the adjacent wetland and natural area. In addition, the off-ramp at exit 6 will be widened which could impact the trail once constructed. In regard to segment F3, there is the potential to use the on ramp to I-5 area as a staging area for a future paving project, but this is not scheduled within the foreseeable future. In both scenarios, if the trail is constructed first, these ODOT projects could impact the trail and possibly create the need to relocate and rebuild.
- Based on this conversation and evaluating these segments, the design team concluded that segment C6 would be the better long-term solution. Moving forward with C6 significantly reduces impacts to the natural environment and wildlife, uses an existing trail, generates lower construction costs, and provides a more direct route to commerce and services.
- Based on how far in the future the paving project is for ODOT, the design team has chosen to continue to advance segment F3 with some adjustments. The topography in this area is extremely steep and, out of the three alignment options, F3 lends itself to the most viable option for most trail users.

- Community Partners for Affordable Housing (CPAH) met with design team to discuss their concerns with the trail coming so close their 'Red Rock Creek Commons' building. The tenants on the ground floor worry about privacy and the possibility of the trail lighting being invasive. CPAH also shared apprehension with this alignment alternative due to this being a federally-funded facility and the current agreements within the environmental documents (NEPA, NOAA, USACE, HUD, CWS); CPAH and their partners underwent a complex application and permitting process when they constructed this facility due to the fact there were mitigation efforts recorded for impacts to the vegetated corridor. Modifications to the current agreements could significantly impact the project cost and schedule due to additional environmental permitting.
  - Based on this conversation the design team was able to shift the alignment to the south side of Red Rock Creek to provide some distance from the Red Rock Creek Commons building and avoid tenant disturbance and additional permitting, see Figure 5.

Figure 5. Segment F1 Refinement



- Portland General Electric (PGE) stated its general support for the project, specifically in reference to Segment F1 but noted the importance of trail amenities within this section, specifically trail lighting and the need for a barrier between the trail and the PGE fence.

With all of this information in hand, the design team was able to rate the remaining alignment alternatives, provide reasons for omission and advancement based on the technical team's analysis, and develop the following graphics to help represent visualizations of the proposed trail. The following tables and typical sections were shared with SWG at meeting #3 and finalized after incorporating their final comments. Figure 6 illustrates the overall refined alignment.

Segment A

		Trail Segment Alignment			
	Fanno Creek Trail to SW Wall Street Crossing	A1	A2	A3	A4
Design Criteria	**Overall Rating**	●	●	◑	◑
	User Experience	●	◑	◑	◑
	Connectivity/Continuity	●	●	○	◑
	Environmental Impacts	●	●	●	◑
	Ease of Permitting	●	●	●	◑
	Cost, Constructability and Funding	◑	●	◑	◑
	Property Ownership	●	●	◑	◑
	Safety and Security	●	●	●	●
	Community Support	●	◑	◑	◑

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

Segment	Reasons for Omission
A3*	• Does not meet ADA requirements. • Would require additional acquisition/easement. • No infrastructure currently in place. • Safety concerns with trail through active residential parking area.
A4	• Removed through the public engagement process. • Ramp along new retaining wall to resolve elevation difference. • Impact to property development.

***** This segment is not part of the preferred alignment alternative; the planned stairway from Fields Apartments and connection between SW Wall Street properties creates future recreational loop.

Segment	Reasons to Advance
A1+A2	• No wetland or VC impacts • No likely impacts to archaeological resources • No impacts to significant historic resources • Outside the floodplain • Minimal property acquisition or easement needed • Existing infrastructure in place • Alignment along roadway is highly visible • Direct connection to the proposed Fanno Creek Trail • Allows connectivity from the north and east approaches of SW Wall St

A2: Trail along SW Wall Street



Design Assumptions:

- Grade-separated crossing over railroad and SW Wall Street.
- Widen sidewalk to shared use path width along east side of Fields Apartment driveway.
- Widen sidewalk to shared use path width along north and east side of SW Wall Street.
- Mid-block crossing at SW Wall Street designed for safety.
- Cost estimate includes revisions to LIDA stormwater facilities and street light relocation.
- Signage and pavement markings provide wayfinding for users.

Segment B

		Trail Segment Alignment			
	Potso Dog Park to SW Hunziker Road Crossing	B1	B2	B3	B4
Design Criteria	**Overall Rating**	◑	●	◑	◑
	User Experience	○	●	◑	○
	Connectivity/Continuity	●	●	◑	●
	Environmental Impacts	●	●	◑	●
	Ease of Permitting	◑	●	◑	●
	Cost, Constructability and Funding	●	◑	◑	◑
	Property Ownership	●	◑	◑	◑
	Safety and Security	●	●	○	●
	Community Support	○	●	○	○

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

Segment	Reasons for Omission
B1+B4*	• Low user experience being along roadway • Does not connect with nature • Widening sidewalk to 12-ft impacts redevelopment of property (long term) • Driveway conflicts • Unknown impacts to 2 historic resources at segment B4. • No wetland or VC impacts
B3	• Stream crossing would be required though permanent impact could likely be avoided with a bridge. Assume no wetland impacts. VC significantly impacted

*This segment is not part of the preferred alignment alternative but can be considered for an interim (short term) solution which can be turned into a recreational loop.

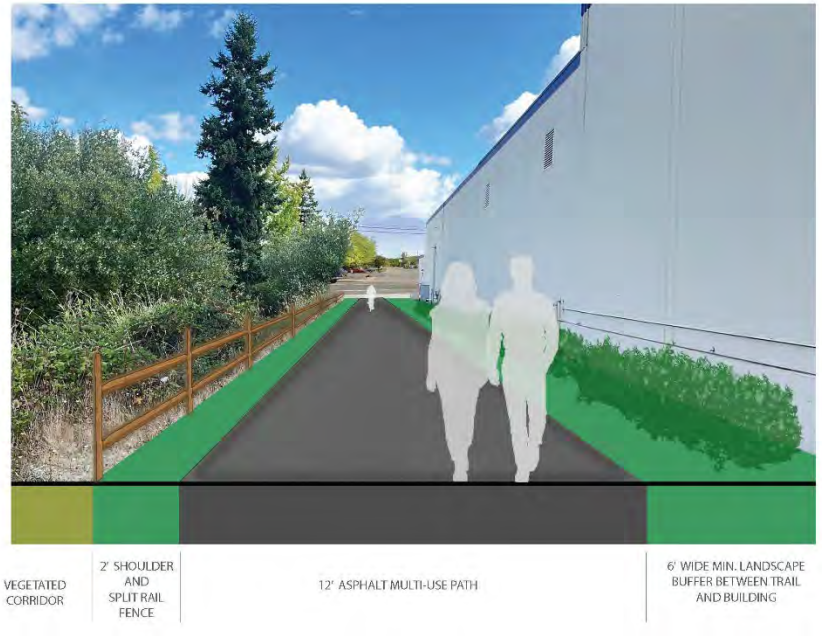
Segment	Reasons to Advance
B2	• More interesting user experience, quiet surroundings • Connects with nature, close to the creek centerline • No conflicts with vehicles • Visibility by adjacent property • Community member support • Where work is on fill, no likely impacts to archaeological resources. No impacts to significant historic resources. • No impacts through dog park. Assuming there is no wetland along the creek this segment will result in slightly less vegetated corridor impact than B3 • Mostly outside of the greenway. May require no-rise documentation • Possible improvement and access to Potso City Dog Park • Minimal property acquisition or easement needed • User experienced enhanced by being within the natural environment • Strong centerline alignment between B2 and C2

Segment B

B2: North side of Potso Dog Park



B2: Behind Charter Mechanical/Along Natural Area



Design Assumptions:

- Protective fencing along Potso Dog Park
- Pedestrian scale fencing along active private property
- Interim: maintain existing facilities along SW Wall St and SW Hunziker Rd
- Enhanced mid-block crossing at SW Hunziker Rd designed for safety
- Cost estimate includes landscaping buffer along existing building
- Signage and pavement markings provide wayfinding for users

Segment C

Trail Segment Alignment

	Hunziker Rd to Walmart Trail	C1	C1A	C1B	C2	C2A	C2B	C3
Design Criteria	**Overall Rating**	◑	◑	◑	●	◑	◑	●
	User Experience	◑	◑	◑	◑	◑	◑	●
	Connectivity/Continuity	◑	◑	◑	●	◑	◑	●
	Environmental Impacts	○	◑	◑	●	○	◑	◑
	Ease of Permitting	◑	◑	◑	●	◑	◑	●
	Cost, Constructability and Funding	◑	◑	◑	●	◑	◑	◑
	Property Ownership	◑	●	◑	◑	◑	◑	●
	Safety and Security	◑	●	●	●	●	●	●
	Community Support	○	◑	◑	●	◑	◑	●

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

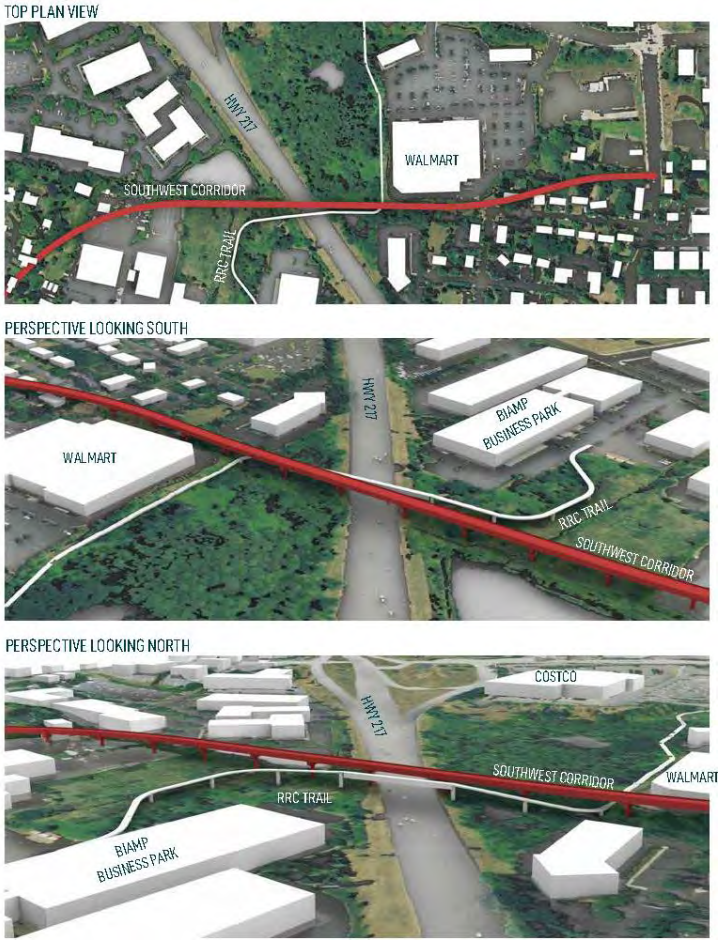
Seg	Reasons for Omission
C1	• Removed due to environmental constraints, disturbance to wildlife • Retaining walls or structure increases cost to protect slope stability of creek channel • Widening sidewalk to 12-ft impacts redev. of property • Frequent flooding reported through this segment
C1A	• Removed through the public engagement process. Has potential as the preferred connection if SWC crossing is constructed before trail crossing over Hwy 217 • Green portion of alignment appears to be right on top of the stream channel. This is the Knez Wetland, owned by The Nature Conservancy • Bifurcates open, natural area already narrowed by dev.
C1B	• Removed due to environmental constraints and constructability • Unnecessary alignment if C1 is removed
C2A	• Removed through the public engagement process
C2B	• Eliminated due to consolidation of alignments, but has potential as the preferred connection if SWC crossing is constructed before trail crossing over Hwy 217

Seg	Reasons to Advance
C2+C3	• Visible, open route between industrial properties has increased user experience over route behind buildings. • Less elevation change to reach structures • Route along perimeter of wetland provides user connection to nature. • Soft curves, continuous route for commuting and visibility. • Easy connection to Walmart trails; potential spur to connect to SWC alignment. • C2 has no impact to vegetated corridor • Connecting structure along perimeter of parking lots to Hwy 217 crossing minimizes impact to floodplains, wetlands. • No likely impacts to archaeological resources. • No wetland or VC impacts; is therefore preferable over C1 • C2 is right on the edge of the floodplain. Minimal impact. • Minimal property acquisition or easement needed • Boardwalk offers an intimate connection with the natural areas.

C2: Fred Shearer & Sons Inc



C3: Highway 217 Crossing



Design Assumptions:

- Convert portion of existing landscape median to sidewalk for pedestrian trail users
- Signage and pavement markings provide wayfinding for users
- Convert portion of drive aisle to shared use pathway
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots
- Boardwalk structure minimizes wetland impact
- Grade-separated ramp structure minimizes wetland impact
- Grade-separated crossing over Highway 217
- Crossing location minimizes impact to existing billboard structure
- Pedestrian scale fencing separating trail and natural space

Segment C

	Walmart Trail to Dartmouth	Trail Segment Alignment C5	C6	C7	C8	C9	C10
Design Criteria	**Overall Rating**	◑	●	◑	◑	◑	◑
	User Experience	◑	●	○	◑	◑	○
	Connectivity/Continuity	●	●	◑	○	◑	◑
	Environmental Impacts	◑	●	◑	●	●	●
	Ease of Permitting	◑	◑	●	●	●	●
	Cost, Constructability and Funding	◑	◑	◑	●	●	●
	Property Ownership	◑	●	◑	●	●	●
	Safety and Security	◑	●	●	●	●	●
	Community Support	◑	●	○	○	○	○

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

Seg.	Reasons for Omission
C5	• Sound and visual impacts of Hwy 217 reduce user experience • Large amount of trail within floodplain and vegetated corridor • Establishing new infrastructure creates new disturbance to existing wildlife habitat • Property acquisition may be difficult, as experienced by streambank restoration project • ODOT has plans to widen Hwy 217 and modify interchange, thereby constraining trail alignment and natural area
C6B*	• Connection to SW Dartmouth St results in lower user experience • If existing sidewalk needs to be widened, a delineation and NRA would be necessary • More turns within alignment, reducing continuous commuter route.
C7-C10	• Removed through the public engagement process

*This segment is not part of the preferred alignment alternative but can be considered for an interim (short term) solution which can be turned into a recreational loop.

Seg	Reasons to Advance
C6+C6A	• No impacts to significant historic resources. • Utilizes existing path west of Walmart and therefore limits new resource impacts. This route avoids new infrastructure in the wetland and upland habitats to the west, thereby limiting new disturbances to existing wildlife habitat. • Likely to result in less wetland impact than C5 route. • Maps show that C6 is in the floodplain, but the area is already developed and there is an existing trail adjacent to Walmart • Minimal property acquisition or easement needed. Costco property is in currently in negotiations as part of the Red Rock Stabilization Project. • Boardwalk offer an intimate connection with the natural areas. • Soft curves and continuous route for commuting and visibility.

Segment C

C6: Along the natural area on existing trail and next to Walmart



C6: Behind Existing Businesses along the natural area



Design Assumptions:

- Signage and pavement markings provide wayfinding for users.
- Pedestrian scale fencing separating trail and natural space.
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots.
- Boardwalk structure minimizes wetland impact.
- Plaza opportunity on east side of Dartmouth/Costco signalized intersection

Segment D

	Costco Driveway to SW 72nd Avenue	Trail Segment Alignment			
		D1	D2	D3	D4
Design Criteria	**Overall Rating**	◑	●	●	●
	User Experience	◑	●	●	●
	Connectivity/Continuity	◑	●	●	●
	Environmental Impacts	●	◑	●	◑
	Ease of Permitting	●	◑	●	◑
	Cost, Constructability and Funding	●	◑	●	●
	Property Ownership	●	◑	●	●
	Safety and Security	◑	●	●	●
	Community Support	◑	●	●	●

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

Seg.	Reasons for Omission
D1	• Adjacent to existing parking lot and significantly above creek resource results in lower user experience • Creates slightly out of direction travel • Does not align well with C6/C6A segment • Increased amount of on-street trail connection, as compared to D2 • Low amount of permitting for stream crossing and impacting vegetated corridor • Small structure crossing Red Rock Creek • Impact and possible removal of existing parking area • Sight lines obscured from one end to the other

Seg.	Reasons to Advance
D2+D3 +D4	• Immediately adjacent to creek, nature • Multiple connection points • Shorter connection to access Walmart trails • Users feel secure with multiple exit points • Accessible by emergency services • SWG support • No likely impacts to archaeological resources • No impacts to significant historic resources • No impacts to use the existing trail easement along edge of AutoZone.(D3) • If trail can be sited within easements obtained for the Red Rock Creek Stabilization project, no additional land rights will be required • Impacts to TriMet parcel- Current negotiations on the Red Rock Creek Stabilization Project will result in a license with TriMet allowing for trail and public use

Segment D

D4: SW 74th Avenue next to the TriMet Park and Ride



Design Assumptions:

- Pedestrian scale fencing separating trail and natural space
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots
- Boardwalk structure minimizes wetland impact
- Mid-block crossing at SW 74th Ave designed for safety
- Grade-separated undercrossing opportunity at SW 72nd Ave (future)
- Enhanced mid-block crossing at SW 72nd Ave designed for safety (interim)
- Signage and pavement markings provide wayfinding for users

Segment E

		Trail Segment Alignment	
	SW 72nd Avenue to SW 68th Parkway	E1	E2
Design Criteria	**Overall Rating**	○	◑
	User Experience	●	●
	Connectivity/Continuity	●	◑
	Environmental Impacts	◑	◑
	Ease of Permitting	◑	◑
	Cost, Constructability and Funding	●	◑
	Property Ownership	◑	●
	Safety and Security	●	◑
	Community Support	●	◑

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

Seg.	Reasons for Omission
E2	• Removed through the public engagement process • Previously identified cultural site • Under development for future park site by private property owner • Out-of-direction travel to access safe crossing at SW 72nd Ave / SW Atlanta • On-street trail experience to access SW 72nd Ave / SW Atlanta

Seg.	Reasons to Advance
E1	• No impacts to significant historic resources • There are no mapped floodplains in the upper reaches of Red Rock Creek • Trail in-line with roadway crossings • No stream crossing necessary • Opportunity for maintenance access along trail to sanitary sewer line • Pedestrian crossing at SW 68th Pkwy has clear sight lines

Segment E

E1: Approaching SW 68th Parkway



Design Assumptions:

- Low retaining walls manage side slope differential
- Pedestrian scale fencing or handrails where necessary
- Mid-block crossing at SW 68th Pkwy designed for safety

Segment F

		Trail Segment Alignment				
	SW 68th Parkway to I-5/Barbur Blvd Intersection	F1	F2	F3	F4	F5
Design Criteria	**Overall Rating**	●	◑	●	◑	◑
	User Experience	●	●	●	○	○
	Connectivity/Continuity	●	●	◑	○	●
	Environmental Impacts	◑	◑	●	●	●
	Ease of Permitting	◑	◑	●	●	◑
	Cost, Constructability and Funding	◑	◑	◑	●	◑
	Property Ownership	●	◑	●	◑	◑
	Safety and Security	◑	◑	●	◑	◑
	Community Support	●	●	◑	●	○

○ Does not meet Criteria
◑ Partially Meets Criteria
● Meets Criteria

Seg	Reasons for Omission
F2	• Portion removed through the public engagement process • Part of this alignment appears to be right on top of the creek channel, just east of SW 68th Pkwy • Steep topo. along Comcast building and parking lot • Bridge crossing Red Rock Creek at upper reach
F4*	• Low user experience being along roadway • Steep grade, challenge to meet ADA accessibility • Topo. challenge from SW 64th Ave to signal at Hwy 99W • Route not as intuitive • Out-of-direction travel along Coronado Street to access signal at Hwy 99W • Low-volume roadway crossing at Coronado Street
F5	• Steep grade, challenge to meet ADA accessibility • Slight out of direction travel • Frequent landing spaces, switchbacks, retaining walls • Significantly impacted by SWC alignment • Not accessible by emergency services • Low-volume roadway crossing at Coronado Street

Seg	Reasons to Advance
F1+F3	• Where work is on fill, low risk to archaeological resources. • Minimize stream impact with bridge crossing; vegetated corridor encroachments will be minimal. • Boardwalk or bridge crossing offers an intimate connection to natural areas. • PGE is supportive of trail location adjacent to substation. • Trail along/below I-5 connects users to nature. • Connection at SW 64th Ave offers a secondary entry to trail. • Utilizing initial portion of F2 avoids conflict with vegetated corridor mitigation plantings and agreement currently in place along Red Rock Creek Commons

* This segment is not part of the preferred alignment alternative but can be considered for an interim (short term) solution which can be turned into a recreational loop.

Segment F

F1: Along PGE Substation



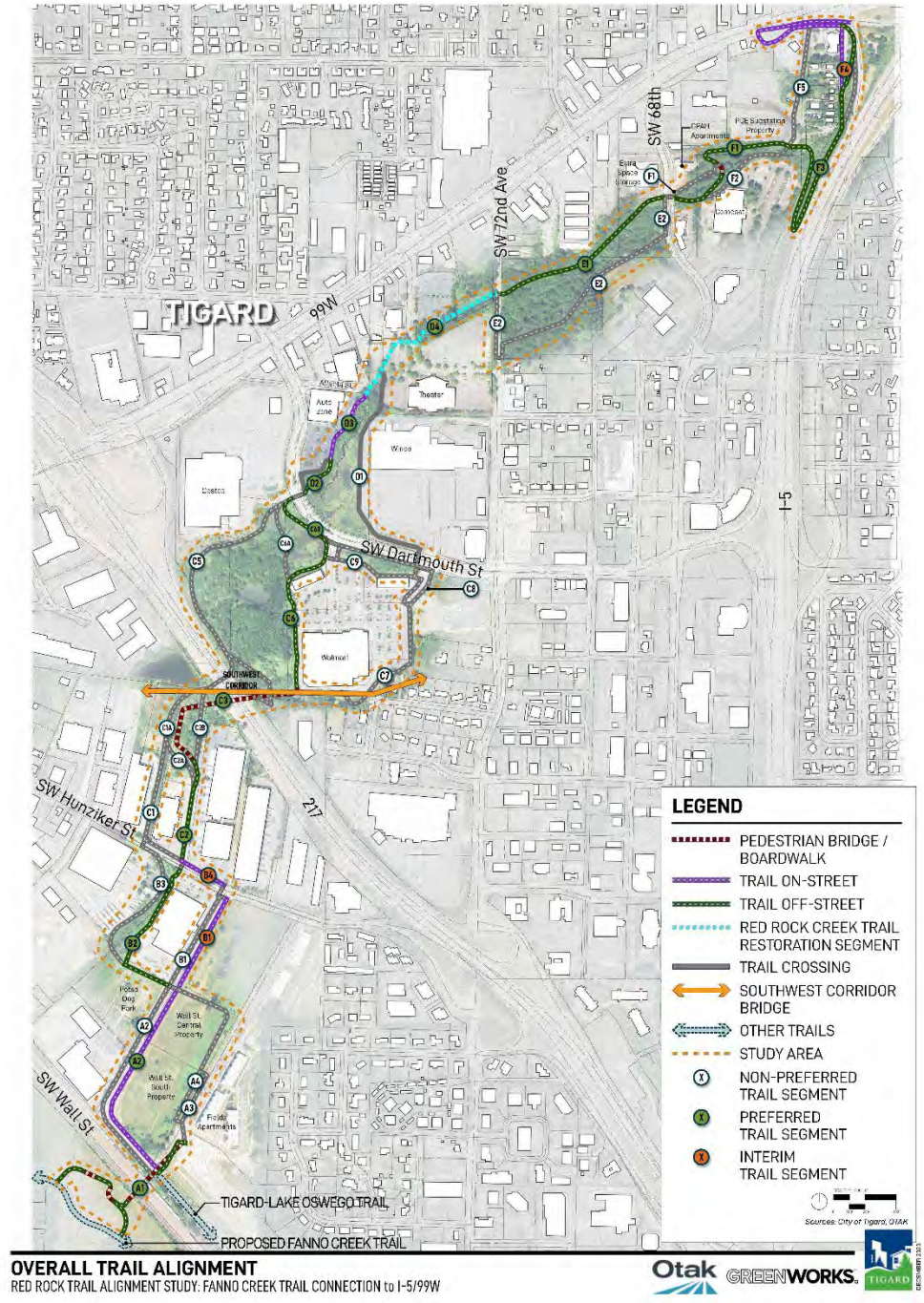
F4: Along I-5 On Ramp



Design Assumptions:

- Landscape buffer along active private property
- Grade-separated crossings over Red Rock Creek
- Retaining walls manage side slope differential
- Pedestrian scale handrails where vertical change is 30" or greater
- Pedestrian scale fencing separating trail and natural space
- Pedestrian scale lighting where trail is adjacent to buildings, parking lots, substation
- Protective barrier separating trail along I-5 on-ramp
- Signage and pavement markings provide wayfinding for users

Figure 6. Alignment Alternatives – Additional Refinement

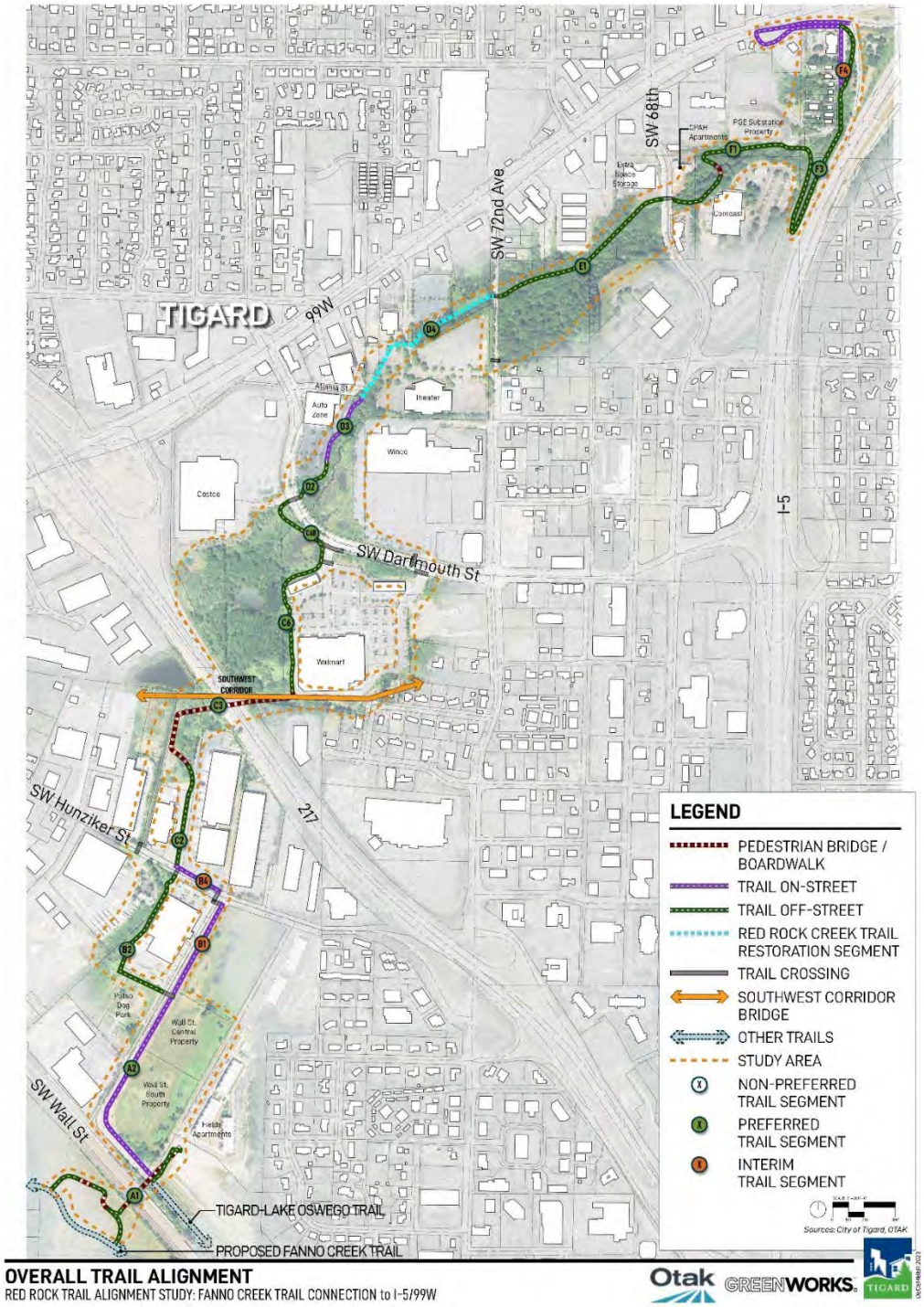


Preferred Alignment

To reach consensus on the preferred alignment the design team used the “Fist to Five” voting process. Fist to Five introduces the element of the quality of the "yes." A fist is a “no” and any number of fingers is a “yes,” with an indication of how good a “yes” it is. This moves a group away from quantity voting to quality voting, which is considerably more informative. This is accomplished by raising hands as in voting, with the number of fingers raised that indicates level of agreement.

At the end of SWG meeting #3, the committee was able to meet consensus on all alignments with the exception of Segment C6. This alignment alternative required additional modifications to meet property owner concerns regarding safety and maintenance along this segment of trail. Figure 7 represents the Preferred Alignment; the design team is following up with the property owners to ensure this portion of the trail received the same analysis and design treatment as alternatives in other constrained areas.

Figure 7. Preferred Alignment



Further Considerations

Recreation Loops

Throughout the alignment alternative selection process, the design team learned that many alignments have value to stakeholders. Their location and connectivity make these remaining alignments eligible to serve as a trail for recreation purposes. Often, residents or employees desire facilities in a series of loops to be used for personal fitness, socializing, or pet exercise. While they are not selected for the preferred alignment for transportation purposes, these remaining alignments should be further studied for recreation loops and identified in the update to Tigard's Trails Master Plan or Parks and Recreation Master Plan.

Trail Connections

Within Segment C3, the preferred alignment will interact with two unique active transportation items that must be well-coordinated throughout final design. As preferred alignment C3 meets grade on the east side of Hwy 217, the trail will must maintain a connection to the remaining Walmart property perimeter trail that continues south and east of the building. This intersection of two trails may require realignment and reconstruction of a portion of the Walmart perimeter trail.

Early communications between Tigard and TriMet have established understanding for an active transportation facility to connect the Hall St and Elmhurst stations, such as including a sidewalk along the length of the elevated guideway of the track. A connection from the Walmart perimeter trail to the elevated guideway trail has been studied conceptually to meet ADA guidelines. While the preferred alignment for Red Rock Creek Trail will be grade-separated at the intersection, future design will include of signage and will manage the confluence of the three trail systems. See Figure 8 and 9 (designed by MIG).

Figure 8. Elevated Multi-Use Path to Red Rock Creek Trail – Plan View

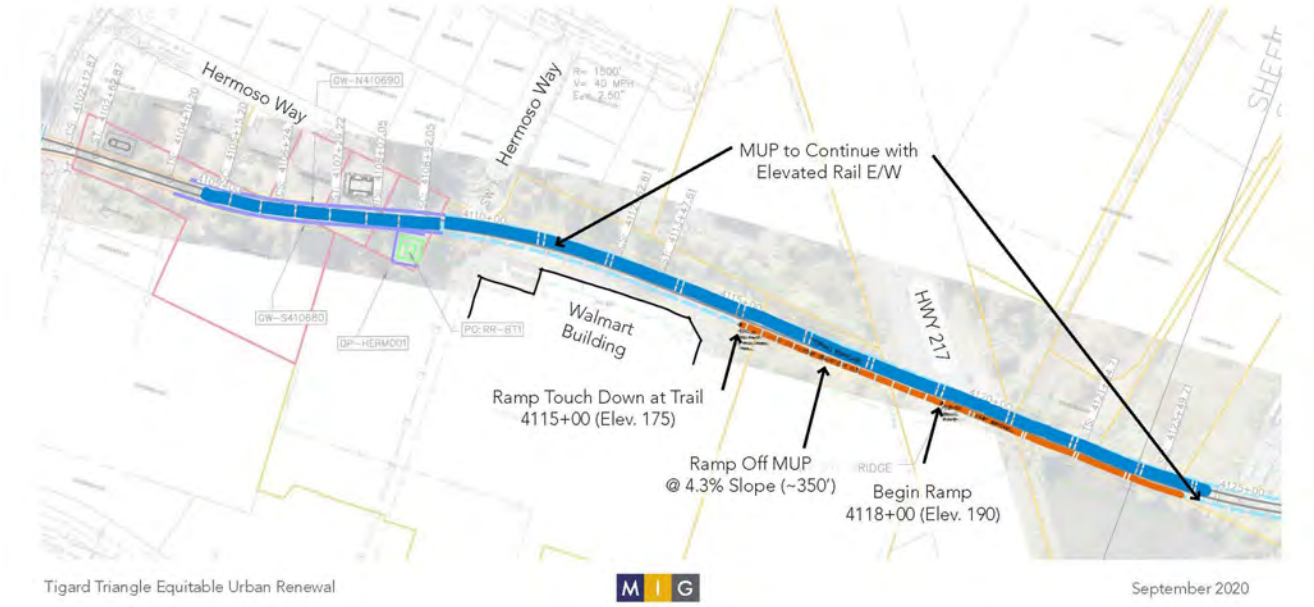
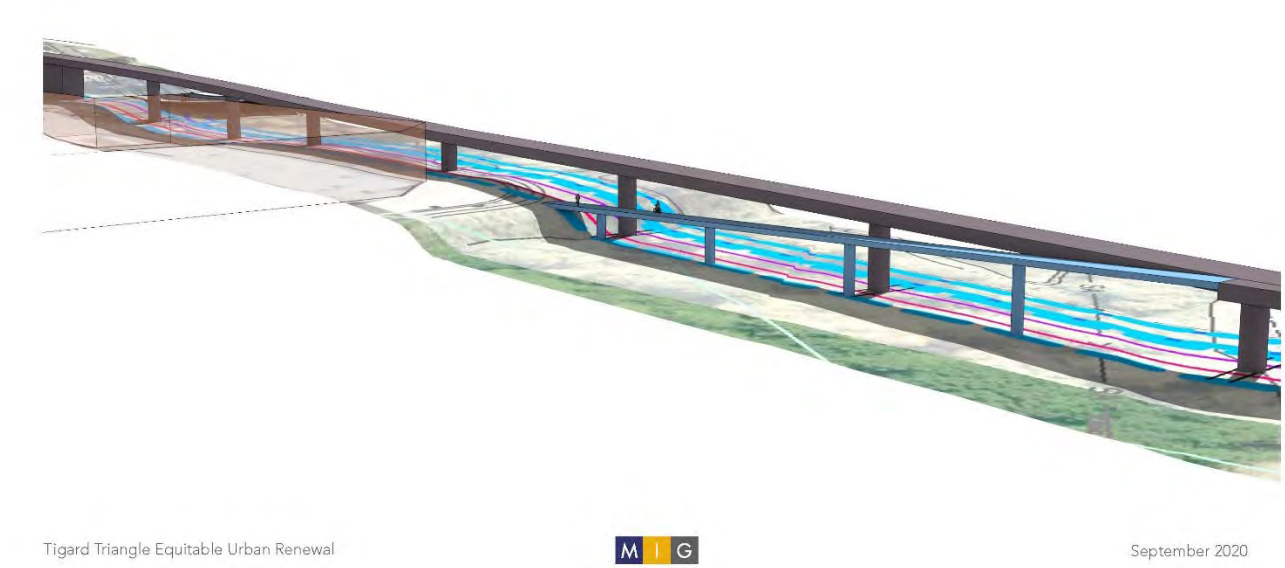


Figure 9. Elevated Multi-Use Path to Red Rock Creek Trail – Alternate View

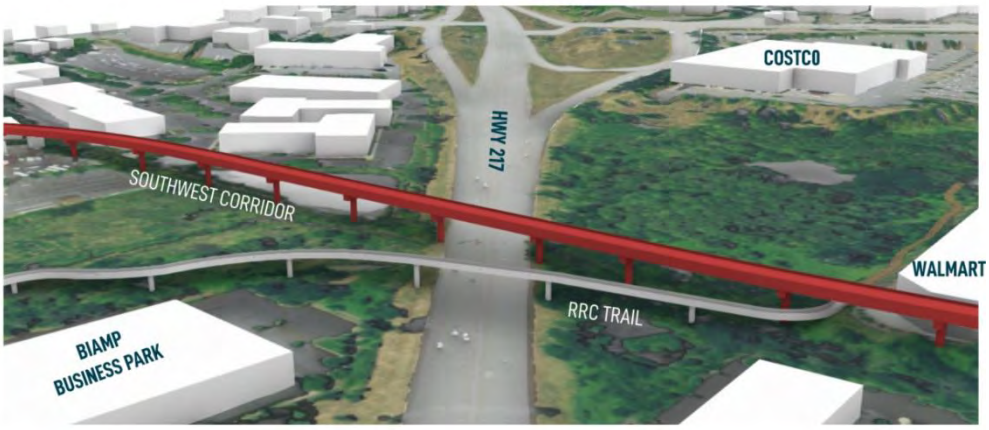


Next Steps

The design team is scheduled to present the preferred alignment to the SWG and conduct a public workshop to share with the community. In these meetings the design team will review the Draft Trail Study Report, final recommendation, high level cost estimate, and implementation strategy.

Appendix D: Grade Separation Bridges





Red Rock Creek Trail Alignment Study
Grade Separation Bridges: OR217 and Portland and Western Railroad
Feasibility Report

Submitted to:
ODOT Region 1 Attn Katie Gillespie
123 NW Flanders St
Portland, OR 97209

Prepared By:
Otak, Inc.
805 Broadway Street, Suite 130
Vancouver, WA 98660
Project No. 20291

July 27, 2023

Otak

TABLE OF CONTENTS

Page

Executive Summary **1**

Introduction and Background **2**

Design Criteria and Project Constraints **3**

Alternatives **3**

Cost Estimates **6**

Cover Page Visualization Sources:

- Red Rock Creek Trail Bridge over railroad, Otak, Inc., 2019
- Red Rock Creek Trail Bridge over Highway 217, GreenWorks, 2023

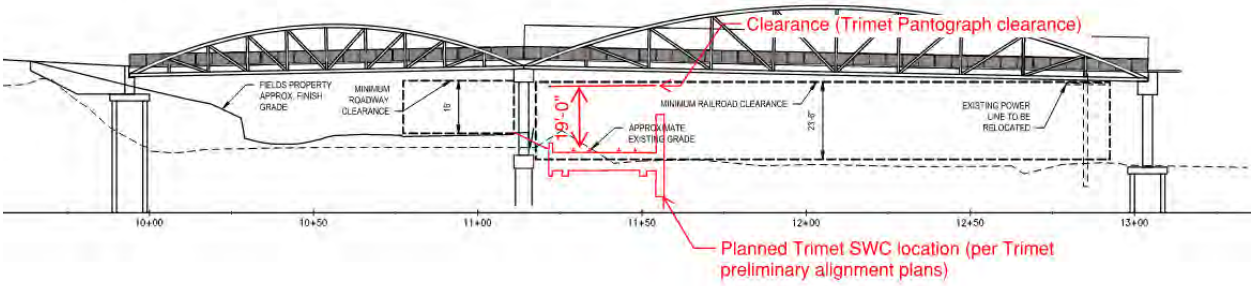
_____	_____
Prepared by Scott Nettleton P.E.	Reviewed by Amanda Owings, P.E.

Executive Summary

The Red Rock Creek Trail grade separation structures are two major bridge crossings required to safely provide uninterrupted pedestrian access along the proposed Red Rock Creek Trail alignment.

Two crossings are identified in proposed study as alignments C1A and C3; to cross over Oregon Highway 217, the crossings are required to span the highway without interim support in the highway median. A lengthy ramp structure approach will be required at the south approach. The north approach also will require ramping to the main grade separation but to a lesser extent. Complicating this selection is the standing agreement between City of Tigard and TriMet to incorporate this pedestrian crossing into the planned Southwest Corridor (SWC) expansion of MAX light rail in the Portland metropolitan area, identified as alignment C1A. Alignment C3 is identified as a separate structure from the SWC structure.

The Portland and Western railroad crossing on proposed alignment A1 has been previously studied and the Type, Size, and Location report for that structure is available under separate cover. That structure remains unchanged, its location confirmed by further analysis within this report. Information concerning the anticipated TriMet MAX vertical clearance at this structure has been investigated and added to the proposed structure elevation and confirms that the proposed grade separation will provide vertical clearance for the MAX line without need to modify the structure grade.

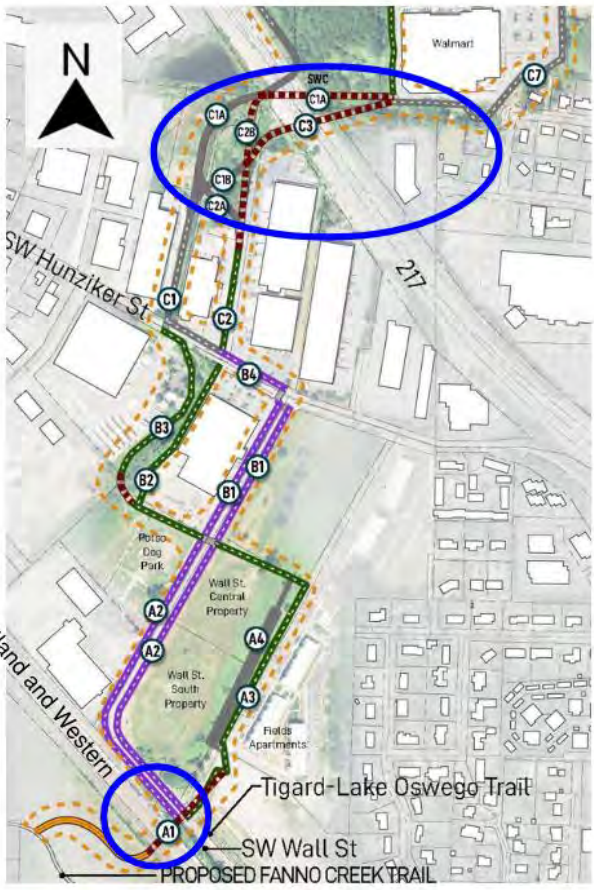


Alignment A3 Portland and Western Separation with TriMet MAX line illustrated

Introduction and Background

The Red Rock Creek Trail is a proposed two-mile multi-use regional trail located in the City of Tigard. The trail is designed to provide pedestrian and bicycle access in a single alignment through public right-of-way and public easements. Red Rock Creek Trail will be used to connect northern Tigard at Highway 99W/I-5 to a connection at its southerly terminus with the Fanno Creek Trail. This connection will be located between the end of SW Milton Court and the landing near the Tigard Public Library. This project is planned to eventually connect to the Tigard-Lake Oswego regional trail. Once completed this regional trail is expected to attract a high concentration of pedestrian traffic through the creation of a more complete, safe and grade separated, pedestrian traffic network.

The Red Rock Creek Trail features two grade-separated crossings. One at the southern terminus crossing above the Portland and Western railroad tracks between the Hunziker Industrial Area and the parklands east of Fanno Creek and the other above Highway 217 southeast of the Highway 99 interchange.



For the railroad crossing, the nearest existing crossings are at-grade crossings located at Hall Boulevard to the west and Bonita Road to the east. This proposed grade-separated crossing would provide safe and consistent accessibility to pedestrians and bicyclists looking to cross these railroad tracks. Safety and accessibility are anticipated to increase the attractiveness and livability of the area leading to increased property values and associated commerce.

The Hwy 217 crossing similarly has established grade separations with sidewalk facilities at the Hwy 99 bridge to the north and west and the SW 72nd Ave crossing to the south and east. The planned TriMet MAX expansion identified as the SWC currently shows a grade separation coincident with Red Rock Creek Trail alignment C1A. An agreement to pursue shared pedestrian access to this crossing between TriMet and the City of Tigard has been reached. However, the SWC project has been placed on indefinite

hold and currently has no planned date to continue toward final design or construction. An alternative alignment, C3, is proposed in a nearby location aligned at a 90 degree orientation to Hwy 217 resulting in shorter spans, leading to some cost savings should this structure be pursued independent of the SWC crossing.

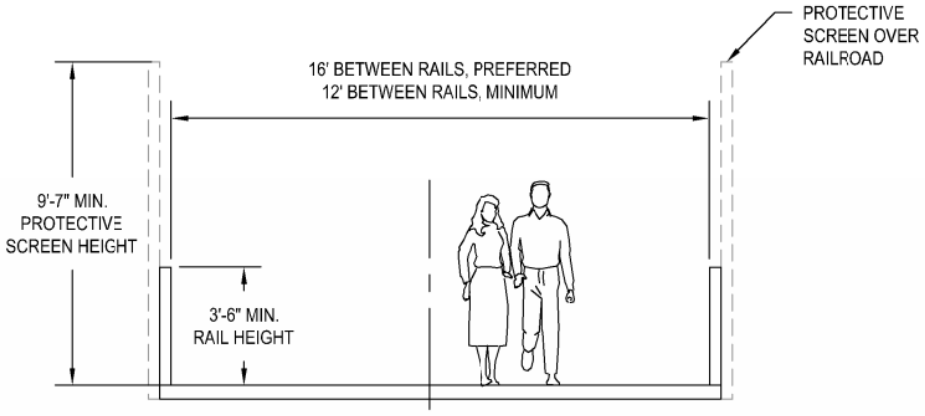
The following alternative analysis will observe topographic surveys, consider generic bridge superstructure and likely subsurface foundation construction costs to establish a preliminary estimate of project bridge costs to be applied to the overall trail alignment study.

Design Criteria and Project Constraints

The main design parameters for the grade-separated crossings are:

- Width of Trail: 12 feet plus a two-foot shoulder on each side
- Width of Bridge: 12 feet minimum inside of railings, 16 feet preferred (assumed for estimation in this report)
- Minimum vertical clearance over Hwy 217: 19.5-feet above paved surfacing
- Minimum vertical clearance over railroad: 23.5-feet from top of rail
- Vertical Clearance over future MAX: Wire height under overpass – 14 ft min (TriMet Design Criteria)
- Minimum vertical clearance over Wall Street: 16-feet from roadway finish grade
- Maximum continuous slope of trail for ADA compliance: 5%, or up to 8.33% with landings at 200-foot intervals
- Assumed structure thickness at mid-span over Hwy 217: 5-feet (trail surface to bottom of structure)

Figure 1: Typical Bridge Section (maximum federal standards shown)



Alternatives

The Portland and Western Railroad crossing has been studied in-depth and a Type, Size, and Location report is available under separate cover. The conclusions of that report remain generally valid for the current trail alignment study and no further analysis has been attempted in this report.

Alignment C1A is expected to be applied to the SWC grade separation structure and structure types and configurations appropriate for light rail transit would be selected for that alignment. This report does not attempt to re-create work performed in the preliminary study of the SWC alignment.

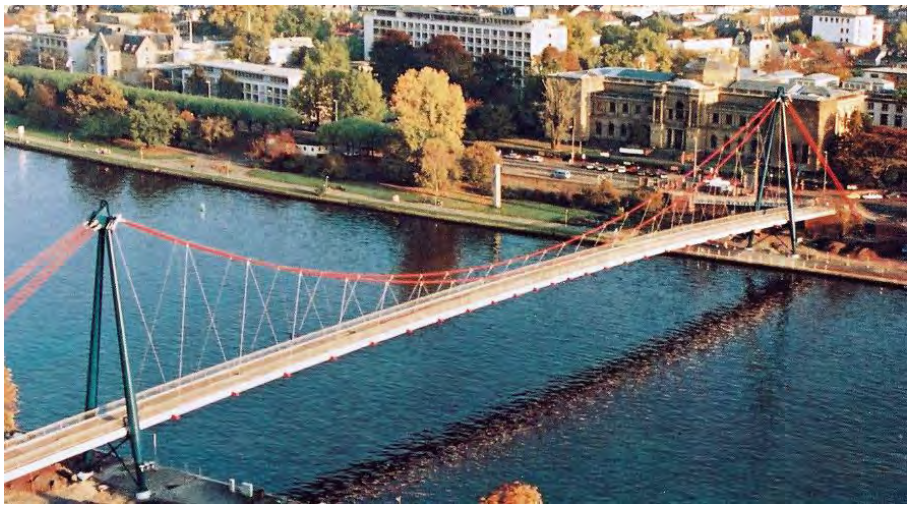
A stand-alone structure along alignment C3 would require a main span over the highway of approximately 250 feet in length to avoid any column support at the OR217 median. This can be achieved using a number of structure types, some structure types that have been successfully installed at this length include:

- Steel Truss
- Suspension
- Arch
- Stress Ribbon

Examples of each of these types that have been constructed with similar spans include:



Kissimee Trail Truss Bridge Steel truss (approx. 225 ft main span)


Holbein Bridge (hybrid suspension bridge, approx. 400 ft main span)



French Prairie Bridge (tied arch, approx. 300 ft main span)



Stress ribbon bridge, approx. span 300 ft

For simplicity the north and south approaches are anticipated to be cast-in-place concrete slab viaduct-style structures comprised of numerous 30 to 40 foot spans as required to elevate the trail above the roadway and return to grade.

Elevators are not included in this estimate due to the high cost of maintenance and concerns for user safety.

Cost Estimates

Square foot estimate of the bridge structure over the Portland and Western Railroad has been previously estimated at $2,085,000 for the bridge structure with total cost to construct of $6,900,000.

On a per square foot basis this equates to $425 per square foot of walking surface area. Applying this cost to the main span of the Hwy 217 crossing that span can be anticipated to be 250ft x 16ft x $425/SF = $1,700,000.

The approach structures are estimated at $300 per square foot of trail area. Total anticipated length of approach to both ends of the structure is estimated to be 850 feet of viaduct structure. The cost for approaches to the C3 alignment bridge is estimated to be $4,080,000.

Table 1: Preliminary Project Costs, Hwy 217 Grade Separation

Main Span Construction Cost	$1,700,000
Connecting viaduct Cost	$4,080,000
Contingecy (40%)	$3,264,000
Engineering Services (20%)	$1,808,800
Construction mangement (15%)	$1,356,600
Total Structure Cost	$12,209,400

Total costs for both grade separation structure, irrespective and independent of a TriMet SWC structure, is estimated to be $19,200,000 to complete both major structures.

Appendix E: Type, Size, and Location Report - Fields Property



Fields Property – Red Rock Creek Trail Bridge

Type, Size, and Location Report

Final

Submitted to:
Skip Grodahl
DBG Properties, LLC
2164 SW Park Pl
Portland, OR 97205

Prepared By:
Otak, Inc.
700 Washington Street, Suite 300
Vancouver, WA 98660
Project No. 17052.005

January 8, 2021

Otak

TABLE OF CONTENTS

Page

Executive Summary **1**

Introduction and Background **3**

Design Criteria and Project Constraints **5**

Alternatives Studied **8**

Bridge Options 9

Renewable Energy Installation Addition 14

Trail Options 14

Cost Estimates **21**

Evaluation for Selected Preferred Alternate **21**

Conclusion and Next Steps **22**

Appendices

Appendix A—Preferred Alternate Drawings and Cost Estimate
Appendix B—Examined Alternates Drawings
Appendix C—Examined Alternates Cost Estimates
Appendix D—Handrail Protective Fencing Exhibit
Appendix E—Renewable Energy and Resiliency Study
Appendix F—Drainage Memo
Appendix G—Rail Crossing Order Draft
Appendix H—Preliminary Foundation Report

Figures

Figure 1: Red Rock Creek Trail 4
Figure 2: Typical Bridge Section (maximum federal standards shown) 5
Figure 3: Typical Trail Section 5
Figure 4: Typical Bridge Profile 6
Figure 5: Site Constraints West of Railroad 7
Figure 6: Reserve Street Pedestrian Bridge, Missoula MT 9
Figure 7: Bowstring Truss Bridge 9
Figure 8: Woodburn Interchange Lighting, Woodburn, OR 10
Figure 9: Spring Creek Bridge, Winthrop WA 11
Figure 10: Cable Stay Bridge 11
Figure 11: Up Lighting at Tillicum Crossing Bridge, Portland, OR 12
Figure 12: Cantilevered Arch Truss Bridge 13
Figure 13: Examples of Black Painted and Weathering Steel 13
Figure 14: Examples of Oregon Green Color 13
Figure 15: Trail Connection Option 1 16
Figure 16: Trail Connection Option 2 17
Figure 17: Trail Connection Option 3 18
Figure 18: Trail Connection Option 3, Mirrored Alignment 19
Figure 19: Elevator Connection Option 20

Tables

Table 1—Cost Comparison of Bridge Options 21
Table 2—Cost Comparison of Trail Options 21
Table 3--Preliminary Recommended Design Project Costs 22



01-21-2021

Prepared by Elizabeth Gregg

Reviewed by Scott Nettleton, P.E.

Executive Summary

The Red Rock Creek Trail is a proposed 2-mile multi-use regional trail located in the City of Tigard. When complete, the trail will connect northern Tigard with the currently under design Fanno Creek Trail connection between the end of SW Milton Court and the landing near the Tigard Public Library. The Red Rock Creek trail could also provide pedestrian and bicycle access to recreation fields which may be constructed in the undeveloped area between this new segment of the Fanno Creek Trail and the adjacent railroad. When complete, this section of the Red Rock Creek Trail will provide grade separation above the Railroad for connection to the eventual build-out of the Tigard-Lake Oswego regional trail. The regional trail will establish a network of connectivity and a specific concentration for pedestrian traffic to the site to avoid an at-grade crossing with the inherent dangers of crossing the railroad and an expectation of attractive and high usage volumes.

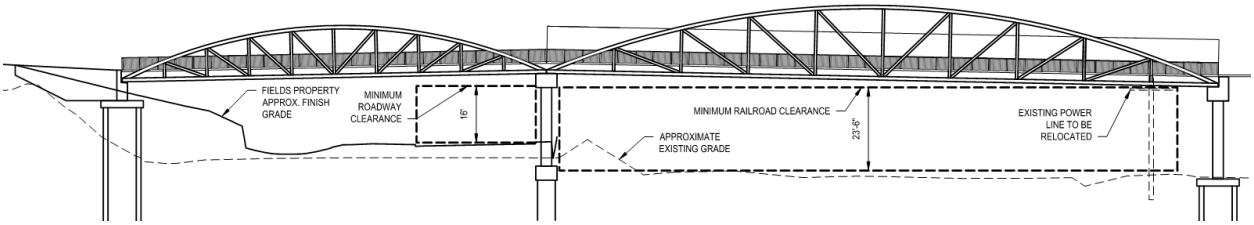
Completing this connection, the trail alignment crosses the existing railroad tracks between the Hunziker Industrial Area, currently being developed, and the park setting east of Fanno Creek. The rail alignment is owned in part by Portland and Western Railroad, a subsidiary of Genesee and Wyoming railroad. Trimet is currently in the preliminary design phases of Southwest Corridor light rail extension, which positions the light rail along the on the east side of this railroad right-of-way and it is anticipated that the Agency will purchase a segment to support this alignment. Currently, the nearest crossings of the railroad in this area are at-grade crossings at Hall Boulevard to the west and Bonita Road to the east.

The purpose of this alternatives analysis is to examine structure types, gather relevant information through engineering investigations with topographic survey, subsurface foundations exploration, search of public records and contact with directly affected parties to define potential outcomes leading to a preliminary recommended design that defines the budgetary requirements to achieve project completion.

Initial brainstorming considered all structure types and configurations. The given need to span above the railroad and given clearance needed favored structure types with the superstructure above the deck level to minimize the bridge landing elevation, and hence the path length to grade in the park. This eliminated deck girder type structures, such as a typical prestressed concrete girder bridge from further consideration. This initial brainstorming identified six structure types to be pursued, ranging from conventional truss to long span cable supported structures. All six alternates featured steel superstructures to minimize the superstructure depth, thereby reducing the approach height, length to grade, and slopes for ADA compliance. Steel structures also respect a major City of Tigard area employer, Fought and Co.; Fought participated in type selection meetings. The initial set of structures were reduced to 3 viable alternatives through discussion with the interested parties. These are, in order of anticipated cost: A two-span bowstring truss; a cable stayed, single tower structure; and a unique cantilever truss configured with the truss above a suspended deck surface below.

In addition to the structure types, approach alignments and grades at either end have been considered with understanding that Americans with Disabilities Act compliance for both the bridge and the approaches is required. To the east the bridgehead connection has been developed and coordinated, to date, with the planned site development of the Fields Property, and to the west the design standard for the Fanno Creek trail has been emulated. Several alignments and access options, including consideration of a public elevator, have been developed, the costliest being those that rely on high walls to avoid ROW impact to the adjacent railroad property. Approaches that incorporate an elevator were eventually rejected due to long term maintenance concerns despite being price competitive.

The preferred alternative is a bowstring truss bridge with an anticipated budget to completion, not considering future inflation, of $6,685,000 including completion of engineering design and construction activities.



Introduction and Background

The Red Rock Creek Trail is a proposed 2-mile multi-use regional trail located in the City of Tigard. When complete, the trail will connect northern Tigard with the currently under design Fanno Creek Trail connection between the end of SW Milton Court and the landing near the Tigard Public Library. The Red Rock Creek trail could also provide pedestrian and bicycle access to recreation fields which may be constructed in the undeveloped area between this new segment of the Fanno Creek Trail and the adjacent railroad. When complete, this section of the Red Rock Creek Trail will provide grade separation above the Railroad for connection to the eventual build-out of the Tigard-Lake Oswego regional trail. The regional trail will establish a network of connectivity and a specific concentration for pedestrian traffic to the site to avoid an at-grade crossing with the inherent dangers of crossing the railroad and an expectation of attractive and high usage volumes.

Completing this connection, the trail alignment crosses the existing railroad tracks between the Hunziker Industrial Area, currently being developed, and the park setting east of Fanno Creek. The rail alignment is owned in part by Portland and Western Railroad, a subsidiary of Genesee and Wyoming railroad. Trimet is currently in the preliminary design phases of Southwest Corridor light rail extension, which positions the light rail along the on the east side of this railroad right-of-way and it is anticipated that the Agency will purchase a segment to support this alignment. Currently, the nearest crossings of the railroad in this area are at-grade crossings at Hall Boulevard to the west and Bonita Road to the east.

The purpose of this alternatives analysis is to examine structure types, gather relevant information through engineering investigations with topographic survey, subsurface foundations exploration, search of public records and contact with directly affected parties to define potential outcomes leading to a preliminary recommended design that defines the budgetary requirements to achieve project completion.

DBG Properties, LLC and City of Tigard have reached an agreement to study the feasibility of a grade separated crossing originating on the Field's Property development owned by DBG. This crossing would provide a more direct link to the Fanno Creek Trail and library, while also providing value to the Field's Property development. Otak, Inc. was retained by DBG to perform an alternatives analysis for the proposed crossing. The park property to the west is under joint ownership by the City of Tigard and Metro. The east bridgehead is on the DBG property and spans Wall Street/Tech Center drive currently being constructed parallel to the railroad alignment. Trimet and Genessee and Wyoming Railroad are affected landowners but are not party to this study.

Figure 1: Red Rock Creek Trail

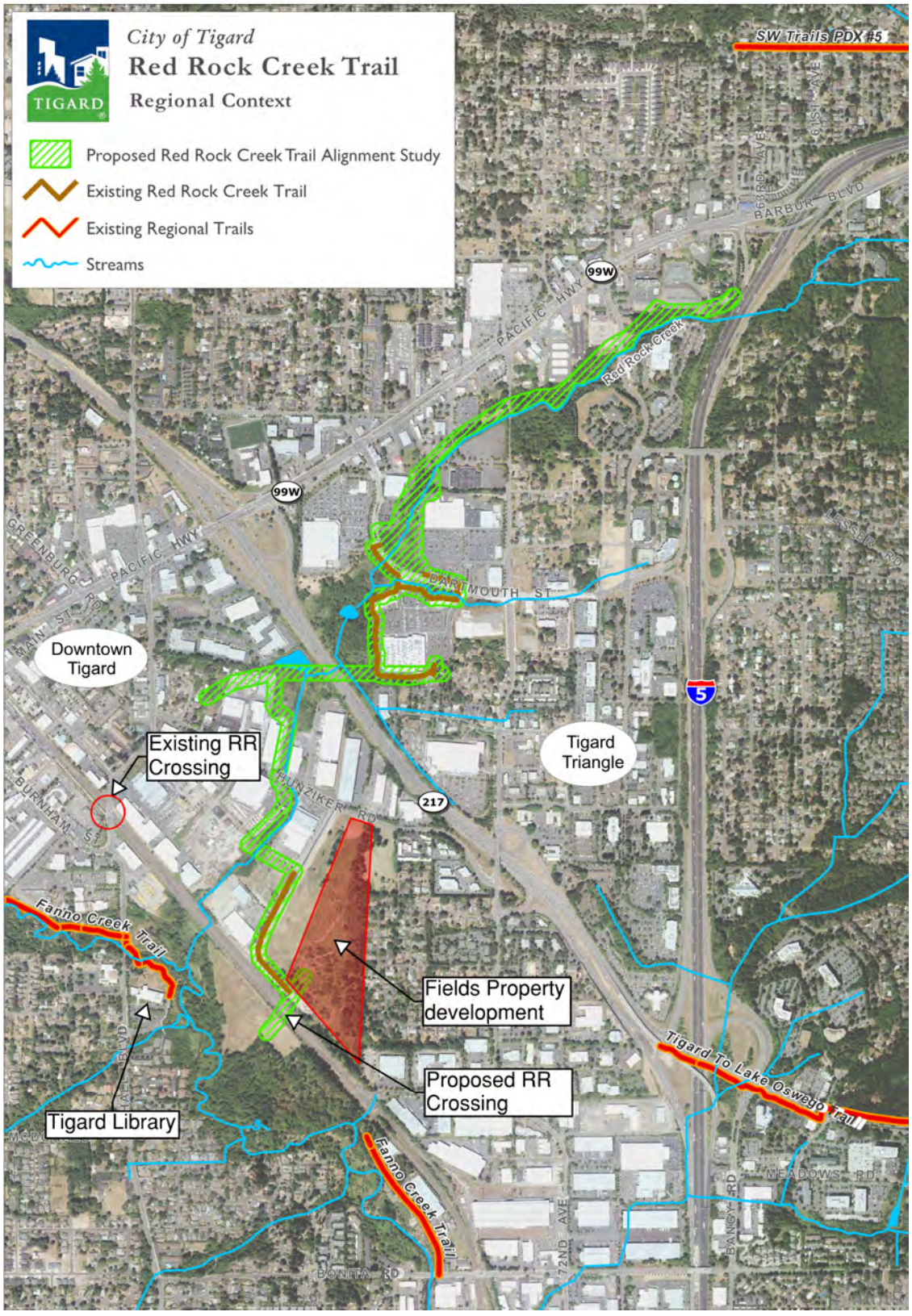


Image Courtesy of City of Tigard

Design Criteria and Project Constraints

The main design parameters for the crossing are:

- Width of Trail: 12 feet plus a two-foot shoulder on each side
- Width of Bridge: 12 feet minimum inside of railings, 16 feet preferred
- Minimum vertical clearance over Railroad: 23.5 feet from top of rail
- Minimum vertical clearance over Wall Street: 16 feet from roadway finish grade
- Horizontal clearance along Railroad: 25 feet from centerline of track
- Maximum continuous slope of trail for ADA compliance: 5%, or up to 8.33% with landings at regular intervals
- Seismic Design: 1,000-year Life Safety

This crossing poses several safety concerns for users of the Red Rock Creek Trail. The current crossing is an at-grade crossing of the railroad, and Hall Boulevard currently only has sidewalks on the far side of the street, requiring additional work along Hall or an at-grade crossing of a busy street. With the planned location of the Red Rock Creek Trail, connecting to this crossing also requires around three-quarters of a mile of out of direction travel.

Typical bridge and trail sections and a typical bridge profile are shown in Figures 2 to 4.

Figure 2: Typical Bridge Section (maximum federal standards shown)

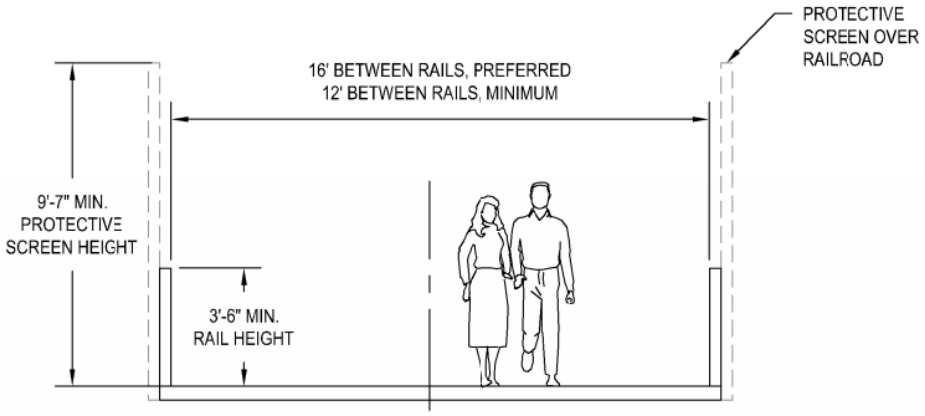
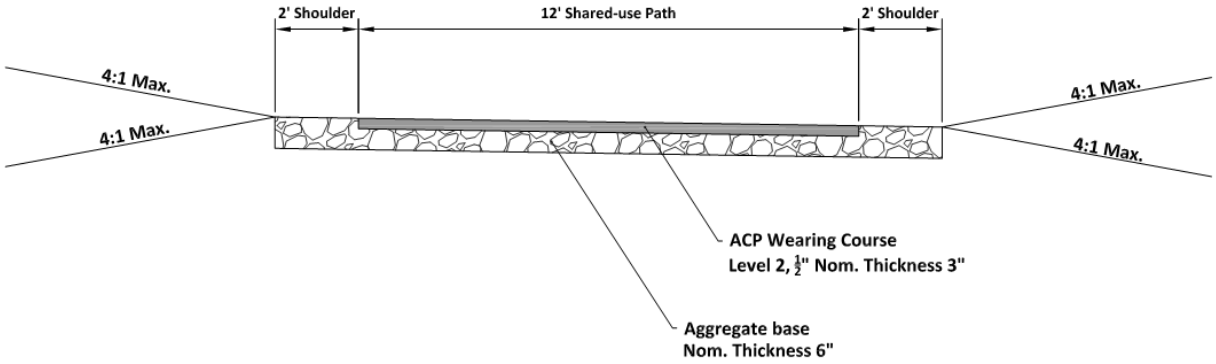


Figure 3: Typical Trail Section



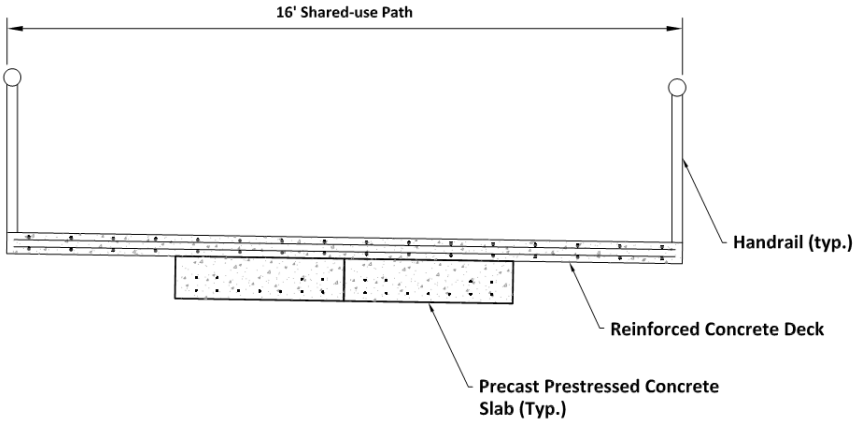
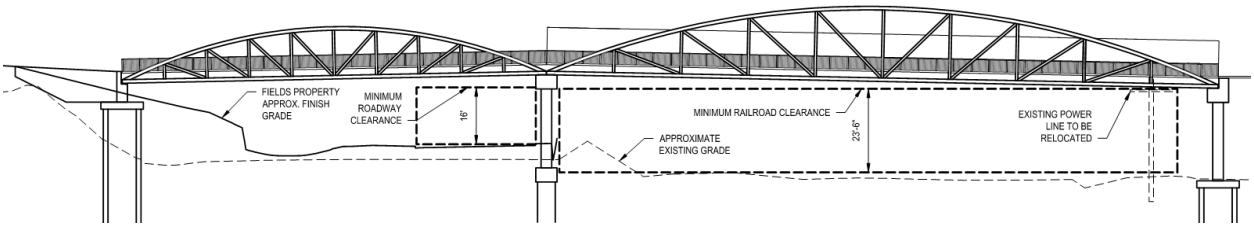


Figure 4: Typical Bridge Profile



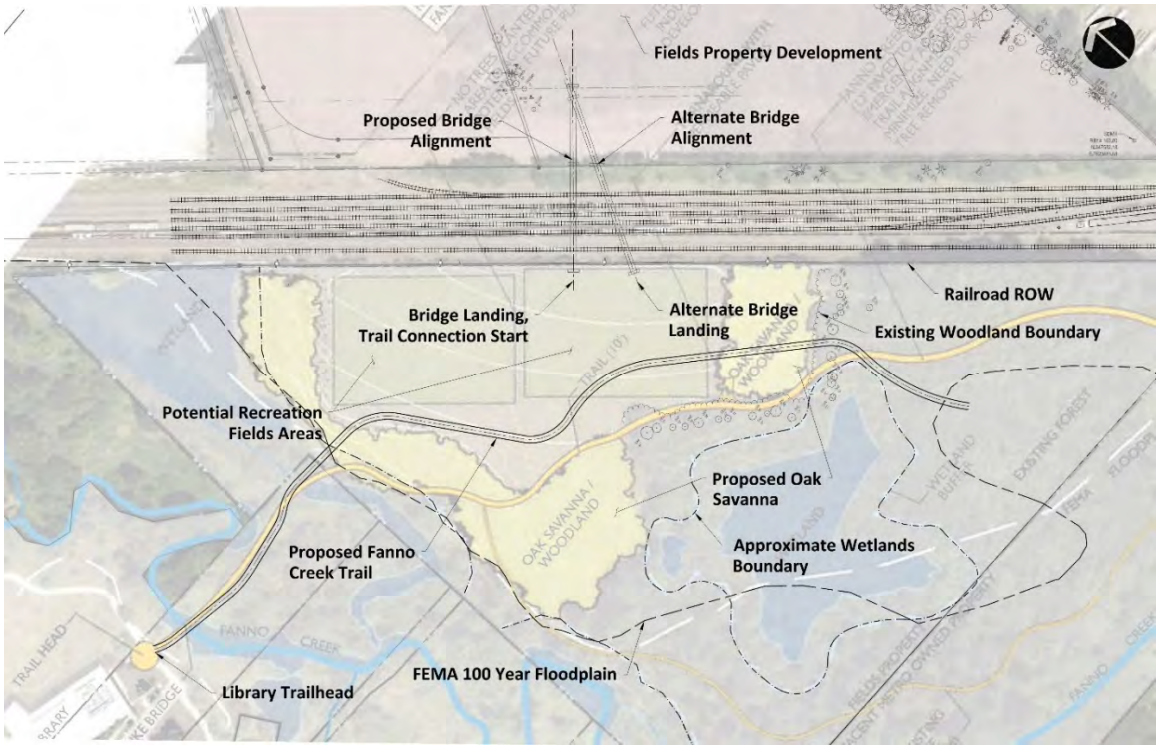
In addition to these design criteria, there are other constraints on the project. These constraints include environmental impacts, the possibility of recreation fields being constructed on the west side of the railroad, extended ADA access to the crossing, impacts to the Field's Property development and use, and geotechnical design and analysis considerations.

The proposed crossing will have environmental impacts on the undeveloped area near the Fanno Creek Trail. Trail alignments through this area should consider impacts to wetlands and known turtle habitat near Fanno Creek, impacts to oak savanna and other forested areas in the vicinity, and impacts to animal movements through the open fields area.

Currently, plans do not call for lighting on the trail on the west side of the bridge. The design team has considered the potential for the completed trail to become a significant commuter route for bicyclists and pedestrians, but a more thorough analysis of usage would be needed to determine if installing lighting on the trail is a worthwhile investment, this analysis has not been performed here. It would be reasonable to assume that night use, given the contact between tis development and the Tigard downtown core area, may be a desirable attribute, and consideration for installation of infrastructure of electrical conduit and identified light pole locations as part of a future enhancement project is recommended. No costs for such installations have been included in the estimates with this report.

The proposed crossing would also need to consider the possibility of recreation fields being constructed in the undeveloped area near Fanno Creek. Currently, Otak understands that this is not the preferred location for the recreation fields. However, as this site has not been ruled out, at least one trail alignment alternate should accommodate future recreation fields.

Figure 5: Site Constraints West of Railroad



Extended ADA access to the bridge should be provided on both ends in addition to ADA compliance on the bridge itself. On the west side of the railroad, access should be provided from the Fanno Creek Trail (also ADA compliant) to the bridge via a trail constructed on either earth berms, structure, or both. On the east side of the railroad, accessible routes should provide a connection from the Red Rock Creek Trail on Wall Street to the bridge. Accessible routes should also be located within the Fields Property to connect the greater development with the bridge on the south end.

Though not an established hard constraint for the project, consideration should be given to maintaining a minimum trail radius on the west side access path in accordance with AASHTO recommendations for curve radius on a shared-use path. The minimum radius of 75 feet is based on an assumed bicycle design speed of 20 mph for shared-use paths in urban areas. At the time of this report the minimum radius requirement is understood to be a controlling constraint in order to capture state and federal funding for the project. Regardless, given the site constraints established at this time the west side approach design considers alternatives that do not meet this requirement in order to address environmental, land use and and aesthetic concerns.

As bridge and trail options are being considered independently in this analysis, the final trail alignment will need to be adjusted to match with the final location of the west bridge landing.

The proposed east side bridge landing is located on the south end of the Fields Property immediately adjacent to proposed office buildings. Currently, the site plan for the office buildings is still in development, but the bridge design should consider the effect of the bridge landing on the office buildings and continued coordination is required to ensure that the bridge landings and office buildings are located in the optimal positions. In particular the alignment of trail access to the east bridgehead will fluctuate as the site design continues to be developed and that access is currently considered to be a part of that development. It is understood that an ADA accessible path from Wall Street to the property buildings is a desirable feature of the site development and will be included with that final site plan. An estimate of the costs for the east bridge head is included in the cost estimates in this report.

Geotechnical investigations on the northeast side of the railroad near the Fields Property Development indicates soft soils and deep bedrock elevations. A preliminary foundation report detailing the investigations is attached in Appendix H. Based on the geotechnical findings, bridge foundations and foundations for bridge approach structures would be driven piles or drilled shafts. Borings also revealed the presence of liquefiable soils in the area. In an earthquake event, these soils could settle by up to 5 inches. Approach embankments, retaining walls, and any other structure not on deep foundations would be designed for potential settlements.

Alternatives Studied

Based on the above design constraints along with environmental and geotechnical considerations, various trail and bridge options were developed. Of the many bridge types and configurations considered, three options where selected for further study based on aesthetics, site configuration, and cost.

The overall aesthetic of the bridge design was chosen to harmonize between the railroad crossing, the developed property and the natural park settings of the site. Generally, the railroad aesthetic incorporates use of truss or lattice elements and “rusted” steel emulated with weathering steel where possible, or painted steel in a brown or black coloring, again to emulate the industrial style of the surroundings. In addition to the railroad aesthetic, the bridge would also need to mesh with the look of the Field’s Property development on one end and the natural field and forested areas on the other. To accomplish this, preference was given to bridges utilizing a modern structure type, enhancing the development, muted colors reflecting the natural park environment and looking to incorporating industrial elements that would reflect the historic use at the site where appropriate.

The configuration of the bridge and trail considers several factors. First the bridge landing on the Fields Property development has some impact on the layout of the office buildings planned in this location. Because of this, two bridge alignments were considered. The first alignment is perpendicular to the railroad. This reduces the overall length of the bridge and therefore the overall costs but requires the office buildings to be shifted southeast or reduced in size. The second alignment is angled to the railroad, which helps the bridge to connect more easily to the planned access route from the Field’s Property and increases the available room for the office buildings; however, it also lengthens the bridge by approximately 20 feet with the associated increase the bridge costs for all options.

Based on geotechnical investigations, all bridge options will be founded on deep foundations. Driven piles are the preferred foundation type as they are generally less costly, however, at the center support for two span options founding on a drilled shaft may be more economical given there is limited space available to locate between the constructed Wall Street and the railroad right-of-way line. This limiting space would affect the number of driven piles that can be used for that foundation. In order to achieve the required foundation strength, a drilled shaft would likely be required given these restrictions. It is recommended that final design, however, consider a number of factors. These include the imminent change in ownership. This location is currently being considered for purchase by Trimet for a light rail corridor. While Heavy Rail has restrictive requirements for placing foundations within their property, which would be costly to accommodate, light rail is considerably more flexible and if at the time of final design, the purchase has progressed coordination with Trimet may allow for a driven pile foundation at this location. Additionally, while Wall street is recently constructed, it may prove economical to deconstruct and re-build a portion of the shoulder of this roadway, again to accommodate the wider pile supported foundation. Should either of these scenarios prove too restrictive to the construction there will be some increase in mobilization costs to use both drilled shafts and driven piles, but these costs will likely be offset by the difference in price between driven piles and drilled shafts. This has been assumed and captured in the estimates prepared for this report.

Bridge Options

Option 1—Bowstring Truss

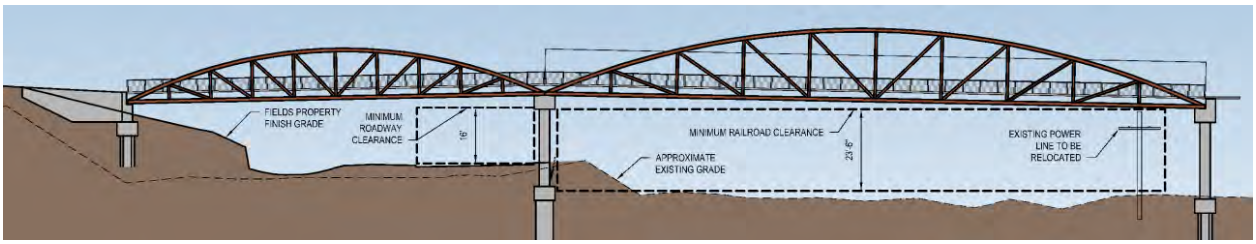
The first option studied was a two-span bowstring truss bridge. This bridge was chosen for its widespread availability and relatively low cost. The bowstring truss style is chosen over the more typical rectangular truss type for its more graceful aesthetic.

Figure 6: Reserve Street Pedestrian Bridge, Missoula MT



This underscores the aesthetic emphasis for the location. The underlying railroad is a typical switch yard configuration with multiple tracks and remains a difficult aesthetic challenge for the immediate vicinity. The Fields Property is the first property to develop along this yard area for purposes other than an industrial development. The transition from the developed site into the more natural park setting to the west also demands a softer structure that deemphasizes the linearity and hard edges of the railroad.

Figure 7: Bowstring Truss Bridge



The bowstring truss bridge features two spans; span 1 is 118 feet long, and span 2 is 190 feet long. Because of the difference in length, the truss spans maintain the aspect ratio of height to length which provides a graceful appearance in profile. This is even more significant in a foreshortened view, which will be the primary angle that the structure will be observed. The structure appropriately reacts to its site with the clear asymmetry in the overall bridge arrangement. The trusses would be fabricated with weathering steel out of respect to the railroad aesthetic.

Bridge rails could be either conventional metal railings or decorative mesh panels set into the truss openings. Conventional metal railings would provide a more open feel but would require a separate section over the railroad for fall protection. Decorative panels would feel more enclosed but would provide better continuity across the bridge as the same panels can be used across the whole bridge. Lighting, if any, remains an issue of discussion. Aesthetic lighting could be applied to this structure with great effect similar to that applied nearby on the Woodburn Interchange crossing above Interstate 5.

Figure 8: Woodburn Interchange Lighting, Woodburn, OR



The bowstring truss bridge would be fabricated in a shop and shipped to the site in pieces. The pieces would be assembled in a staging area near the bridge site and then lifted into place with cranes. This minimizes impacts on the railroad, thereby minimizing project costs. However, the placement of the bridge would still require a temporary closure of the railroad and Wall Street lasting several hours. As this project is still in the preliminary phases, no coordination with the railroad regarding closure times or duration has been performed.

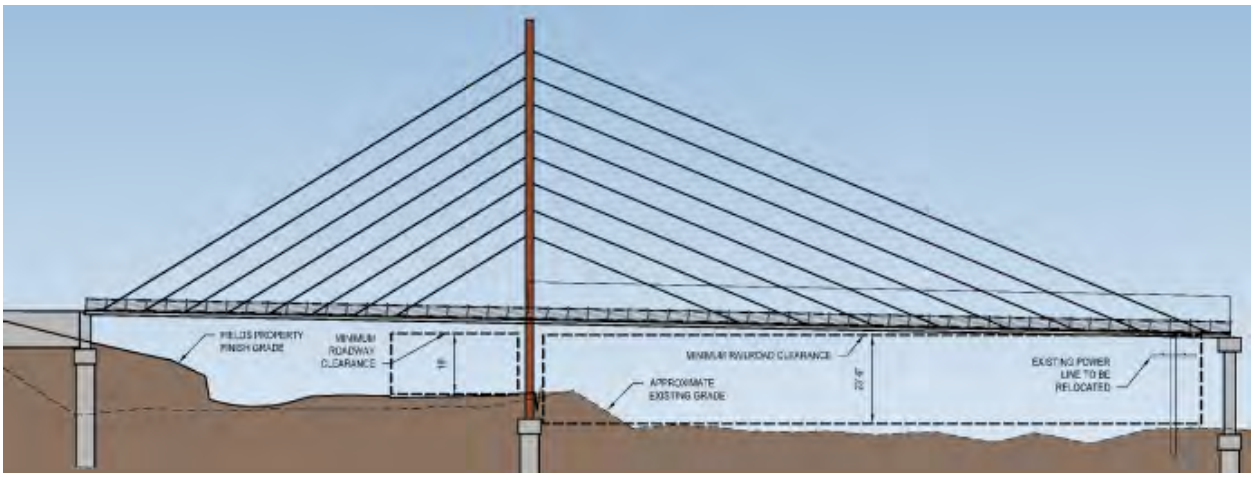
Option 2—Cable Stay

Figure 9: Spring Creek Bridge, Winthrop WA



The second option studied was a single tower cable stay bridge. This bridge was chosen to provide a "signature" look with minimal impacts to the railroad. This structure type is particularly attractive as it can be erected in a section by section manner with limited impact to rail operations throughout construction.

Figure 10: Cable Stay Bridge



The central support was designed to match the railroad aesthetic by mimicking the look of a truss portal frame, similar to the photograph of the Spring Creek structure. To further the aesthetic, the central tower would be fabricated with weathering steel. The placement of the central support is confined by Wall Street and the railroad right-of-way; this causes the central support to not be in the center of the bridge span. The bridge deck would be made of light, thin elements to further emphasize the central support, and provide a lighter, less busy look overall.

Similar to the bowstring truss option bridge rails could be either conventional metal railings or decorative mesh panels. Conventional metal railings would provide a more open feel but would require a separate section over the railroad for fall protection. Decorative panels would feel more enclosed but would provide better continuity across the bridge as the same panels can be used across the whole bridge. Lighting, if any, remains an issue of discussion. Up lighting of structures of this type for aesthetic effect is a proven methodology to enhance the dramatic lines of the structure.

Figure 11: Up Lighting at Tillicum Crossing Bridge, Portland, OR



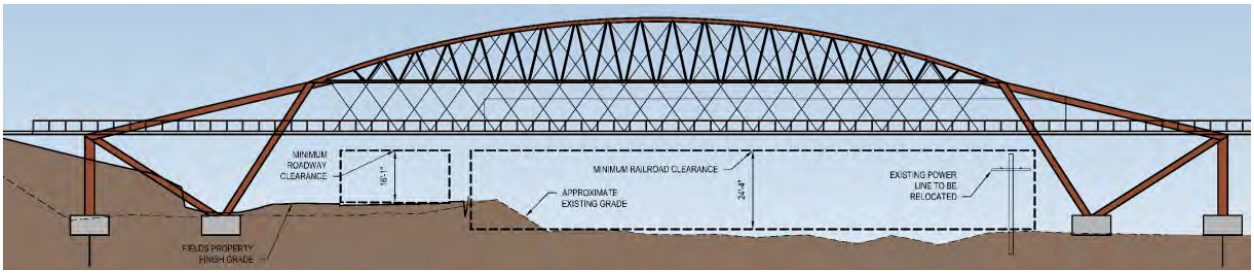
The central support for the cable stayed bridge would be fabricated in a shop, then shipped to the site and erected. Deck sections would then be placed from the central support outward over Wall Street and the railroad. The deck sections are smaller and lighter that full sized truss spans and can be placed with smaller equipment, thereby reducing construction cost. This method minimizes impact to the railroad but would probably still require temporary closures of the railroad and Wall Street during the deck placement.

Option 3—Cantilevered Arch Truss

The third option studied was a three-dimensional truss structure with cantilevered trussed ends. This bridge was chosen to provide a unique, signature bridge structure while eliminating a central pier and causing minimal impacts to the railroad during construction. The cantilevered ends of this bridge would be constructed first. While the ends are being constructed, the center truss span would be assembled nearby. The center span would then be lifted and set into place and secured to the cantilevered ends. After the structure is in place, deck sections would then be suspended from the center span in a section by section manner. The deck sections are smaller and lighter than the center truss span and can be placed with smaller equipment, thereby reducing construction cost. This option has minimal impacts to the railroad and only requires one railroad closure as the center span is placed.

This would be a unique bridge type and configuration without a known equivalent, bringing that notoriety to the bridge and to the City of Tigard.

Figure 12: Cantilevered Arch Truss Bridge



The aesthetic of this option differs significantly from the other two options. The profile of the bridge is asymmetrical, as the north east cantilever end is almost entirely buried while the south west end is entirely exposed. The center truss span serves as the focal point of the bridge with a light, thin deck suspended below it. The bridge could be made with weathering steel or painted black for a more historical look or could be painted in other colors for a more modern feel. For a different historical feel, the bridge could even be painted the same green color (Oregon green) as bridges like the St. Johns Bridge or the Coos Bay Bridge.

Figure 13: Examples of Black Painted and Weathering Steel





Figure 14: Examples of Oregon Green Color





This bridge also has much more substantial foundations than the other options. Both compression and tension supports will be required to anchor the cantilevered ends. The compression supports will be founded on driven piles, while the tension supports will likely be micropiles. The increased size of the foundations will reduce some of the usable space for the office building development on the east side and the potential ball fields on the west side.

Renewable Energy Installation Addition

The Red Rock Creek Bridge has been identified as an important location for the City of Tigard's renewable energy and resiliency initiatives. The team has examined the feasibility of including renewable energy generation in the construction of the Red Rock Creek Bridge.

The team performed a study of two options for Photovoltaic (PV) solar panel arrays located on the bowstring truss bridge option. PAE's conclusions and figures are included in Appendix E. The study concluded that PV panels placed on top of the bridge would produce enough electricity to offset the electricity used by bridge lighting, while excess production could be used to support renewable energy and resiliency goals within the City of Tigard.

The first option places panels in a sawtooth pattern to achieve optimum angles for generation. This option creates visual interest for the bridge structure while providing the most efficient output for the individual solar panels. However, self-shading limits the size of the panels that can be used, reducing the overall output of the system to 30,000 Kilowatt-hours (kWh) of energy production annually.

The second option places panels in-line with the top of the bridge. This provides some shading from sun and rain to the bridge deck. While the production of each panel is reduced due to sub-optimal placement angles, the overall output of the system is increased to 55,000 kWh due to the larger number of panels.

In order to meet resiliency goals, access to power produced by the solar array would be available off-grid. In addition, a small battery array can be installed to provide onsite storage and allow power from the array to be used at night.

Trail Options

Several trail options for the connection to the Fanno Creek Trail were developed to a concept level. Three trail options and an elevator option were selected to be advanced for final consideration based on aesthetics, cost, environmental compatibility, drainage and public usage concerns. Due to the relatively narrow space between the proposed west side bridge landing and the Fanno Creek trail (approximately 140 feet at the narrowest) and the alignment length needed to make an ADA compliant trail, only Trail Option 3 meets the understood 75-foot minimum radius recommendation for horizontal alignment which is understood to be a requirement to access federal funding for this construction.

All options use a 5% maximum grade ADA path from their respective connection points with the Fanno Creek trail up to the west side bridge landing, a vertical change of approximately 25 feet. Stairways, either concrete or steel, are also included as optional more direct routes up to the bridge landing. These would include bike troughs allowing for ascent. As the stairway routes are optional and not part of the ADA routes their placement in the drawings is preliminary and no associated cost difference between placement or material type is considered in the estimates.

For the connection from the Fields Property, ADA accessible routes were examined connecting across the property development to provide access from Wall Street, Crestview Street, and Hunziker Street. The costs for this connection are based on the most recent site plan for the Fields Property Development, are included the estimates for bridge completion presented herein.

It is important to note that although funding issues may arise if a horizontal trail alignment not meeting a federal standard is chosen, the smaller radii shown do not inherently make the trail unsafe, but rather would require more control and care for bicycle speeds. With sound engineering design a smaller radius trail at this location could still be made safe and usable for all trail users and travel modes.

Aesthetics

The west approach to the structure is contained within a natural park setting. Currently the area is an open field with grasses and some very low shrubs bordered by oak savanna typical to the low valley areas of western Oregon. Concepts concentrate on gradual slopes that would mimic natural hillocks ascending and providing area for the savanna to expand and climb up to the trail level. This is desirable as this is perceived as the ultimate development of plantings in the area and the desire is emphasize the transition from built structure of the bridge to grass covered surroundings into the tall oaks of the savanna.

Costs

The options considered are balanced between those with extensive structural work to avoid impacting the ground level and those relying on earth grading to provide the trail support. In general, earth grading is less costly than using structure. The use of a large retaining wall to avoid impacting the railroad property is ultimately the most costly approach

Environmental Compatibility

The locale is an extension of the lengthy natural area that is the Fanno Creek corridor. This corridor provides the limited pathway through the otherwise developed west side for animals to coexist with the human population. A primary goal of the Fanno Creek development is to preserve the area and promote this environment. Options examined consider the free movement of animals that inhabit the corridor with options to avoid the trail and human interaction without being forced into the developed railroad property. Another consideration for the elevator option in particular is the impact of routing electrical power to this area. Power to the elevator would likely be routed across the bridge from the Fields Property to avoid impacting the natural area in the Fanno Creek Corridor.

Drainage

Trail construction increases the impervious surface in the area. This increase always has the effect of concentrating flow, washing potential contaminants from the paved surfacing and decreasing natural infiltration detention. If not considered carefully, fill placed could impact wetland areas and change drainage patterns on site. In this case the wetland boundaries have been identified and options have been configured to avoid any impact. Final design will need to formally delineate wetlands and confirm this no impact status. The nearby Fanno Creek has been judged to be far enough form the site to ensure that no overland flow form the trail will be concentrated discharge. All flow will sufficiently infiltrate before reaching the creek or its tributaries. The extents of construction are above the identified flood plain and there is no identified danger of any floodplain rise with the additional fills presented. Further analysis of the drainage issues at the site can be found in Appendix F.

Public Usage

Discussion has centered on the transition of this project. Moving from built environment, over industrial development of the railroad and then immediately into the natural area. This development will draw a number of different users. Bicycle commuters, recreational users such as joggers, hikers and walkers, school groups examining the savanna, potential sports spectators and even a certain number of through travelers.

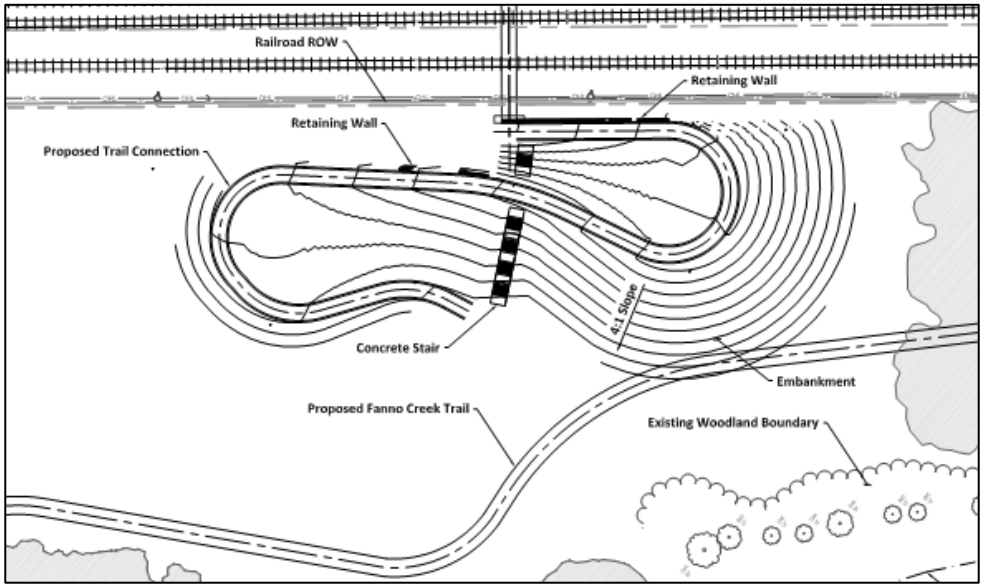
Trail Option 1

Trail Option 1 is a sinusoidal path placed entirely on embankment that makes two sweeping curves (41-foot radii) down to the Fanno Creek trail with an optional concrete stairway leading down the embankment from the bridge landing, crossing the ADA path at approximately mid-length, and meeting the path again at existing grade. The embankment has a maximum 4:1 slope allowing for both maintenance and planting adjacent to the trail and would require a retaining wall adjacent to the railroad right-of-way full height (approximately 25 feet) up to the bridge landing and gradually lowering in height along each side following the slope of the embankment. The transition from the bridge to the trail connection is an immediate 90° turn at the bridge landing, which would require significant advance signing and warning (rumble strips in the deck surfacing) for bicycle users to significantly slow or stop at this location. In addition, the 41-foot radii curves do not meet the 75-foot minimum radius to capture state or federal funding and would require a reduced bicycle speed limit with the appropriate signing.

This option would not allow for the construction of any recreational fields due to the large surface area required by the embankment and could present an obstacle to east-west wildlife movement through the area. The connection would however be completely outside of floodplain, environmental areas, and proposed oak savanna restoration areas.

Aesthetically, this option would likely provide a natural appearance to trail users moving up from the Fanno Creek trail towards the Field Property, but the large retaining walls adjacent to the railroad could interfere with the view from the Fields Property itself. It would be recommended that the wall be situated to accept vine cover to soften the large concrete surface.

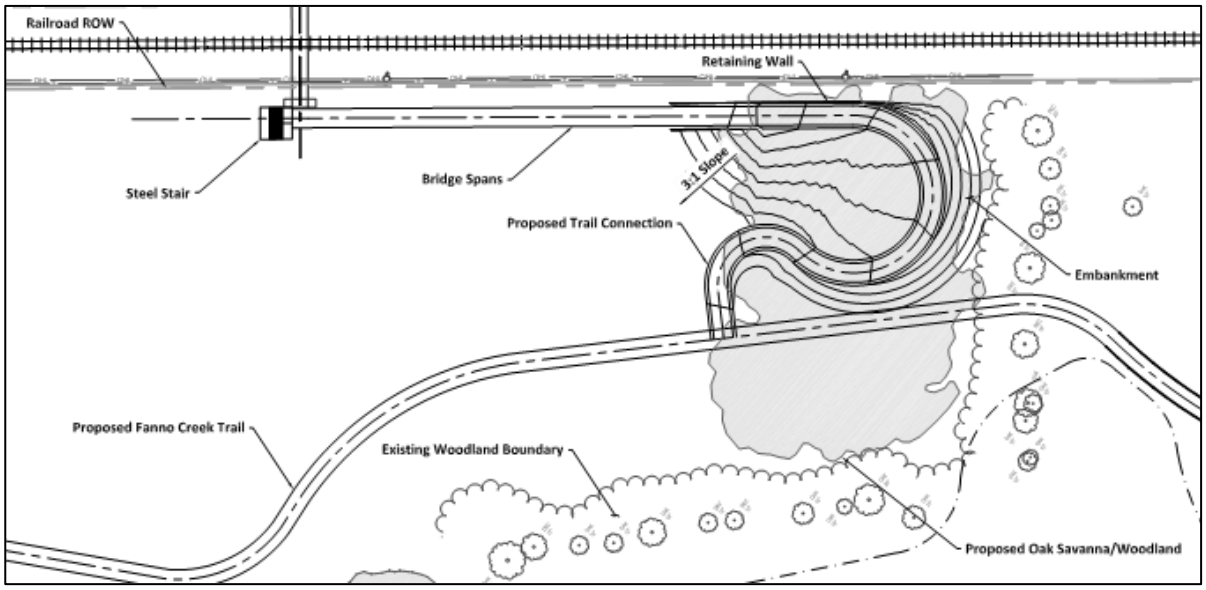
Figure 15: Trail Connection Option 1



Trail Option 2

Trail Option 2 is a combination of short bridge spans (approximately 40 feet) running parallel to the railroad and connecting to a curved section (30-50 foot radii) on embankment, with an optional steel stairway at the bridge landing. The embankment has a maximum 4:1 slope allowing for both maintenance and planting adjacent to the trail and would require a retaining wall adjacent to the railroad right-of-way with a maximum height of approximately 12 feet. The transition from the bridge to the trail connection is an immediate 90° turn at the bridge landing, which would require significant advance signing and warning (rumble strips in the deck surfacing) for bicycle users to significantly slow or stop at this location. In addition, the curves do not meet the 75-foot minimum radius to capture state or federal funding and would require a reduced bicycle speed limit with the appropriate signing.

Figure 16: Trail Connection Option 2



The short bridge spans are precast prestressed concrete slab girders with a structural concrete deck on top. Foundations would be driven piles similar to those used on the main structure.

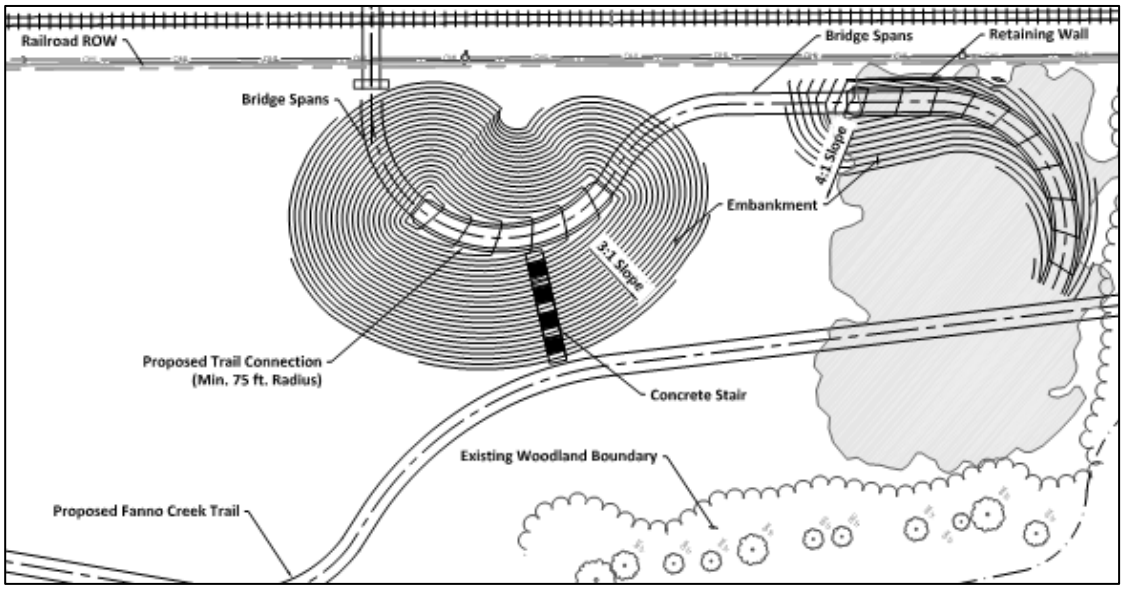
This option would allow for the construction of a single recreation field by shifting the trail alignment as far to one side of the area as possible. The trail connection would extend into planned oak savanna areas but would be outside floodplain and environmental areas and would present the smallest obstacle to wildlife crossing through the area.

Option 2 would also present the smallest visual impact to the area both from the Fanno Creek trail and the Fields Property. The highest portion of the trail would be bridge spans that would be open underneath, with a small compact embankment section to one side of the property.

Trail Option 3

Trail Option 3 is a combination of short bridge spans (approximately 40 feet) and embankment section that accommodates a 75-foot minimum trail radius, with an optional concrete stairway running down embankment and connecting the Fanno Creek trail separately from the ADA path. The embankment has a maximum 4:1 slope allowing for both maintenance and planting adjacent to the trail and would require a retaining wall adjacent to the railroad right-of-way with a maximum height of approximately 5 feet. The transition from the bridge to the trail connection is a curve running tangent to the bridge alignment.

Figure 17: Trail Connection Option 3



The short bridge spans shown are precast prestressed concrete slab girders with a structural concrete deck on top or simply cast-in-place concrete. Both span options are similar in price and cause little difference in the overall approach cost. Foundations would be driven piles similar to those used on the main structure. This structure provides topographic interest to the site for more adventurous users and provides animal passage in the east-west direction.

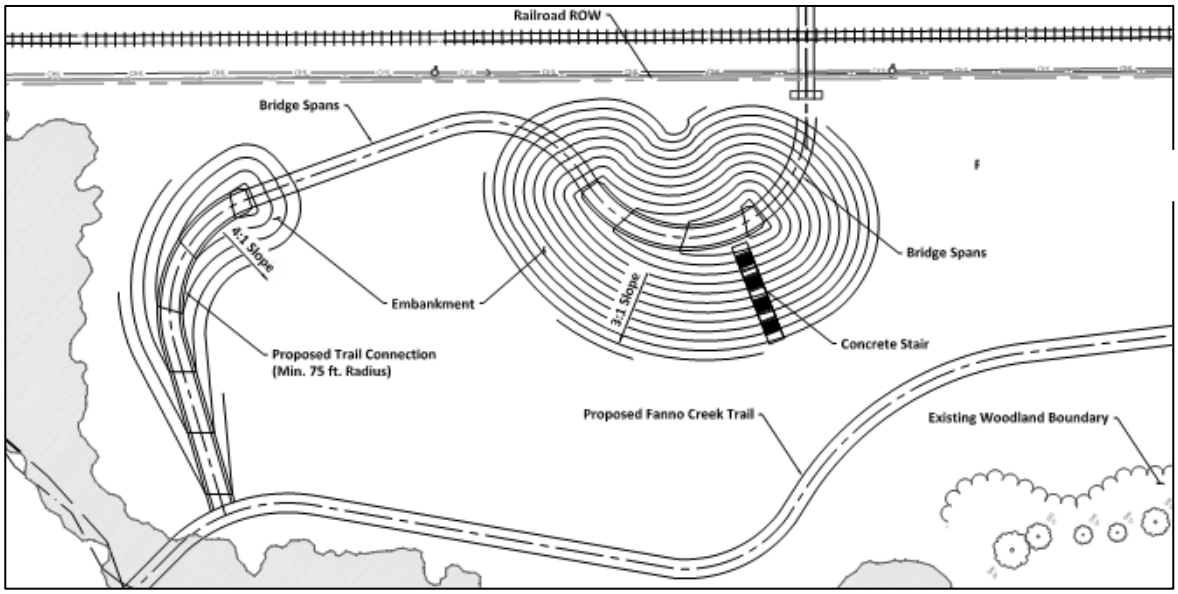
This option would allow for the construction of a single recreation field by shifting the trail alignment as far to one side of the area as possible. The trail connection would extend into planned oak savanna areas outside floodplain and environmental areas.

Care would have to be taken to avoid draining stormwater onto the railroad right-of-way, either through grading of the site or through a diversion system running under the embankment.

The large embankment could present a visual impact to the area from both the Fanno Creek trail and the Fields Property.

The drainage and visual impact could be partially or total mitigated by mirroring the alignment of the trail. This mirrored alignment would be out of view of the office buildings, and more area would be available between the embankment and the railroad to divert stormwater. The mirrored alignment would also connect to the Fanno Creek Trail closer to the library and would have the same construction cost as the original alignment. However, mirroring the trail alignment would not allow for the construction of recreation fields.

Figure 18: Trail Connection Option 3, Mirrored Alignment

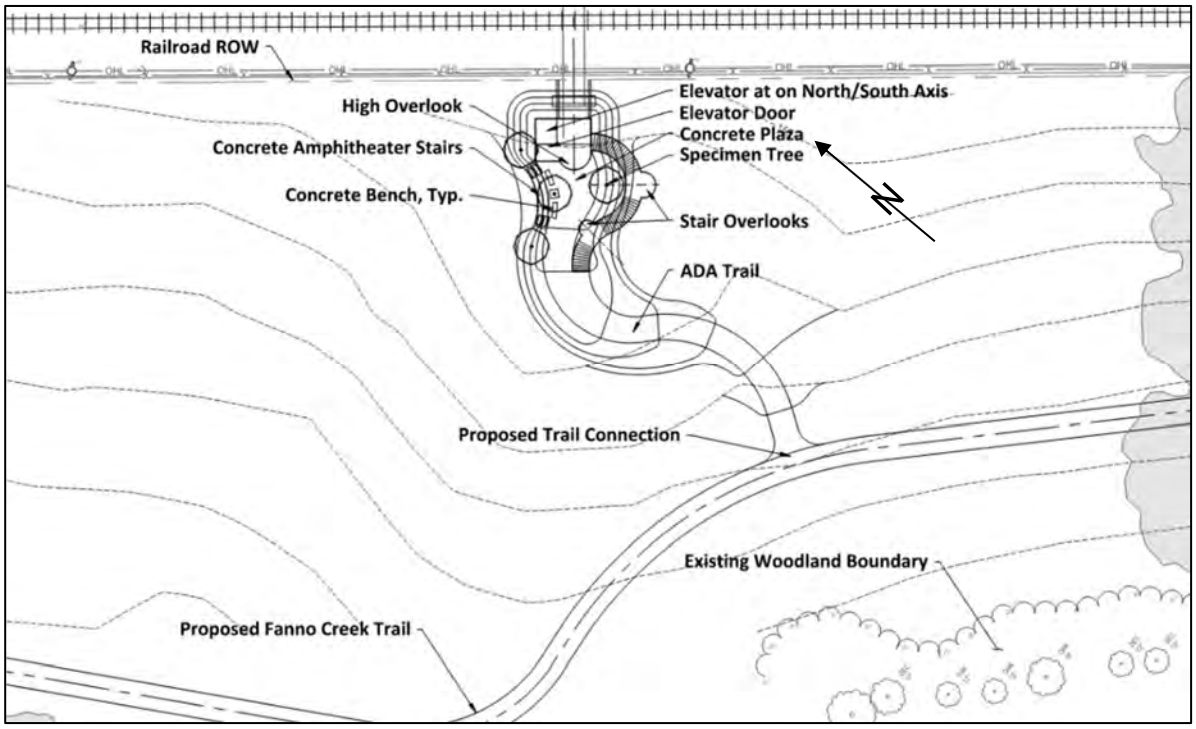


Elevator Option

Several configurations for a public elevator and trail were considered. All options featured an elevator and stairs connecting the bridge landing to an at-grade plaza. A trail connects the plaza to the Fanno Creek Trail. A preferred elevator option was selected for comparison to the trail alignments. Drawings of all considered elevator options are included in Appendix B.

The recommended preferred elevator option is shown in Figure 19 below. This option features a glass and steel elevator tower and curved stairs connecting to a plaza area at ground level. Bridge and stair landings act as viewpoints for the surrounding oak savanna restoration area. The plaza features seating areas for small gatherings and is slightly elevated above the surrounding plains to separate the plaza area from the natural areas and provide amphitheater type seating on the north side. This slightly reduces the vertical distance to the bridge landing and provides drainage away from the plaza. The plaza is connected to the Fanno Creek Trail by a short trail section with ADA compliant grades of 5% or less. The trail is surfaced with asphalt while the plaza, stairs treads and landings, and bridge landing have assumed concrete surfacing.

Figure 19: Elevator Connection Option



Cost Estimates

A comparison of costs for the bridge and trail alternatives are shown in Table 1 and 2. These tables show the project cost of the bridge and trail options including a 30% construction contingency, City of Tigard project administration costs (20% of construction and design costs), and costs for engineering and construction services (12% each). Engineering costs also cover costs for permitting and design costs associated with project funding from federal grants.

Table 1: Cost Comparison for Bridge Options

Bridge Option	Project Cost
Bowstring Truss	$ 3,678,292.80
Cable Stay	$ 4,283,433.00
Cantilever Arch Truss	$ 6,729,660.00

Table 2: Cost Comparison for Trail Options

Trail Option	Project Cost
Option 1	$ 3,180,580.20
Option 2	$ 2,343,915.00
Option 3	$ 2,574,813.78
Elevator Option	$ 2,160,486.00

As shown in Table 1, bridge options increase in price as the bridges become more complex, with the basic bowstring truss option being the least costly and the unique cantilever arch truss being the most costly. The cost of the cable stay bridge is approximately 120% that of the bowstring truss, while the cost of the cantilevered arch truss is 180%.

The costs of the trail options are shown in Table 2. Trail options 2 and 3 have roughly the same cost, while option 1 is more expensive due to the extensive, tall retaining walls along the railroad. The cost for the elevator option includes an amount for present value of maintenance and operation costs for the elevator, which are expected to be much higher than maintenance costs for the graded trail options. The estimated cost for maintenance of the elevator is approximately $6,000 per year for annual and preventative maintenance with a major service costing $30,000 occurring every 10 years. Operating costs for the elevator are estimated at $6,500 per year. The cost of 50 years of elevator operation as a present value lump sum have been added to the final cost to completion.

The cost of a renewable energy installation is added to the cost for the bowstring truss bridge option. If an in-line solar panel array and battery array are installed (most costly option) the cost of this addition is estimated at an additional $615,693 raising the expense for completion for the bowstring truss bridge to $4,295,693.

Evaluation for Selected Preferred Alternate

The preferred alternate for this crossing was chosen after discussion with involved parties including City of Tigard, DBG Properties, and the Fields Parcel 2 Design team. Based on this discussion, the preferred alternate for this crossing is a bowstring truss bridge paired with trail option 3. These alternates were chosen based on several criteria. The most important criteria for selection were cost, aesthetics, and site configuration. Other criteria for selection included potential environmental impacts, railroad impacts, long-

term maintenance, and construction schedule. Renewable energy installation would be an additional cost that may be considered further by City of Tigard, depending on the availability and type of funding used for this project.

Of the three bridge options, the bowstring truss is the least costly. It also has aesthetic advantages: it works well with the railroad and industrial aesthetic of the site while also being less obtrusive than other options when viewed from the office buildings. It has minimal impacts to the railroad, since it can be placed during a single railroad closure. If there are no unforeseen delays, construction can likely be accomplished in a single season.

During the selection process, a concrete bridge alternate to the bowstring truss was considered. The concrete alternate produced a savings in direct bridge cost but required a much higher profile grade that resulted in unacceptable impacts on the approaches and even greater approach cost impacts than the savings in bridge cost. Therefore, the concrete alternate was eliminated, and the bowstring truss was chosen as the preferred alternate.

Trail option 3 is the preferred approach alternate, and the mirrored trail 3 alignment is preferred if no recreation fields are to be located at the site. Trail option 3 is one of the least costly trail options and the configuration of Trail option 3 is also beneficial for attracting state or federal funding, as it is the only trail option that features the recommended 75-foot-radius curves. Trail option 3 has minimal environmental impacts, and the gentle slopes of the embankments can be used as an extension of the oak savanna restoration area. If the alignment in mirrored, no walls will be required along the railroad and drainage toward the railroad can be diverted more easily. A mirrored alignment has the additional advantage of placing trail users closer to the library and is out of view of the office buildings.

Conclusion and Next Steps

The purpose of this alternatives analysis was to examine structure types, gather relevant information through engineering investigations with topographic survey, subsurface foundations exploration, search of public records and contact with directly affected parties to define potential outcomes leading to a preliminary recommended design that defines the budgetary requirements to achieve project completion. Within the scope of this report, the preliminary recommended design is a two-span bowstring truss bridge paired with trail option 3. The total project cost is $6,685,000. A breakdown of costs is included in Table 3.

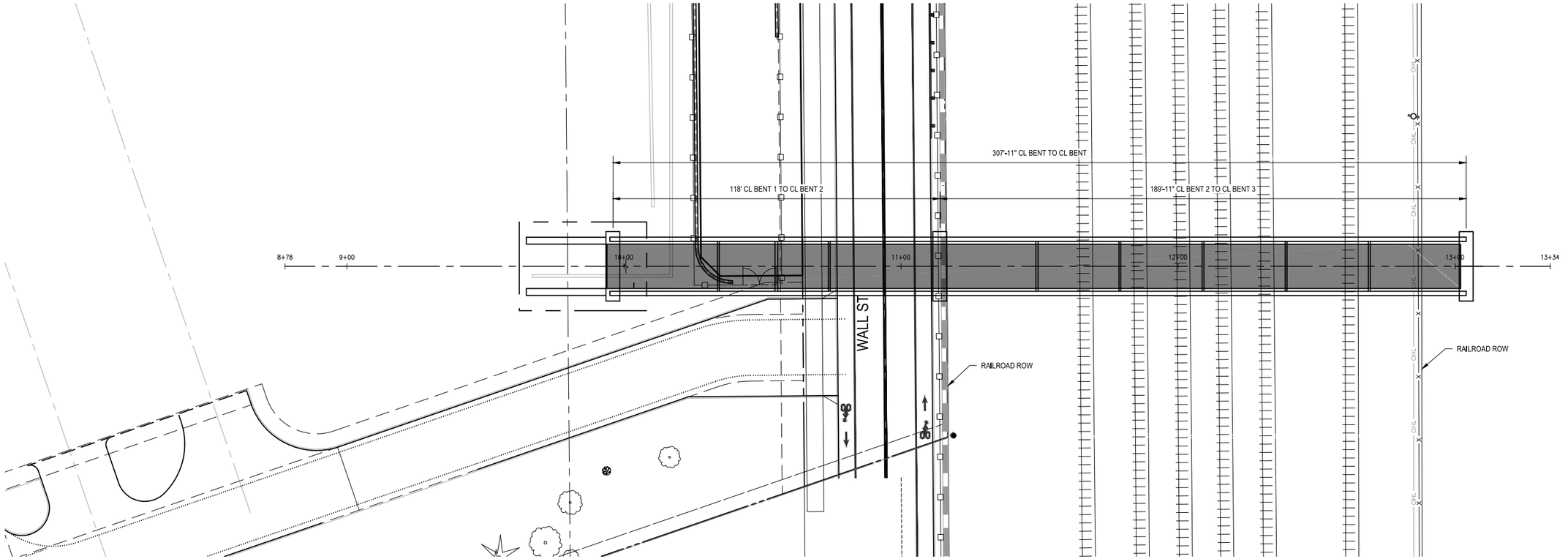
Table 3: Preliminary Recommended Design Project Costs

Bowstring Truss Construction Cost	$ 2,085,015.45
Trail Option 3 Construction Cost	$ 1,459,851.86
Fields Property Bridgehead Construction Cost	$ 244,762.68
Contingency (30%)	$ 1,136,889.00
Engineering Services (12%)	$ 454,755.60
City of Tigard Project Administration (20%)	$ 848,877.12
Construction Services (12%)	$ 454,755.60
Total Project Cost	**$ 6,684,907.32**

Funding for this project is expected to be sourced primarily from state and federal grants, with further contributions from local interested parties. This report is intended to inform interested parties of the associated costs of the project and aid in grant applications by providing preliminary design information. Identification of specific funding sources is not within the scope of this report.

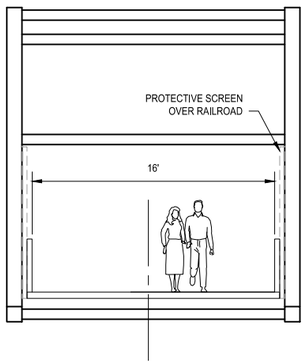
Appendix A

Preferred Alternate Drawings
and Cost Estimate



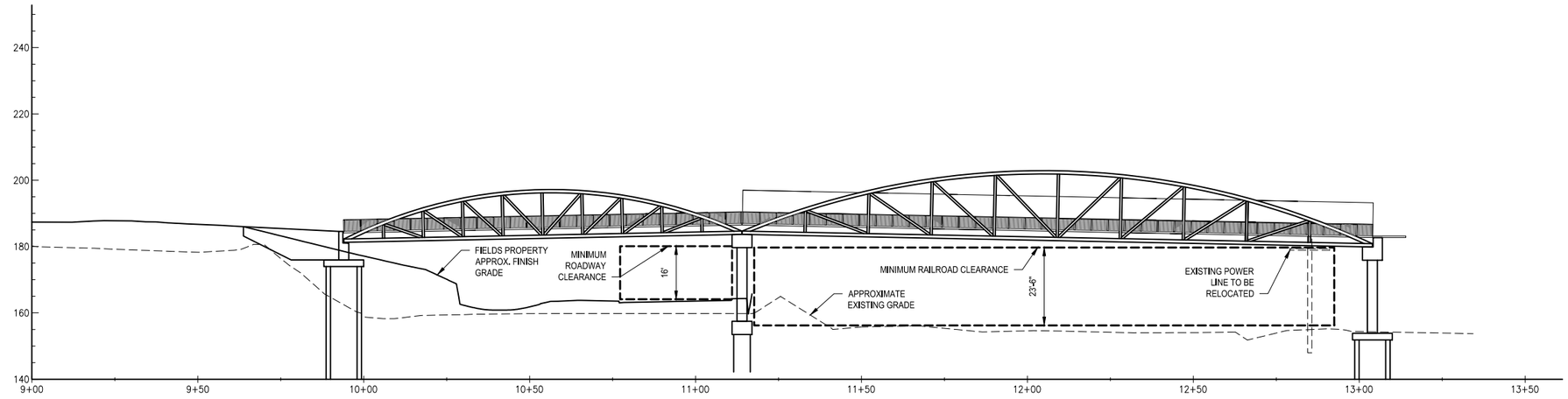
ALTERNATE 1 BRIDGE PLAN

SCALE: 1"=20'



ALTERNATE 1 BRIDGE SECTION

SCALE: 1"=5'



ALTERNATE 1 BRIDGE PROFILE

SCALE: 1"=20'

20' 0' 20' 40'

SCALE IN FEET

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE

CITY OF TIGARD, OREGON

BRIDGE ALTERNATE 1 - BOWSTRING TRUSS

TITLE

#	DATE	DESCRIPTION

REVISIONS

DRAWN BY CHECKED BY

STATUS

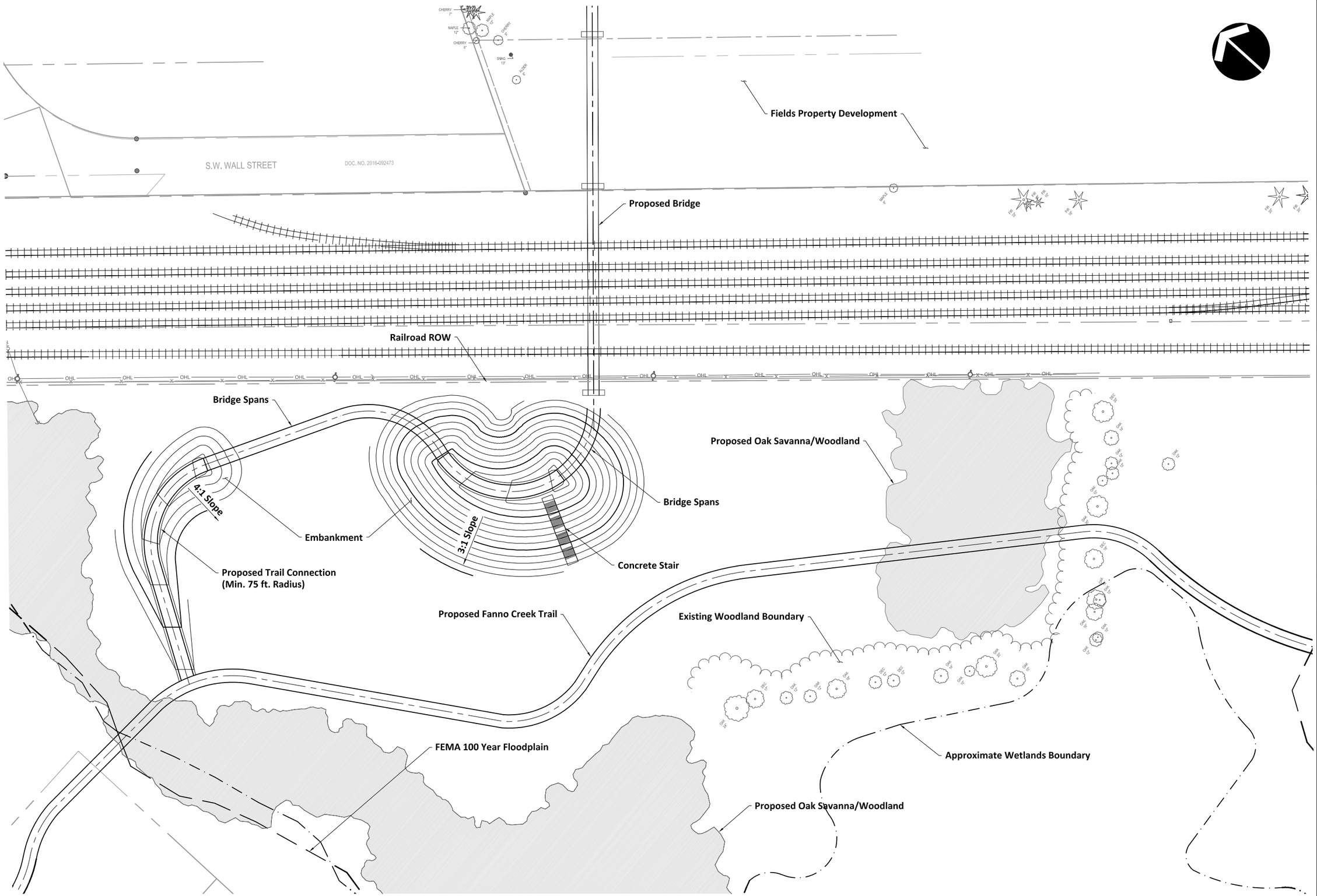
DATE

PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 16, 2019 - 4:17pm L:\Project\17000\17052.00\SCADD\ACAD\Dwg\Exhibits\PRELIM BRIDGE.dwg Layout Name: ALT 1



TRAIL CONCEPT PLAN 4

SCALE: 1"=40'

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360.737.9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

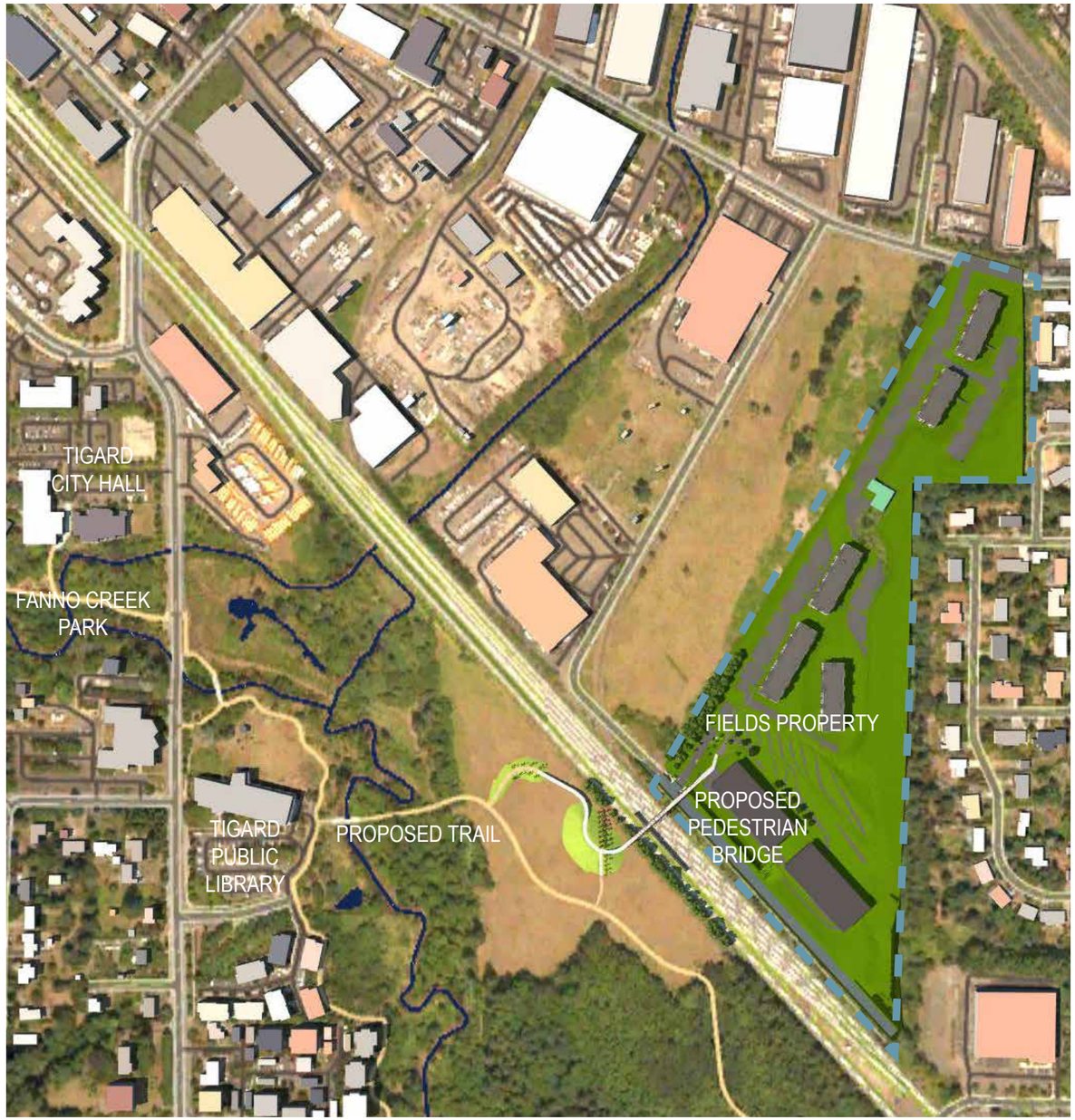
10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 14, 2019 - 1:04pm L:\Project\17000\17052.005\CAD\ACAD\Dwg\Exhibits\17052_Trail Option 7A.dwg Layout Name: Layout2



01 PLAN VIEW
NOT TO SCALE



02 VIEW LOOKING SOUTHEAST - ORGANIC STAIRS
NOT TO SCALE



03 VIEW LOOKING NORTH
NOT TO SCALE

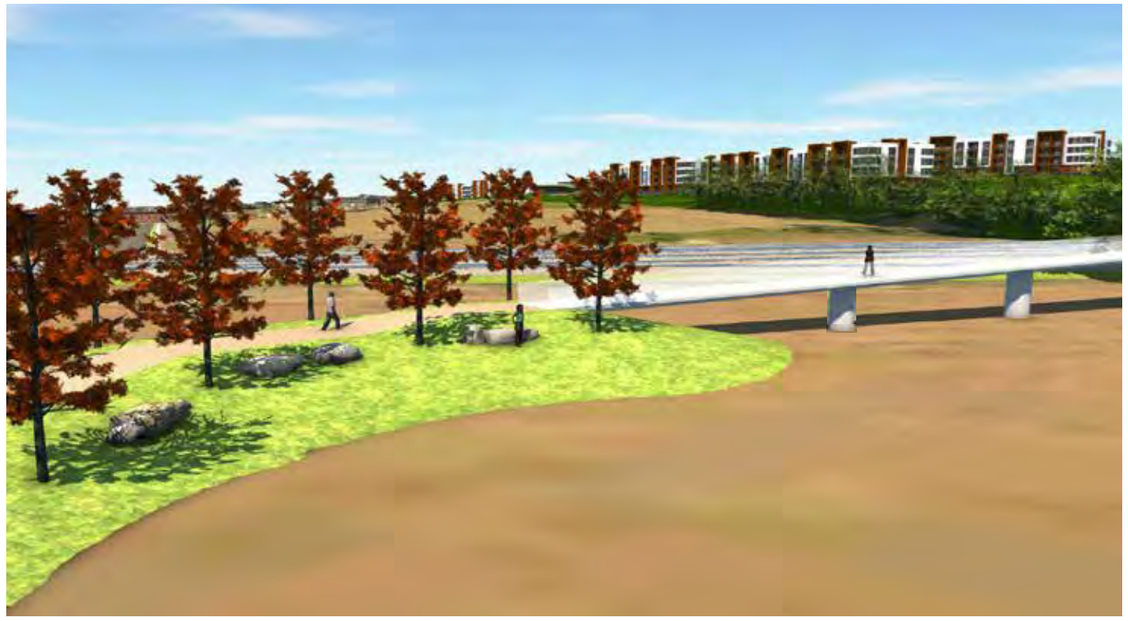
RED ROCK CREEK TRAIL PEDESTRIAN BRIDGE | VISUALIZATIONS

G.K. | NOVEMBER 2, 2020 | PROJECT 17052

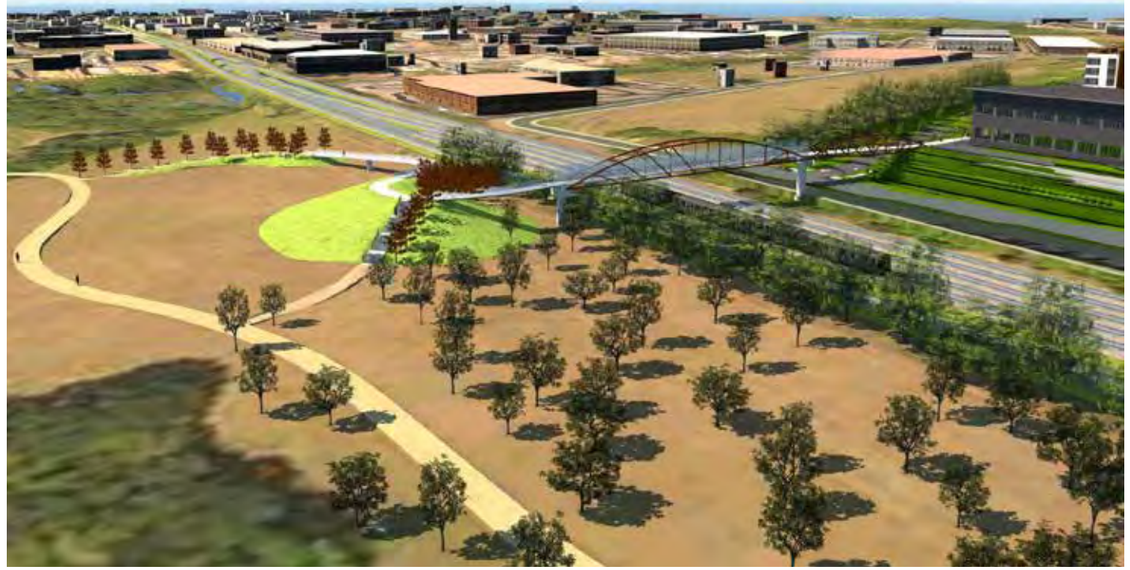
Otak



01 BRIDGE LANDING AT FIELDS PROPERTY
NOT TO SCALE



02 BOULDER SEATING AREAS
NOT TO SCALE



03 BRIDGE WITH OAK SAVANNA
NOT TO SCALE



04 BRIDGE SPAN BETWEEN MOUNDS
NOT TO SCALE

RED ROCK CREEK TRAIL PEDESTRIAN BRIDGE | VISUALIZATIONS

G.K. | NOVEMBER 2, 2020 | PROJECT 17052

Otak

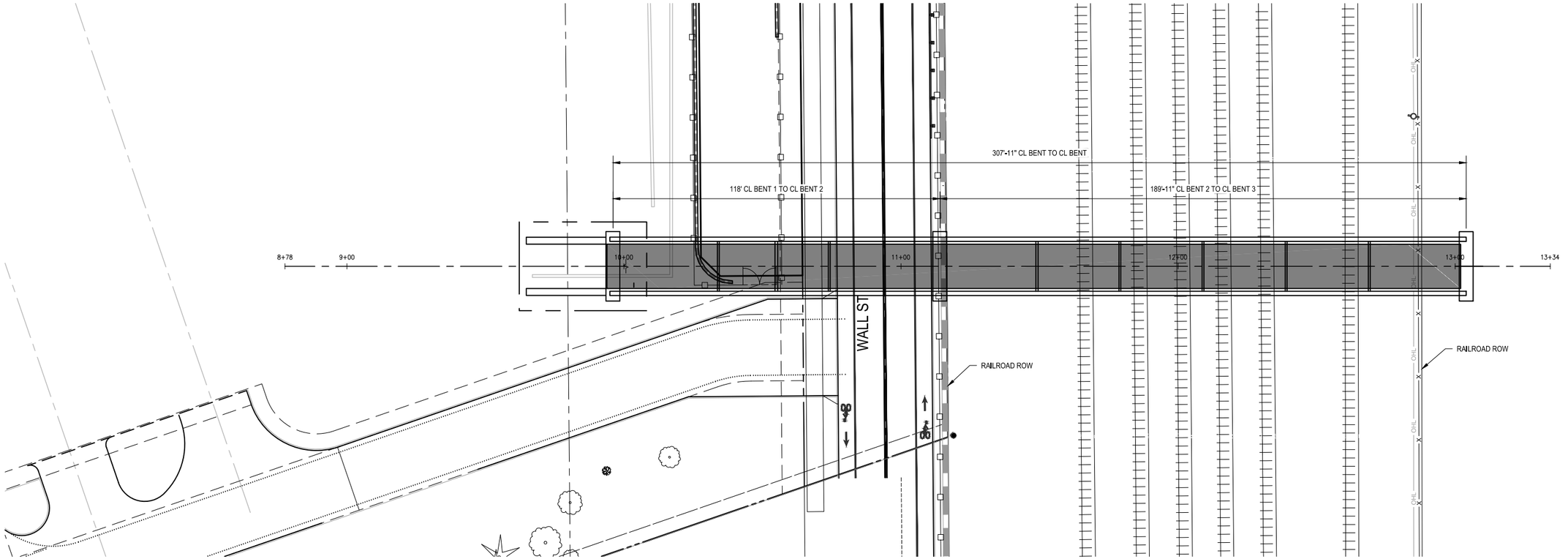
RED ROCK CREEK TRAIL BRIDGE PROJECT - 30% COST ESTIMATE

Prepared by Otak, Inc. Date: 12-09-2020

QUANTITY	UNIT	ITEM	UNIT PRICE	TOTAL
BOWSTRING TRUSS BRIDGE				
1	LS	MOBILIZATION	$ 345,000.00	$ 345,000.00
1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	$ 10,000.00	$ 10,000.00
500	HR	RAILROAD FLAGGING	$ 75.00	$ 37,500.00
1	LS	310 FT 2-SPAN STEEL TRUSS	$ 1,000,000.00	$ 1,000,000.00
65	CY	CONC. CL. 4000 (FOR DECK)	$ 1,500.00	$ 97,500.00
620	LF	BRIDGE RAIL	$ 275.00	$ 170,500.00
380	LF	PROTECTIVE SCREEN	$ 200.00	$ 76,000.00
160	CY	CONC. CL. 4000 (FOR FOUND.)	$ 1,500.00	$ 240,000.00
48	CY	DRILLED SHAFT CONCRETE	$ 500.00	$ 24,000.00
9600	LB	DRILLED SHAFT REINFORCEMENT	$ 1.50	$ 14,400.00
65	LF	DRILLED SHAFT EXCAVATION, 60 IN	$ 500.00	$ 32,500.00
720	LF	FURNISH 16" DIA. STEEL PIPE PILES	$ 65.00	$ 46,800.00
12	EACH	DRIVE STEEL PILES	$ 2,000.00	$ 24,000.00
600	SF	RET. WALL, MODULAR GRAVITY	$ 50.00	$ 30,000.00
1	LS	UTILITY RELOCATION	$ 50,000.00	$ 50,000.00
1	LS	EROSION/WATER POLLUTION CONTROL	$ 2,000.00	$ 2,000.00
1	LS	LANDSCAPING	$ 40,000.00	$ 40,000.00
TRAIL OPTION 3 (CONNECTION TO FANNO CREEK TRAIL)				
12600	CY	EMBANKMENT IN PLACE	$ 30.00	$ 378,000.00
970	TON	LEVEL 1 ,1/2 INCH ACP	$ 125.00	$ 121,250.00
1300	TON	AGGREGATE BASE	$ 35.00	$ 45,500.00
650	SF	CONCRETE STAIR	$ 100.00	$ 65,000.00
220	SF	RET. WALL, MODULAR GRAVITY	$ 150.00	$ 33,000.00
865	FT	HANDRAIL	$ 100.00	$ 86,500.00
7000	SQFT	CAST-IN-PLACE SLAB BRIDGE	$ 45.00	$ 315,000.00
45	CY	CONC. CL. 4000 (FOR FOUND.)	$ 1,500.00	$ 67,500.00
1680	FT	FURNISH 16" DIA. STEEL PIPE PILES	$ 65.00	$ 109,200.00
28	EA	DRIVE STEEL PIPE PILES	$ 2,000.00	$ 56,000.00
1	LS	LANDSCAPING	$ 50,000.00	$ 50,000.00
FIELDS PROPERTY BRIDGEHEAD (CONNECTION TO FIELDS PROPERTY DEVELOPMENT)				
2070	SF	CONCRETE RAMP	$ 18.00	$ 37,260.00
150	SF	CONCRETE STAIRS	$ 100.00	$ 15,000.00
740	LF	PEDESTRIAN HANDRAIL	$ 70.00	$ 51,800.00
2028	SF	CONCRETE TRAIL	$ 15.00	$ 30,420.00
1760	SF	RETAINING WALL	$ 50.00	$ 88,000.00
			Subtotal	$ 3,789,630.00
			Contingency (30%)	$ 1,136,889.00
			Engineering Services (12%)	$ 454,755.60
			City of Tigard Project Administration (20%)	$ 848,877.12
			Construction Services (12%)	$ 454,755.60
			Construction Total	**$ 4,926,519.00**
			Project Total	**$ 6,684,907.32**

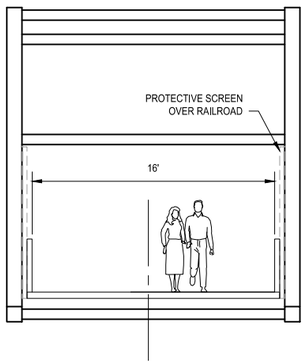
Appendix B

Examined Alternates Drawings



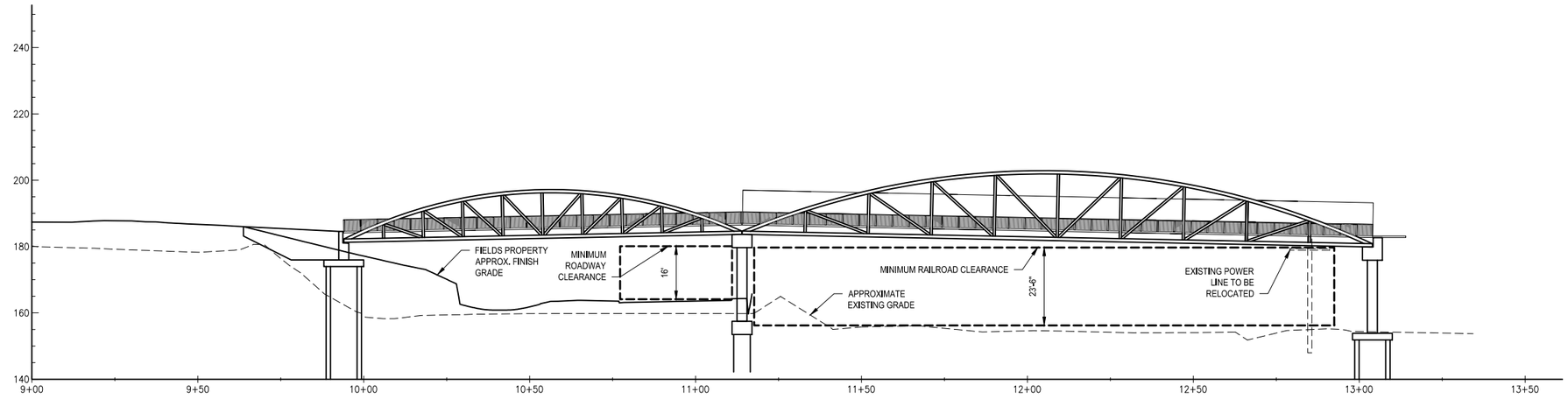
ALTERNATE 1 BRIDGE PLAN

SCALE: 1"=20'



ALTERNATE 1 BRIDGE SECTION

SCALE: 1"=5'



ALTERNATE 1 BRIDGE PROFILE

SCALE: 1"=20'

20' 0' 20' 40'

SCALE IN FEET

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE

CITY OF TIGARD, OREGON

BRIDGE ALTERNATE 1 - BOWSTRING TRUSS

TITLE

#	DATE	DESCRIPTION

REVISIONS

DRAWN BY CHECKED BY

STATUS

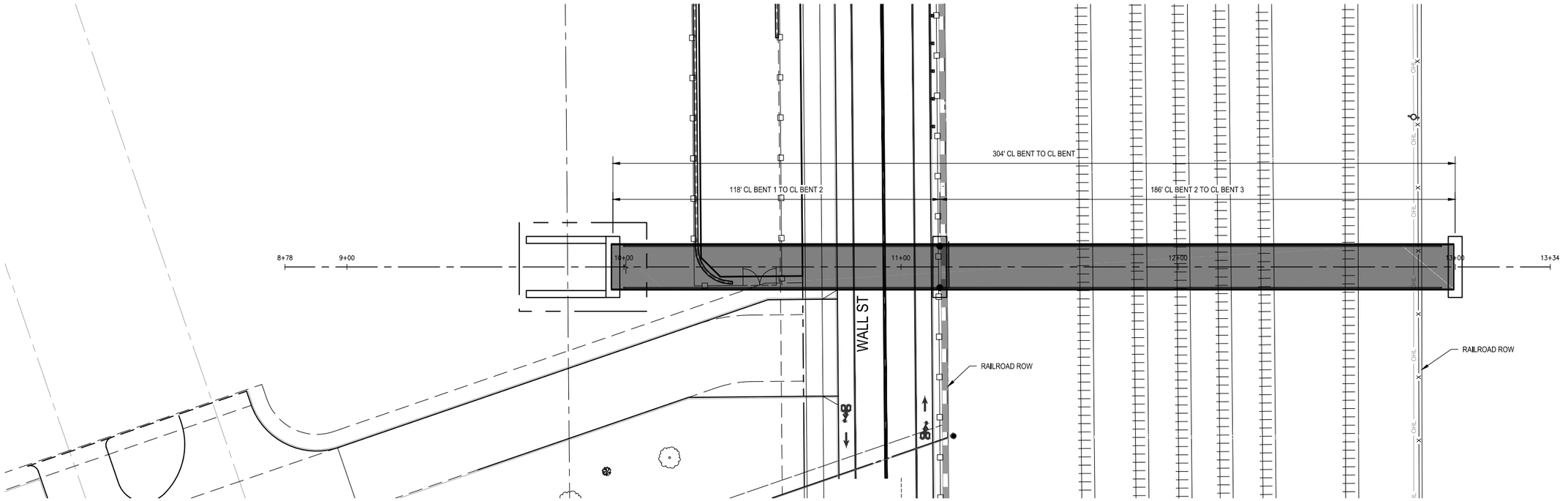
DATE

PROJECT NUMBER

© 2018 OTAK, INC.

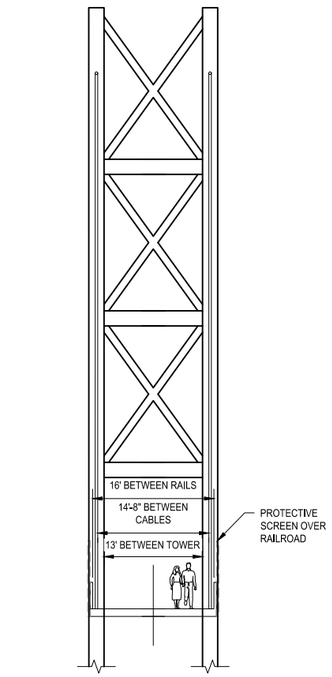
If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 16, 2019 - 4:17pm L:\Project\17000\17052.00\SCADD\ACAD\Dwg\Exhibits\PRELIM BRIDGE.dwg Layout Name: ALT 1



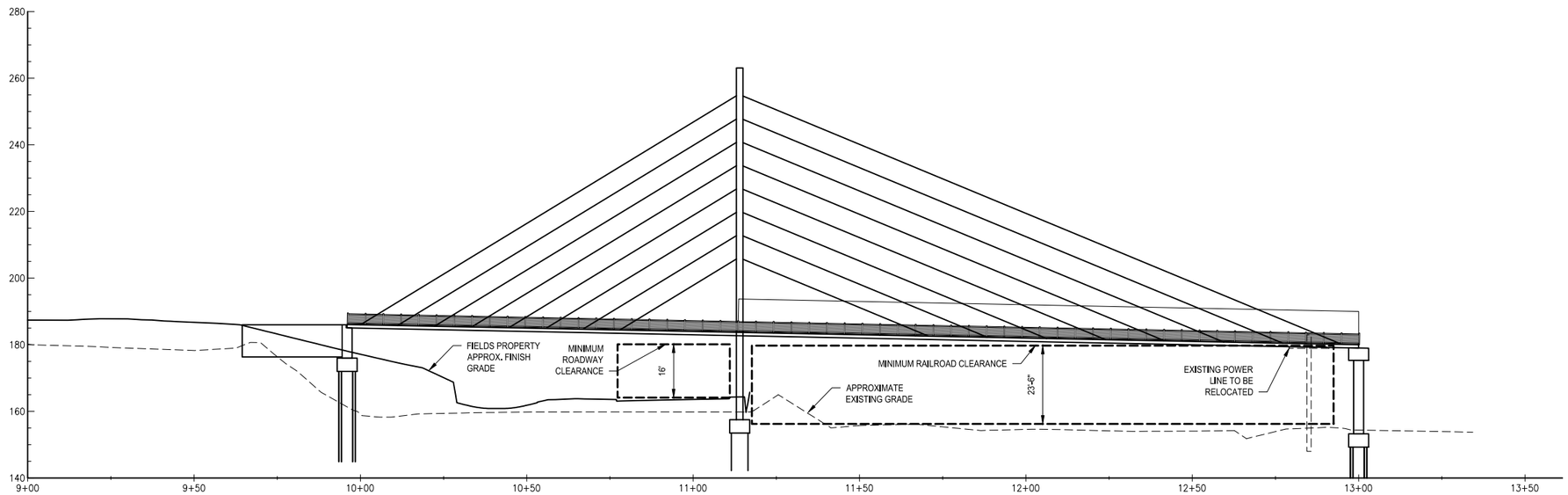
ALTERNATE 2 BRIDGE PLAN

SCALE: 1"=20'



ALTERNATE 2 BRIDGE SECTION

SCALE: 1"=10'



ALTERNATE 2 BRIDGE PROFILE

SCALE: 1"=20'

20' 0' 20' 40'

SCALE IN FEET

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE

CITY OF TIGARD, OREGON

BRIDGE ALTERNATE 2 - CABLE STAY

TITLE

#	DATE	DESCRIPTION

REVISIONS

DRAWN BY CHECKED BY

STATUS

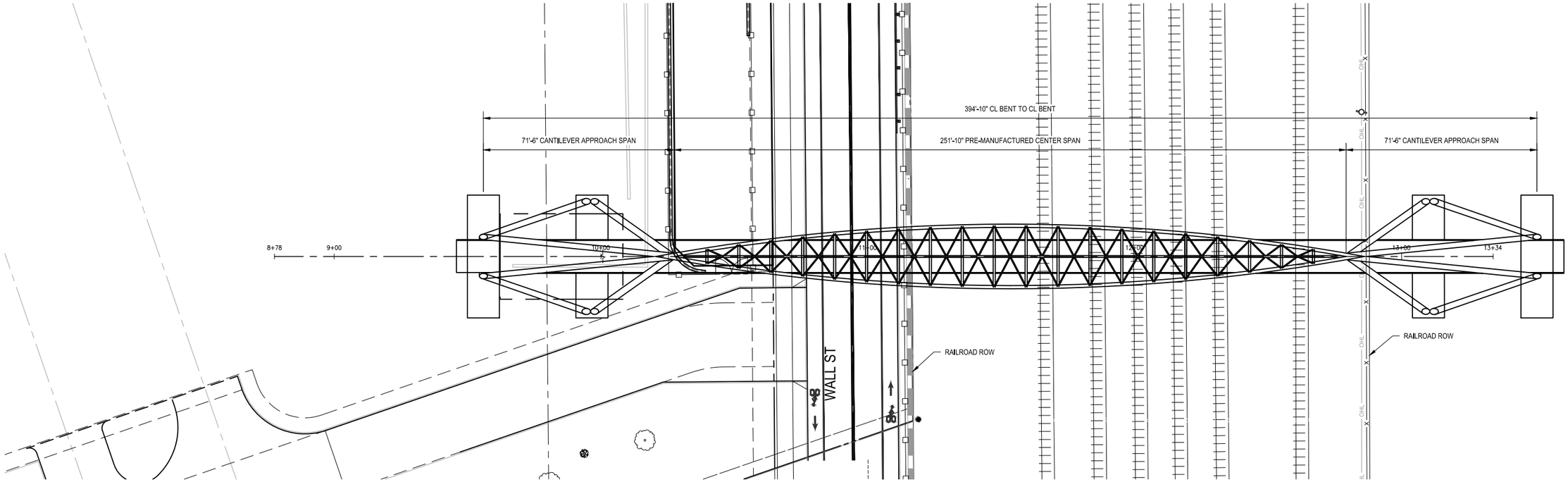
DATE

PROJECT NUMBER

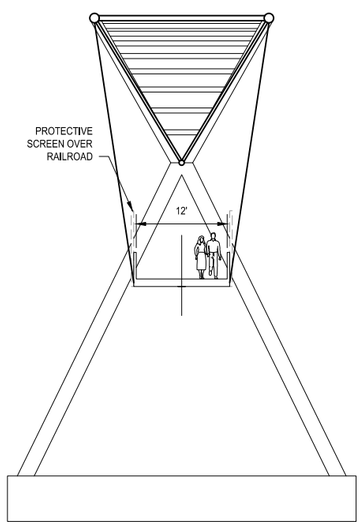
© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

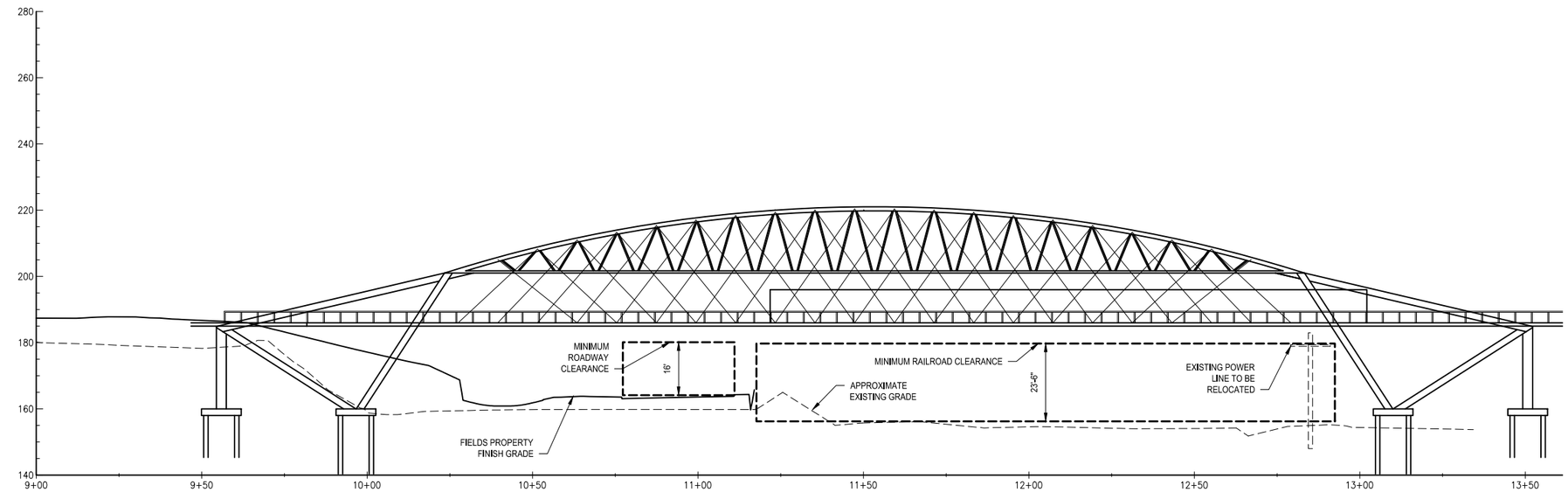
Plotted: Oct 16, 2019 - 4:18pm L:\Project\17000\17052.00\SCADD\ACAD\Dwg\Exhibits\PRELIM BRIDGE.dwg Layout Name: ALT 4



ALTERNATE 3 BRIDGE PLAN
SCALE: 1"=20'



ALTERNATE 3 BRIDGE SECTION
SCALE: 1"=10'



ALTERNATE 3 BRIDGE PROFILE
SCALE: 1"=20'

20' 0' 20' 40'
SCALE IN FEET

Plotted: Oct 16, 2019 - 4:18pm L:\Project\17000\17052.005\CAD\ACAD\Dwg\Exhibits\PRELIM BRIDGE.dwg Layout Name: ALT 7

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

BRIDGE ALTERNATE 3 - CANTILEVER ARCH TRUSS

TITLE

#	DATE	DESCRIPTION

REVISIONS

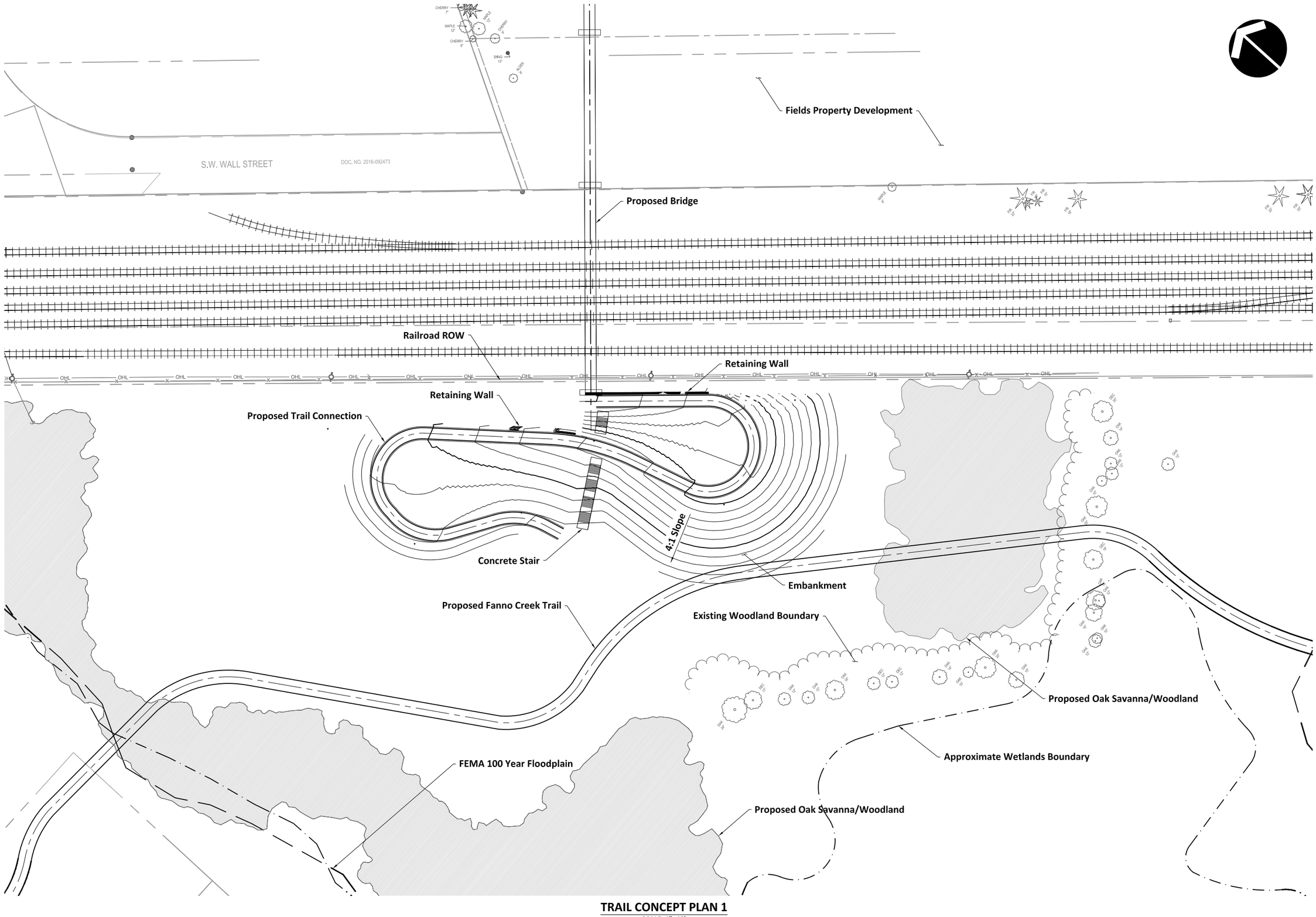
DRAWN BY CHECKED BY

STATUS

DATE

PROJECT NUMBER

© 2018 OTAK, INC.
If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.



TRAIL CONCEPT PLAN 1

SCALE: 1"=40'

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360.737.9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

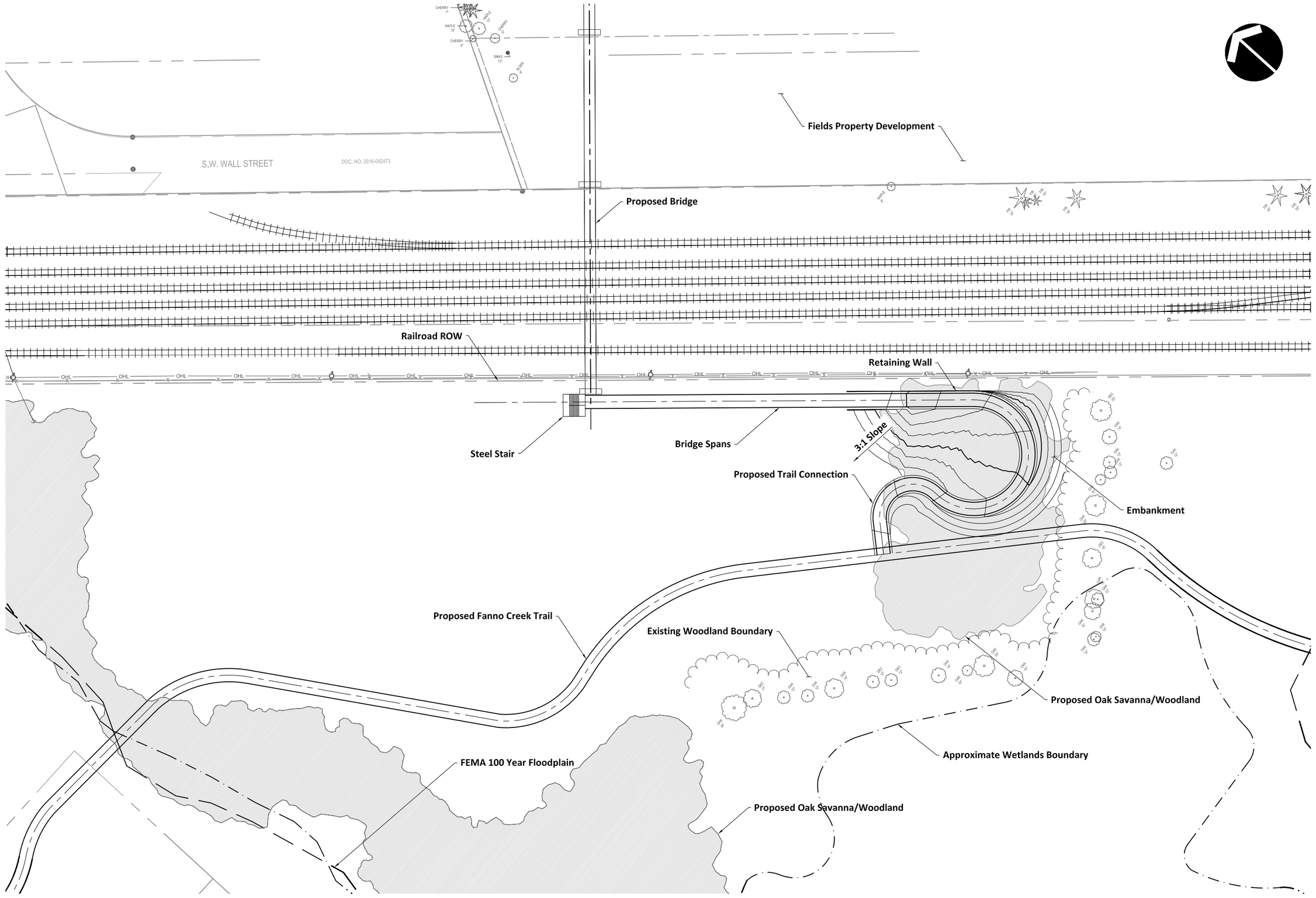
10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 14, 2019 - 1:07pm L:\Projects\17000\17052.005\CAD\ACAD\Dwg\Exhibits\17052_Trail Option 2.dwg Layout Name: Layout2



TRAIL CONCEPT PLAN 2

SCALE: 1"=40'

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360.737.9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

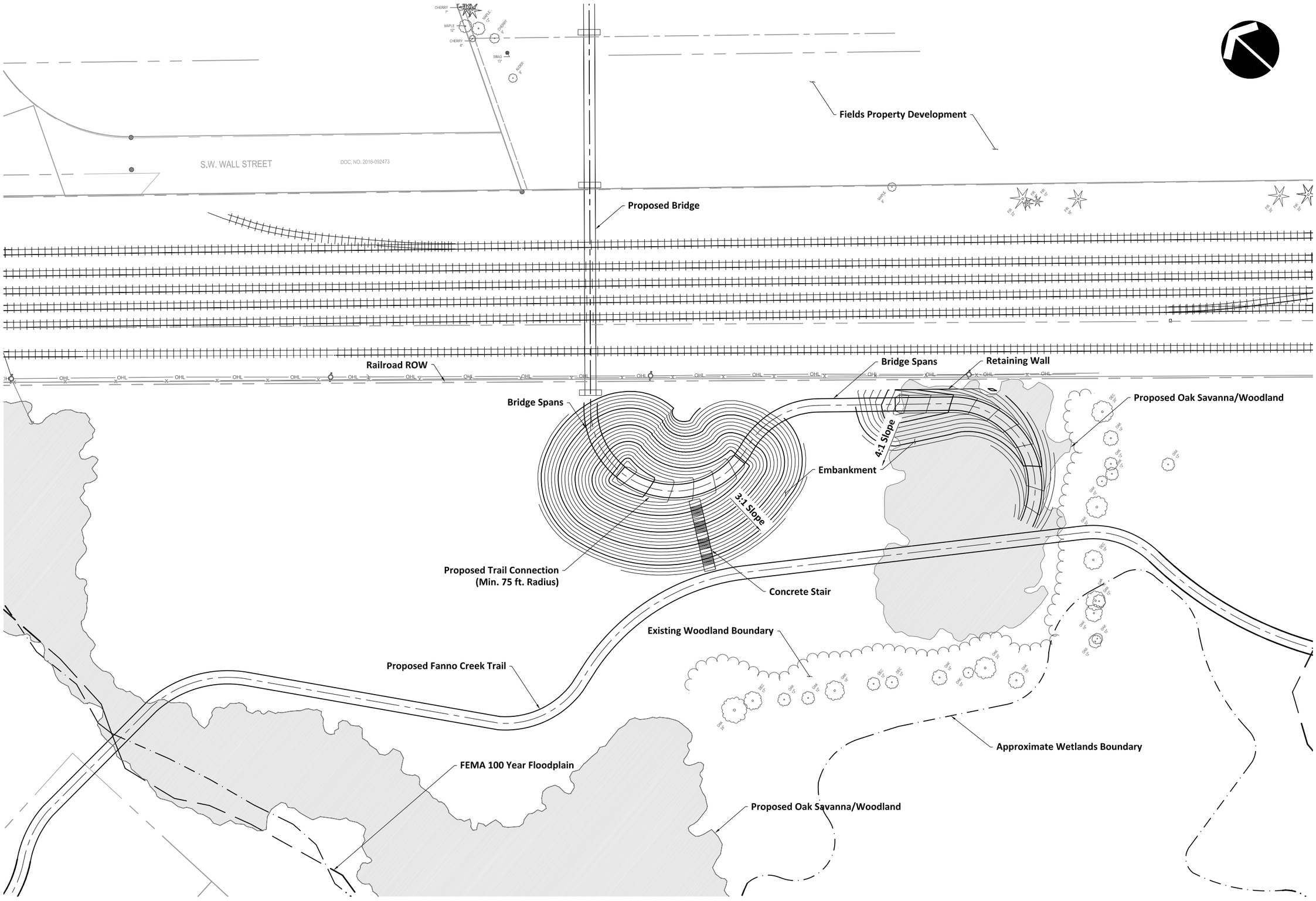
10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 14, 2019 - 1:02pm L:\Project\17000\17052.005\CAD\ACAD\Dwg\Exhibits\17052_Trail Option 4.dwg Layout Name: Layout2



TRAIL CONCEPT PLAN 3

SCALE: 1"=40'

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360.737.9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE

CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

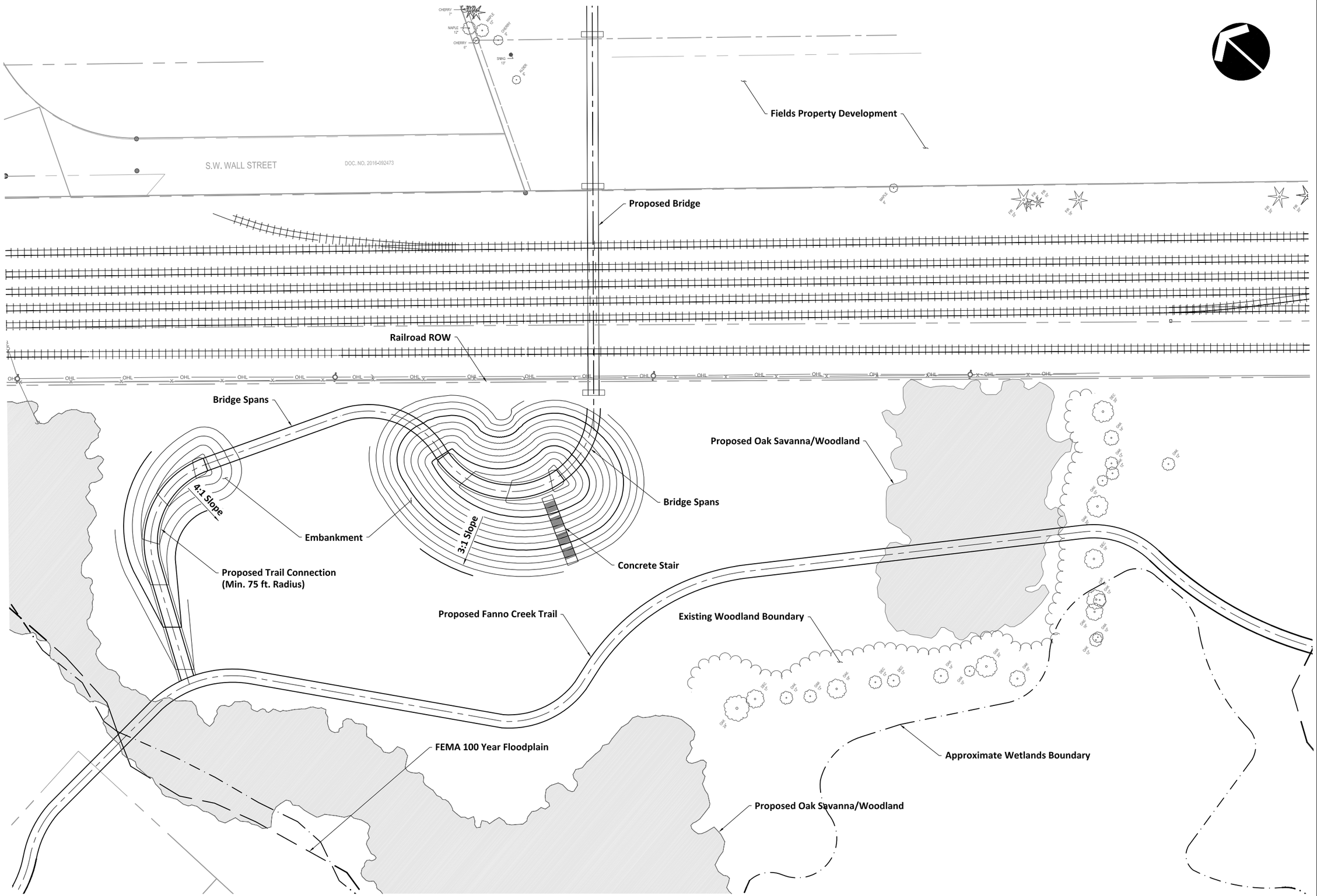
10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 14, 2019 - 1:03pm L:\Projects\17000s\17052.005\CAD\ACAD\Dwg\Exhibits\17052_Trail Option 7.dwg Layout Name: Layout2



TRAIL CONCEPT PLAN 4

SCALE: 1"=40'

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360.737.9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

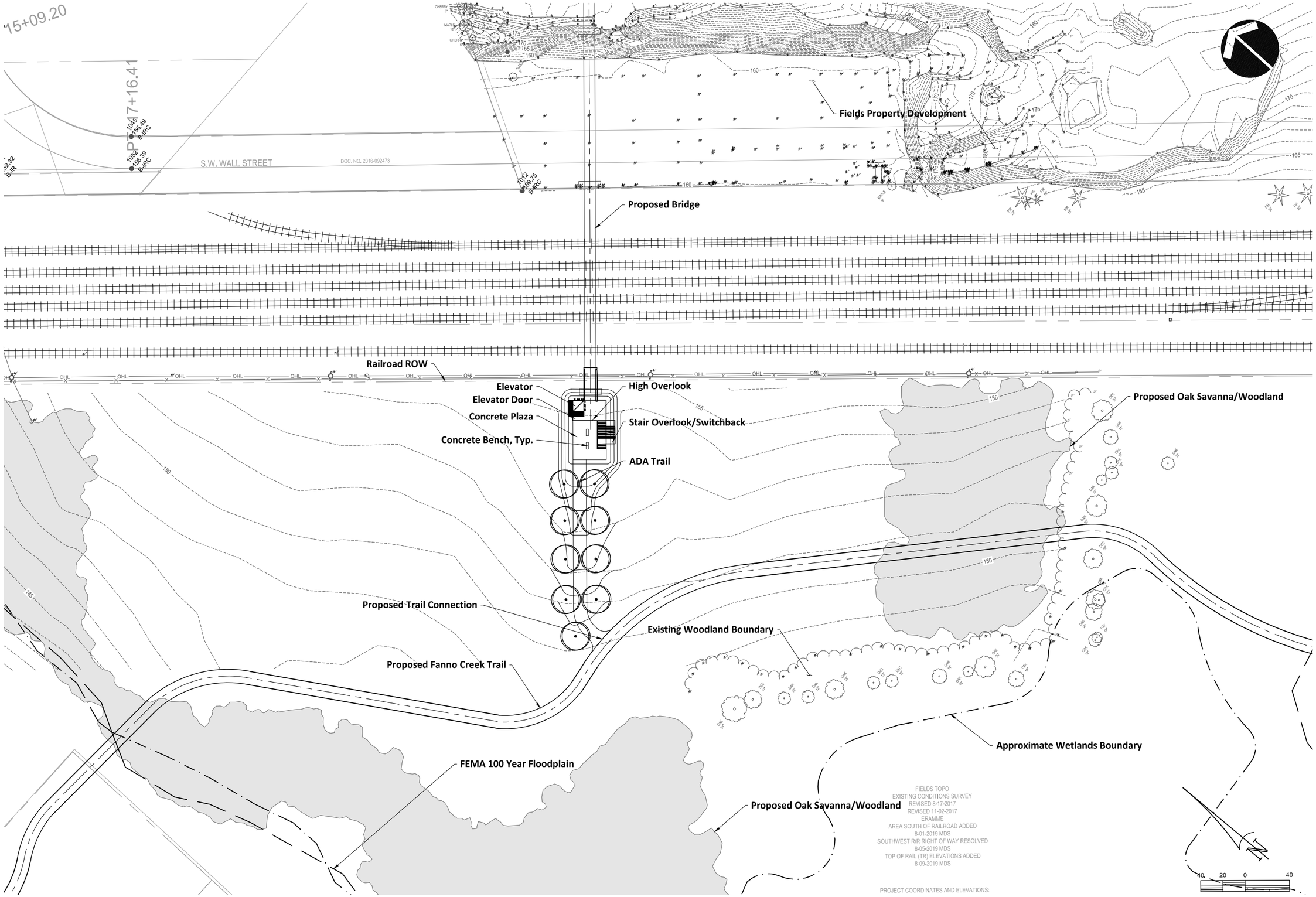
10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 14, 2019 - 1:04pm L:\Project\17000\17052.005\CAD\ACAD\Dwg\Exhibits\17052_Trail Option 7A.dwg Layout Name: Layout2



SWITCHBACK ELEVATOR/STAIR CONCEPT

SCALE: 1"=40'

Otak

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

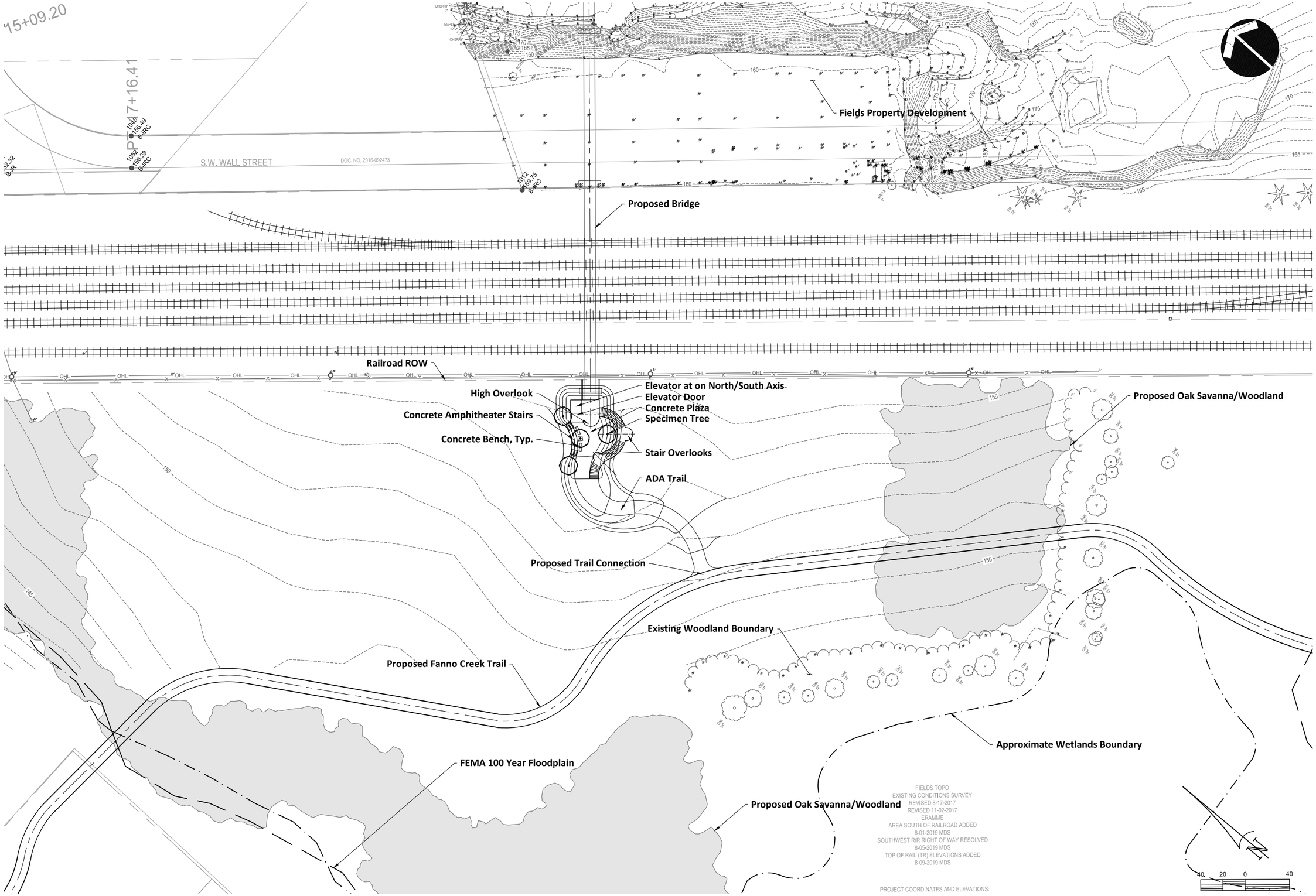
10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 09, 2020 - 8:25am C:\Users\gazioli\Appdata\Local\Temp\AcPublish_12688\17052_Elevator Plaza.dwg Layout Name: SWITCHBACK



FIELDS TOPO
EXISTING CONDITIONS SURVEY
REVISED 8-17-2017
REVISED 11-02-2017
ERAMME
AREA SOUTH OF RAILROAD ADDED
8-01-2019 MDS
SOUTHWEST R/R RIGHT OF WAY RESOLVED
8-05-2019 MDS
TOP OF RAIL (TR) ELEVATIONS ADDED
8-09-2019 MDS

PROJECT COORDINATES AND ELEVATIONS:

ORGANIC ELEVATOR/STAIR CONCEPT

SCALE: 1"=40'

Otak
Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY

PRELIMINARY
STATUS

10/14/19
DATE

17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 09, 2020 - 8:25am C:\Users\gabriel\AppData\Local\Temp\AcPublish_12688\17052_Elevator Plaza.dwg Layout Name: CURVED

Railroad ROW
Stair Overlook
Stairs
Boulder Bench, Typ.
Elevator at on North/South Axis
Elevator Door
Concrete Plaza
Ornamental Tree Planting
ADA Trail
Proposed Bridge
Fields Property Development
Proposed Oak Savanna/Woodland
Proposed Trail Connection
Existing Woodland Boundary
Proposed Fanno Creek Trail
Approximate Wetlands Boundary
FEMA 100 Year Floodplain
Proposed Oak Savanna/Woodland
S.W. WALL STREET
DOC. NO. 2016-092473

FIELDS TOPO
EXISTING CONDITIONS SURVEY
REVISED 8-17-2017
REVISED 11-02-2017
ERAMME
AREA SOUTH OF RAILROAD ADDED
8-01-2019 MDS
SOUTHWEST R/R RIGHT OF WAY RESOLVED
8-05-2019 MDS
TOP OF RAIL (TR) ELEVATIONS ADDED
8-09-2019 MDS

PROJECT COORDINATES AND ELEVATIONS:

ANGLED ELEVATOR/STAIR CONCEPT
SCALE: 1"=40'

Otak, Inc.
700 Washington St., Suite 300
Vancouver, WA 98660
360. 737. 9613
www.otak.com

STAMP

CONSULTANT

FIELDS PROPERTY
RED ROCK CREEK BRIDGE
CITY OF TIGARD, OREGON

TITLE

#	DATE	DESCRIPTION

REVISIONS

SML
DRAWN BY CHECKED BY
PRELIMINARY
STATUS
10/14/19
DATE
17052.005
PROJECT NUMBER

© 2018 OTAK, INC.

If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Oct 09, 2020 - 8:25am C:\Users\gabriel\AppData\Local\Temp\AcPublish_12688\17052_Elevator Plaza.dwg Layout Name: ANGLED

Appendix C

Examined Alternates Cost Estimates

BOWSTRING TRUSS

QUANTITY	UNIT	ITEM	UNIT PRICE	TOTAL
1	LS	MOBILIZATION	$ 190,000.00	$ 190,000.00
1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	$ 10,000.00	$ 10,000.00
500	HR	RAILROAD FLAGGING	$ 75.00	$ 37,500.00
1	LS	310 FT 2-SPAN STEEL TRUSS	$ 1,000,000.00	$ 1,000,000.00
65	CY	CONC. CL. 4000 (FOR DECK)	$ 1,500.00	$ 97,500.00
620	LF	BRIDGE RAIL	$ 275.00	$ 170,500.00
380	LF	PROTECTIVE SCREEN	$ 200.00	$ 76,000.00
160	CY	CONC. CL. 4000 (FOR FOUND.)	$ 1,500.00	$ 240,000.00
48	CY	DRILLED SHAFT CONCRETE	$ 500.00	$ 24,000.00
9600	LB	DRILLED SHAFT REINFORCEMENT	$ 1.50	$ 14,400.00
65	LF	DRILLED SHAFT EXCAVATION, 60 IN	$ 500.00	$ 32,500.00
720	LF	FURNISH 16" DIA. STEEL PIPE PILES	$ 65.00	$ 46,800.00
12	EACH	DRIVE STEEL PILES	$ 2,000.00	$ 24,000.00
600	SF	RET. WALL, MODULAR GRAVITY	$ 50.00	$ 30,000.00
1	LS	UTILITY RELOCATION	$ 50,000.00	$ 50,000.00
1	LS	EROSION/WATER POLLUTION CONTROL	$ 2,000.00	$ 2,000.00
1	LS	LANDSCAPING	$ 40,000.00	$ 40,000.00
			Subtotal	$ 2,085,200.00
			Contingency (30%)	$ 625,560.00
			Engineering Services (12%)	$ 250,224.00
			City of Tigard Project Administration (20%)	$ 467,084.80
			Construction Services (12%)	$ 250,224.00
			Construction Total	**$ 2,710,760.00**
			Project Total	**$ 3,678,292.80**

BOWSTRING TRUSS WITH IN-LINE SOLAR ARRAY OPTION				
QUANTITY	**UNIT**	**ITEM**	**UNIT PRICE**	**TOTAL**
1	LS	MOBILIZATION	$ 190,000.00	$ 190,000.00
1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	$ 10,000.00	$ 10,000.00
500	HR	RAILROAD FLAGGING	$ 75.00	$ 37,500.00
1	LS	310 FT 2-SPAN STEEL TRUSS	$ 1,000,000.00	$ 1,000,000.00
65	CY	CONC. CL. 4000 (FOR DECK)	$ 1,500.00	$ 97,500.00
620	LF	BRIDGE RAIL	$ 275.00	$ 170,500.00
380	LF	PROTECTIVE SCREEN	$ 200.00	$ 76,000.00
160	CY	CONC. CL. 4000 (FOR FOUND.)	$ 1,500.00	$ 240,000.00
48	CY	DRILLED SHAFT CONCRETE	$ 500.00	$ 24,000.00
9600	LB	DRILLED SHAFT REINFORCEMENT	$ 1.50	$ 14,400.00
65	LF	DRILLED SHAFT EXCAVATION, 60 IN	$ 500.00	$ 32,500.00
720	LF	FURNISH 16" DIA. STEEL PIPE PILES	$ 65.00	$ 46,800.00
12	EACH	DRIVE STEEL PILES	$ 2,000.00	$ 24,000.00
600	SF	RET. WALL, MODULAR GRAVITY	$ 50.00	$ 30,000.00
1	LS	UTILITY RELOCATION	$ 50,000.00	$ 50,000.00
1	LS	EROSION/WATER POLLUTION CONTROL	$ 2,000.00	$ 2,000.00
1	LS	LANDSCAPING	$ 40,000.00	$ 40,000.00
1	LS	IN-LINE SOLAR ARRAY	$ 200,000.00	$ 200,000.00
1	LS	BATTERY ARRAY	$ 150,000.00	$ 150,000.00
			Subtotal	$ 2,435,200.00
			Contingency (30%)	$ 730,560.00
			Engineering Services (12%)	$ 292,224.00
			City of Tigard Project Administration (20%)	$ 545,484.80
			Construction Services (12%)	$ 292,224.00
			Construction Total	**$ 3,165,760.00**
			Project Total	**$ 4,295,692.80**

CABLE STAY				
QUANTITY	**UNIT**	**ITEM**	**UNIT PRICE**	**TOTAL**
1	LS	MOBILIZATION	$ 221,000.00	$ 221,000.00
1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	$ 10,000.00	$ 10,000.00
500	HR	RAILROAD FLAGGING	$ 75.00	$ 37,500.00
1	LS	305 FT 2-SPAN CABLE STAY	$ 1,250,000.00	$ 1,250,000.00
147	CY	CONC. CL. 4000 (FOR DECK)	$ 1,500.00	$ 220,500.00
610	LF	BRIDGE RAIL	$ 275.00	$ 167,750.00
380	LF	PROTECTIVE SCREEN	$ 200.00	$ 76,000.00
125	CY	CONC. CL. 4000 (FOR FOUND.)	$ 1,500.00	$ 187,500.00
44	CY	DRILLED SHAFT CONCRETE	$ 500.00	$ 22,000.00
8800	LB	DRILLED SHAFT REINFORCEMENT	$ 1.50	$ 13,200.00
60	LF	DRILLED SHAFT EXCAVATION, 60 IN	$ 500.00	$ 30,000.00
720	LF	FURNISH 16" DIA. STEEL PIPE PILES	$ 65.00	$ 46,800.00
12	EACH	DRIVE STEEL PIPE PILES	$ 2,000.00	$ 24,000.00
600	SF	RET. WALL, MODULAR GRAVITY	$ 50.00	$ 30,000.00
1	LS	UTILITY RELOCATION	$ 50,000.00	$ 50,000.00
1	LS	EROSION/WATER POLLUTION CONTROL	$ 2,000.00	$ 2,000.00
1	LS	LANDSCAPING	$ 40,000.00	$ 40,000.00
			Subtotal	$ 2,428,250.00
			Contingency (30%)	$ 728,475.00
			Engineering Services (12%)	$ 291,390.00
			City of Tigard Project Administration (20%)	$ 543,928.00
			Construction Services (12%)	$ 291,390.00
			Construction Total	**$ 3,156,725.00**
			Project Total	**$ 4,283,433.00**

CANTILEVER ARCH TRUSS				
QUANTITY	**UNIT**	**ITEM**	**UNIT PRICE**	**TOTAL**
1	LS	MOBILIZATION	$ 347,000.00	$ 347,000.00
1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	$ 10,000.00	$ 10,000.00
500	HR	RAILROAD FLAGGING	$ 75.00	$ 37,500.00
1	LS	395 FT SINGLE SPAN CANTILEVER ARCH TRUSS	$ 1,800,000.00	$ 1,800,000.00
122	CY	CONC. CL. 4000 (FOR DECK)	$ 1,500.00	$ 183,000.00
792	LF	BRIDGE RAIL	$ 275.00	$ 217,800.00
380	LF	PROTECTIVE SCREEN	$ 200.00	$ 76,000.00
491	CY	CONC. CL. 4000 (FOR FOUND.)	$ 1,500.00	$ 736,500.00
1280	LF	FURNISH 16" DIA. STEEL PIPE PILES	$ 65.00	$ 83,200.00
16	EACH	DRIVE STEEL PIPE PILES	$ 2,000.00	$ 32,000.00
40	EACH	MICROPILES	$ 5,000.00	$ 200,000.00
1	LS	UTILITY RELOCATION	$ 50,000.00	$ 50,000.00
1	LS	EROSION/WATER POLLUTION CONTROL	$ 2,000.00	$ 2,000.00
1	LS	LANDSCAPING	$ 40,000.00	$ 40,000.00
			Subtotal	$ 3,815,000.00
			Contingency (30%)	$ 1,144,500.00
			Engineering Services (12%)	$ 457,800.00
			City of Tigard Project Administration (20%)	$ 854,560.00
			Construction Services (12%)	$ 457,800.00
			Construction Total	**$ 4,959,500.00**
			Project Total	**$ 6,729,660.00**

TRAIL OPTION 1						
QUANTITY	**UNIT**	**ITEM**		**UNIT PRICE**		**TOTAL**
20150	CY	EMBANKMENT IN PLACE	$	30.00	$	604,500.00
2200	TON	LEVEL 1 ,1/2 INCH ACP	$	100.00	$	220,000.00
2960	TON	AGGREGATE BASE	$	30.00	$	88,800.00
850	SF	CONCRETE STAIR	$	100.00	$	85,000.00
4865	SF	RET. WALL, MODULAR GRAVITY	$	150.00	$	729,750.00
250	FT	HANDRAIL	$	100.00	$	25,000.00
1	LS	LANDSCAPING	$	50,000.00	$	50,000.00
				Subtotal	$	1,803,050.00
				Contingency (30%)	$	540,915.00
				Engineering Services (12%)	$	216,366.00
				City of Tigard Project Administration (20%)	$	403,883.20
				Construction Services (12%)	$	216,366.00
				Construction Total	**$**	**2,343,965.00**
				Project Total	**$**	**3,180,580.20**

TRAIL OPTION 2						
QUANTITY	**UNIT**	**ITEM**		**UNIT PRICE**		**TOTAL**
5000	CY	EMBANKMENT IN PLACE	$	30.00	$	150,000.00
1050	TON	LEVEL 1 ,1/2 INCH ACP	$	125.00	$	131,250.00
1420	TON	AGGREGATE BASE	$	35.00	$	49,700.00
1200	SF	STEEL STAIR	$	100.00	$	120,000.00
700	SF	RET. WALL, MODULAR GRAVITY	$	150.00	$	105,000.00
710	FT	HANDRAIL	$	100.00	$	71,000.00
560	FT	PRECAST PRESTRESSED SLABS	$	500.00	$	280,000.00
60	CY	CONC. CL. 4000 (FOR FOUND.)	$	1,500.00	$	90,000.00
1920	FT	FURNISH 16" DIA. STEEL PIPE PILES	$	65.00	$	124,800.00
32	EA	DRIVE STEEL PIPE PILES	$	2,000.00	$	64,000.00
62	CY	CONC. CL. 4000 (FOR DECK)	$	1,500.00	$	93,000.00
1	LS	LANDSCAPING	$	50,000.00	$	50,000.00
				Subtotal	$	1,328,750.00
				Contingency (30%)	$	398,625.00
				Engineering Services (12%)	$	159,450.00
				City of Tigard Project Administration (20%)	$	297,640.00
				Construction Services (12%)	$	159,450.00
				Construction Total	**$**	**1,727,375.00**
				Project Total	**$**	**2,343,915.00**

TRAIL OPTION 3						
QUANTITY	**UNIT**	**ITEM**		**UNIT PRICE**		**TOTAL**
1	LS	MOBILIZATION	$	132,695.00	$	132,695.00
12600	CY	EMBANKMENT IN PLACE	$	30.00	$	378,000.00
970	TON	LEVEL 1 ,1/2 INCH ACP	$	125.00	$	121,250.00
1300	TON	AGGREGATE BASE	$	35.00	$	45,500.00
650	SF	CONCRETE STAIR	$	100.00	$	65,000.00
220	SF	RET. WALL, MODULAR GRAVITY	$	150.00	$	33,000.00
865	FT	HANDRAIL	$	100.00	$	86,500.00
7000	SQFT	CAST-IN-PLACE SLAB BRIDGE	$	45.00	$	315,000.00
45	CY	CONC. CL. 4000 (FOR FOUND.)	$	1,500.00	$	67,500.00
1680	FT	FURNISH 16" DIA. STEEL PIPE PILES	$	65.00	$	109,200.00
28	EA	DRIVE STEEL PIPE PILES	$	2,000.00	$	56,000.00
1	LS	LANDSCAPING	$	50,000.00	$	50,000.00
				Subtotal	$	1,459,645.00
				Contingency (30%)	$	437,893.50
				Engineering Services (12%)	$	175,157.40
				City of Tigard Project Administration (20%)	$	326,960.48
				Construction Services (12%)	$	175,157.40
				Construction Total	**$**	**1,897,538.50**
				Project Total	**$**	**2,574,813.78**

ELEVATOR OPTION				
QUANTITY	**UNIT**	**ITEM**	**UNIT PRICE**	**TOTAL**
1	LS	MOBILIZATION	$ 99,000.00	$ 99,000.00
1	LS	ELEVATOR CAB, MECH. EQUIPMENT	$ 450,000.00	$ 450,000.00
1	LS	ELEVATOR TOWER	$ 238,000.00	$ 238,000.00
1	LS	ELEVATOR MECH. ROOM	$ 75,000.00	$ 75,000.00
740	SF	STEEL STAIR	$ 100.00	$ 74,000.00
230	FT	HANDRAIL	$ 100.00	$ 23,000.00
33	CY	CONC. CL. 4000 (FOR BRIDGE LANDING)	$ 1,500.00	$ 49,500.00
80	TON	LEVEL 1 ,1/2 INCH ACP	$ 125.00	$ 10,000.00
92	TON	AGGREGATE BASE	$ 30.00	$ 2,760.00
525	CY	EMBANKMENT IN PLACE	$ 30.00	$ 15,750.00
1	LS	LANDSCAPING	$ 50,000.00	$ 50,000.00
			Subtotal	$ 1,087,010.00
			Contingency (30%)	$ 326,103.00
			Engineering Services (12%)	$ 130,441.20
			City of Tigard Project Administration (20%)	$ 243,490.24
			Construction Services (12%)	$ 130,441.20
			Elevator O&M	$ 243,000.00
			Construction Total	**$ 1,413,113.00**
			Project Total	**$ 2,160,485.64**

1. Mech. Room assumed 12ft x 12ft w/ 10 ft ceiling
2. Landscaping assumes seeding to match existing conditions. Oak Savanna restoration by others
3. Present value of 50 years of elevator operation and maintenance. Assumes full replacement in 50 years at an assumed 3% discount rate.

FIELDS PROPERTY BRIDGEHEAD (CONNECTION TO FIELDS PROPERTY DEVELOPMENT)

QUANTITY	UNIT	ITEM	UNIT COST	TOTAL
1	LS	MOBILIZATION	$ 23,000.00	$ 23,000.00
2070	SF	CONCRETE RAMP	$ 18.00	$ 37,260.00
150	SF	CONCRETE STAIRS	$ 100.00	$ 15,000.00
740	LF	PEDESTRIAN HANDRAIL	$ 70.00	$ 51,800.00
2028	SF	CONCRETE TRAIL	$ 15.00	$ 30,420.00
1760	SF	RETAINING WALL	$ 50.00	$ 88,000.00
			Subtotal	$ 245,480.00
			Contingency (30%)	$ 73,644.00
			Engineering Services (12%)	$ 29,457.60
			City of Tigard Project Administration (20%)	$ 54,987.52
			Construction Services (12%)	$ 29,457.60
			Construction Total	**$ 319,124.00**
			Project Total	**$ 433,026.72**

Appendix D

Handrail Protective Fencing Exhibit

Otak



Custom hand railing to bicycle height, Bend Whitewater park pedestrian Bridge Bend, Oregon







Oregon standard parapet with handrail and cable weave protective fencing above Railroad Sellwood Bridge, Portland, Oregon



Cable barrier hand railing, to bicycle height, Tillicum Crossing, Portland, Oregon



Thematic protective fencing, Biggs Junction, Oregon



Mount Hood theme rail with protective fencing, Hood river, Oregon













Unique Handrail/protective fencing, Kruse Way Pedestrian Bridge over I-5, Lake Oswego, Oregon



Unique handrail, Depot Street Bridge, Rogue River, Oregon



Standard Oregon Pedestrian Rail, powder coated black and with Bicycle rub rail attached
Glenwood Connector Bridge, Springfield, Oregon



Truss design element with simple railing, Wildwood Trail Bridge, Portland, Oregon



Appendix E

Renewable Energy and Resiliency Study
By PAE Engineers, dated October 23, 2020

Renewable Energy and Resiliency Study

TIGARD RED ROCK CREEK TRAIL BRIDGE

20-1467.00
pae-engineers.com

October 23, 2020

Study Parameters

The Red Rock Creek Trail Bridge is intended to provide an important expansion of the Fanno Creek trail and serve as a critical connection in the longer term vision of a regional trail network. This important pathway has the potential to provide additional value to the City of Tigard through the contribution of renewable energy and resilient power.

This report provides the results of a preliminary study to review the potential for including these additional services to the community through the bridge project.

SYSTEM CONSIDERATIONS:

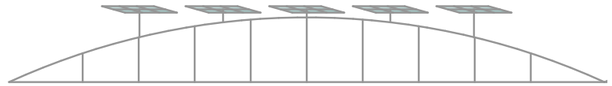
When evaluating different technologies and placement options, the team considered multiple options based on the following criteria:

- Production efficiency
- Access and vandal protection
- Construction and maintenance access
- Optimal energy generation

From this preliminary analysis, photovoltaic panels mounted in optimal and near optimal sun orientations were selected for further study.

Sustainability

In order to achieve maximum energy production, the study focused on placement options that optimized efficiency and production. This led to two options being selected for the final study.



OPTION 1 | SAWTOOTH

Option 1 is a series of photovoltaic platforms oriented in an optimal sun angle. This solution provides the most efficient output due to the ideal solar access. It also results in a visually interesting installation that provides an aesthetic element. But in order to avoid self shading, the platforms are limited in size and require placement spacing. The result is less panels can be installed which therefore results in lower overall production.



OPTION 2 | INTEGRATED

Option 2 is a canopy of photovoltaic panel placed as in inlay in the structure of the bridge. This solution provide a dual benefit of energy production and protection over the walk surface from rain and sun. Due to the orientation and curve of the bridge, portions of the array are in a less than optimal orientation. Since there is no issue with row-to-row shading, more panels can be installed which results in a higher overall production.

Resiliency

The project evaluated the possible contribution of the renewable energy system to a resilient operation scenario for the local area. In an emergency situation resulting in a disruption to utility services, the photovoltaic system could provide enough electricity to support small loads like lighting, electronic device charging and other minor resilient energy needs.

A preliminary analysis considered two options - one with storage and one without. The option without storage has little to no additional system cost but generation is limited to daylight hours when the photovoltaic system is operating. The second option include battery storage, and therefore adds cost, but would provide electricity access for a long time frame. Both options merit further research and could be incorporated as part of a large resiliency plan for Tigard.

Sawtooth 10 Degrees Tilt | **TIGARD RED ROCK CREEK TRAIL BRIDGE**

TOTAL ANNUAL RENEWABLE ENERGY PRODUCTION

30,030 kWh

ANNUAL LIGHTING LOAD

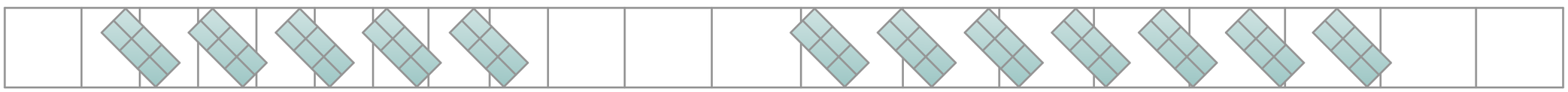
3,285 kWh

ADDITIONAL PRODUCTION

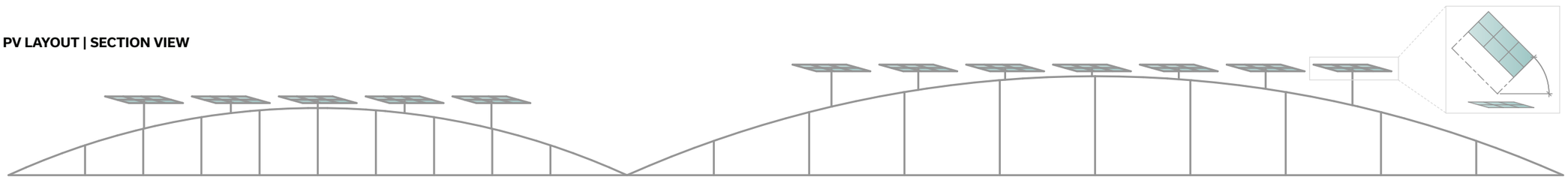
26,740 kWh



PV LAYOUT | PLAN VIEW



PV LAYOUT | SECTION VIEW



NOTE

*Cost estimates are based on industry averages and have been provided as information only.

SAWTOOTH

10 Degrees | 5.7" Spaced
180 Degree Azimuth
(12) 2x3 Arrays
72 Modules 25.9 KW
30.0 MWh

BASIS OF DESIGN:

OPTION 1:
Panel: Sunpower SPR-X22-360-COM-MLSD
Inverter SolarEdge

OPTION 2:
Panel / Microinverter:
Sunpower SPR-X22-360-C-AC

SYSTEM COST ESTIMATE:
$150k - $200k*

TOTAL ANNUAL RENEWABLE ENERGY PRODUCTION

54,660 kWh

ANNUAL LIGHTING LOAD

3,285 kWh

ADDITIONAL PRODUCTION

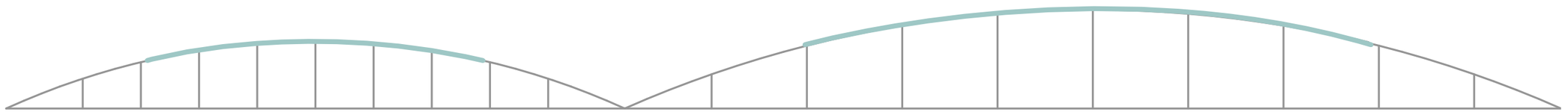
51,380 kWh



PV LAYOUT | PLAN VIEW



PV LAYOUT | SECTION VIEW



INTEGRATED

225 (-135) Degree Azimuth
144 Modules
51.8 Modules 54.7 KW

BASIS OF DESIGN:

OPTION 1:
Panel: Sunpower SPR-X22-360-COM-MLSD
Inverter SolarEdge

OPTION 2:
Panel / Microinverter:
Sunpower SPR-X22-360-C-AC

SYSTEM COST ESTIMATE:
$300k - $350k*

NOTE

*Cost estimates are based on industry averages and have been provided as information only.

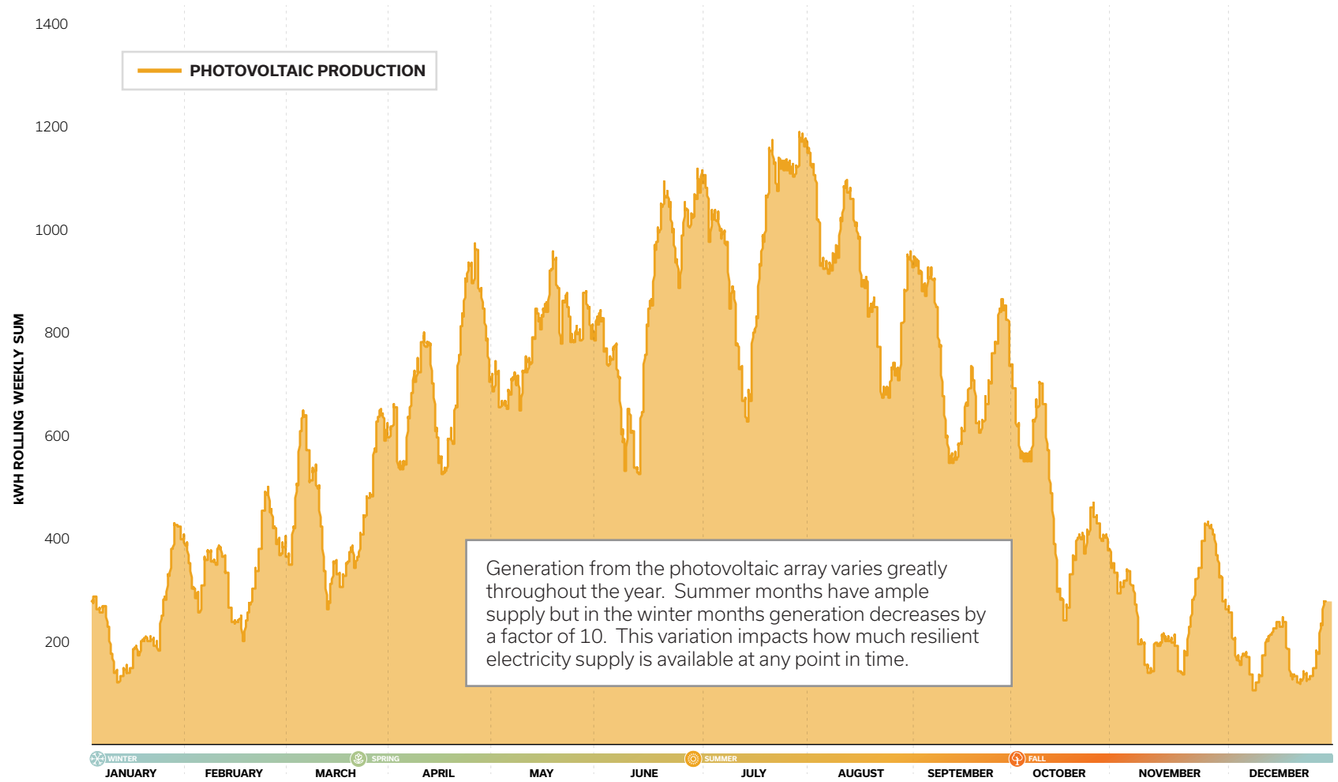
Resiliency



The best time to plan for resiliency is when it isn't needed. Strategic decisions during non-critical times allow for the thoughtful development of the systems and operating protocols needed for continuing daily life during critical times. This analysis is intended to serve as the spark for a larger conversation regarding resiliency in Tigard. The energy resources of the bridge have the potential serve as one element in a larger approach to community resiliency. The bridge could be a stand-alone resiliency asset or it could become part of a larger approach.

This is a preliminary look at the resources generated by the Sawtooth Platform photovoltaic option.

ANNUAL ENERGY PRODUCTION PROFILE | SAWTOOTH 10 DEGREE TILT



Off-Grid Access to Photovoltaic Generation

A simple path to resiliency is an inverter product that allows direct access to the electricity generated by the photovoltaic during daylight hours (does not include storage). With this system, small devices can be charged with the real-time generation to help support emergency operations.

PRODUCT	QUANTITY	MAX OUTPUT	ESTIMATED COST*	SUPPORT
SMA Secure Power Supply	(4)	8kW via (4) 16A 120V receptacles circuits	Included in main photovoltaic system cost*	— Electronic device charging — Small receptacle loads

NOTE

*Cost estimates are based on industry averages and have been provided as information only.

Additional Support with Storage

The inclusion of a small battery array will allow electricity access after daylight hours. Sized for operation during the worse week of the year, this system can store all production from the photovoltaic system for use during daylight and night time hours.

PRODUCT	MODEL	QUANTITY	MAX OUTPUT	ESTIMATED COST*	SUPPORT
Blue Planet Energy	LXHV	(4) 32kW units	125kW	$150,000*	— Electronic device charging — Small amount of LED lighting — Small receptacle loads

Appendix F

Drainage Issues Memo dated October 28, 2019, by Otak, Inc.



Red Rock Trail Bridge
Drainage Issues

Submitted to:
Skip Grodahl
DGB Properties, LLC
2164 SW Park PL
Portland, OR 97205

Prepared By:
Otak, Inc.
808 SW Third Av. Suite 300
Portland, OR 97204
Project No. 17052.005

October 28, 2019

Otak

Purpose and Need

The purpose of this memo is to examine potential drainage issues associated with the construction of a grade separated pedestrian crossing above Wall Street and the parallel railroad grade to connect the Rock Creek Trail to the Fanno Creek Trail. The east bridgehead landing within the private Fields Property development and the west bridge approach being constructed within the parklands jointly owned by City of Tigard and METRO.



FIGURE 1. GRADE CROSSING LOCATION

This project phase is a feasibility study to establish appropriate funding estimates of costs. Stormwater drainage form the project development is a concern given the proximity of Fanno Creek, and current clean water act treatment guidelines. Concentrated runoff caused by the final installation will require some level of treatment and potentially detention to comply with current rules. Additionally, impacts to the floodplain or floodway would require mitigation. These items are assessed here qualitatively in order to identify potential pitfalls that could lead to substantial project costs.

Existing Conditions

The east bridgehead lands in the planned Fields property development. A mixed use low/middle income residential and office development currently in design and permitting with the City. Development to date has included the improvement of SW Wall Street including extension parallel to the railroad right-of-way with planned extension further to the south to eventually connection with SW Tech Center Drive. Drainage issues at this bridgehead are well above the floodplain and bridge drainage will be directed toward the storm water system developed with this work. A large detention/treatment swale is being

constructed under the west end of the bridge which will provide adequate capture of impervious surface runoff from the structure and no further investigation will be required.

The location of the west bridge head is between Fanno Creek and the Railroad right-of-way. The floodplain in the area preventing development of this area leading to the current grass field and oak forest combination common in western Oregon. The goal, as established by the City of Tigard and METRO is to support this environment as natural space. The low grass area has been identified in the current Tigard parks development plan as potential space available for installation of sports fields. At the time of this report there is no specific funding dedicated to that development and alternative locations for similar facilities are being reviewed and considered. This area is currently natural ground surfaces and the introduction of hard surfacing from the bridge and pathway have the potential to concentrate stormflows.

Both floodplain and wetlands have been identified within the area. These areas are some distance from the bridgehead and alignments of approaching trail will be restrained to the upland areas avoiding any fill in either the wetlands or the floodplain.

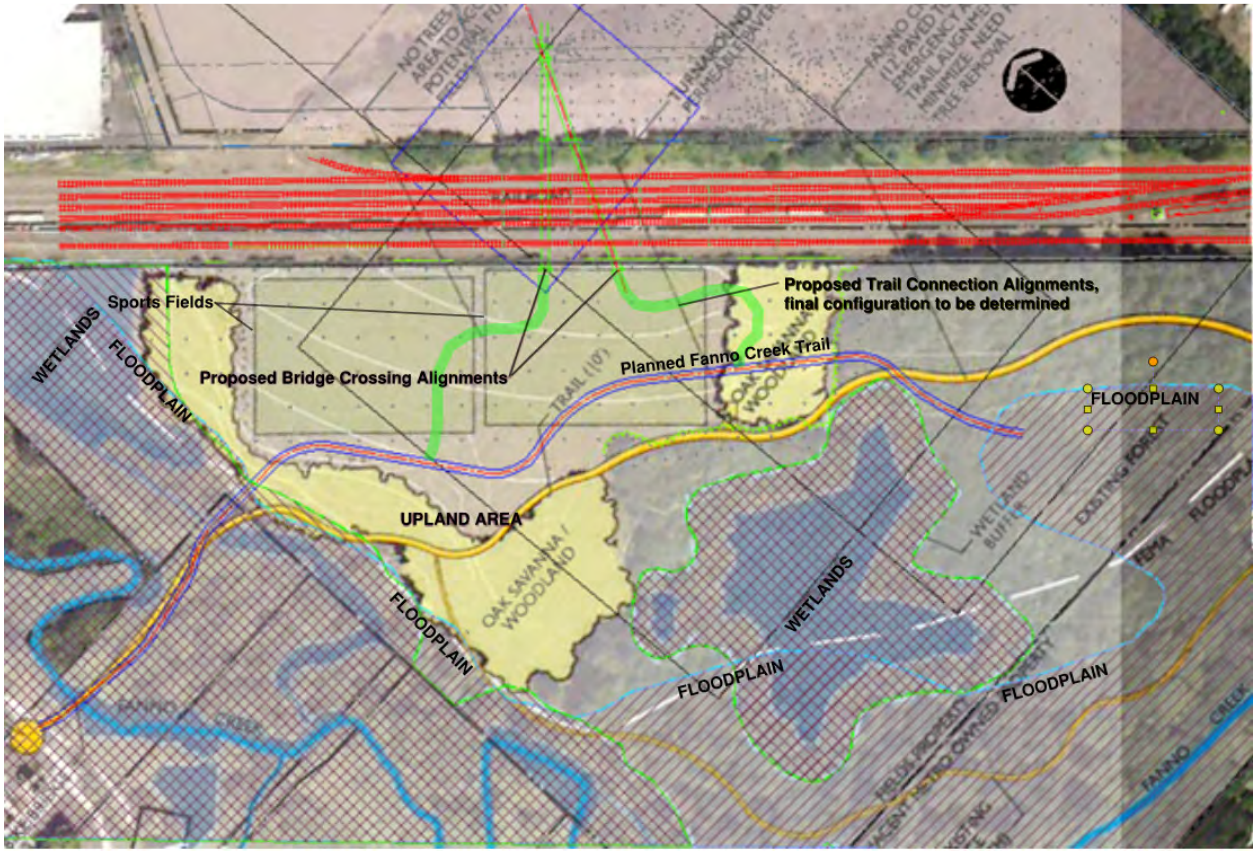


FIGURE 2. WETLANDS AND FLOODPLAIN

Permitting Concerns

Without fill in the floodplain there will be no requirement to permit construction for FEMA compliance. Avoidance of fill in wetlands or the buffer zone will avoid any need for US Army Corp of Engineers and

Oregon Division of State Lands removal/fill permitting. The only remaining concerns being to meet Clean Water Services (CWS) requirements for water quantity control, hydromodification, and water quality treatment.

It is unlikely that CWS will require the project to provide onsite stormwater detention nor a hydromodification assessment and associated hydromodification mitigation approach for downstream impacts. The relatively small project size and location within an undeveloped vegetated upland area limit the risk of impacts to Fanno Creek. If this assumption is incorrect, available stormwater management options include constructing the path with porous pavement or providing additional treatment on the Fields Property to offset managed runoff from the trail.

Pedestrian paths like this are generally considered to be nonpollution generating and it is unlikely CWS will require water quality treatment. Further, the treatment capacity of the adjacent vegetation is recognized in the stormwater requirements. The two applicable stormwater management approaches are landscape filter strips and vegetated corridor as a filter strip (see table 4-3 of the CWS Design and Construction Standards). Thus dispersion of stormwater into the adjacent vegetation will likely be adequate.

The impervious surfacing of the trail will require that the project address the concern. In this case the distance from the sensitive water body and the planned trail alignments can be assumed to provide adequate water treatment in the process of overland flow prior to entering wetlands. No facility is required. Similarly, no identifiable change in detention will occur and hence the overland flow can be expected to be adequate. Based on our review of the project and CWS requirements, we believe dispersing runoff from the new path into the adjacent vegetation will be an approvable approach for managing stormwater runoff from this project. However, the project has not yet been discussed with CWS and our approach is subject to revision based on their feedback.

Localized Trail Drainage

The final concern is collection of storm water from the bridge itself and discharge locations. The bridge is a grade separation above the railroad. To avoid any concentration of flow the bridge should developed without curbing a minimal side sloping of 1% and all stormwater that falls on the structure will naturally drain over the side, preserving the current drainage pattern in the area.

Similarly, along the approaching pathway from the west the path will be constructed flush to the surround grade and avoid any concentrated flow requiring no particular construction to accommodate.

During construction typical erosion control measures will be required along the length of the pathway to avoid soils form escaping the site. This can be accomplished with a series of best management practices including straw wattles, matting, silt fencing and seeding. The relatively flat area in the west approach makes these installations relatively uncomplicated.

Conclusion

The siting of this pathway is such that all current and planned installations can be anticipated to be adequate to accept the stormwater runoff patterns. While the pathway does introduce some measure of impervious surfacing the runoff has ample area to dissipate and infiltrate similar to existing conditions prior to reaching any known water body or wetland.

The drainage patterns from the structure will also result in very limited alteration to existing surroundings, largely spanning surfaces that are already impervious, or to be so developed and as such no special measures are identified at this time to address site drainage. As noted above typical best management practices for erosion control during construction, to comply with the requirement of a 1220 CA permit, will be needed.

Appendix G

Rail Crossing Order Draft

Genesee & Wyoming Railroad Services, Inc.

Real Estate Department, 13901 Sutton Park Dr., S, Suite 160, Jacksonville, FL 32224

APPLICATION FOR ROADWAY ON RAILROAD PROPERTY OR RAILROAD CROSSING

Incomplete or Inaccurate Information will delay application request

Section 1 - Applicant Data

Complete Name of Applicant to appear on Legal Document: City of Tigard Public Works, Oregon

Applicant Mailing Address: 8777 SW Burnham St
Tigard, Oregon 97223

Applicant Overnight Address: Same

Applicant Billing Address: Same

Applicant FEIN or Social Security _____ Applicant Contact Name & _____

Telephone Number: _____ Email Address: _____

Emergency Contact (in case of derailment or fallen/wire pole etc.): _____ Emergency Telephone _____

Applicant:
- ☐ Corporation
- ☐ Partnership
- ☐ Sole Proprietor
- ☐ Individual
- ☒ Municipality
- ☐ Developer
- ☐ Other*

*If other please explain: _____ State of Incorporation or Partnership: _____

Contact during Application Process:

Name: _____

Contact Telephone _____ Email Address: _____

DRAFT

Section 2 - Location Data

Railroad Name: Portland and Western Railroad (PNWR)

Estimated Start Date if new crossing: June, 2021

Nearest City: Tigard County: Washington State: Oregon

If Crossing Nearest Railroad Mile Post (Required): 33 **Feet from Railroad Milepost** 500 - 525 (N) S E W

Latitude/Longitude (Required in Digital Format) (ex 12.3456789/-64.101112): 45.422433/-122.760080

Quarter, Section, Township & Range: S1 T2S R1W

Railroad Subdivision (Required): Oregon Electric Line **US DOT/AAR Crossing Number (Required):**

Section 3 - Facility Type

Facility Type: [X] Crossing [ ] Crossing & Roadway [ ] Parallel Roadway

[X] New Crossing [ ] Existing Crossing [ ] Relocate [ ] New Roadway [ ] Existing Roadway [ ] Other

Use of Facility: [ ] Individual Access [ ] Farm Access [ ] Commercial Access [ ] Construction Access [X] Public Use [ ] Other

[ ] Pedestrian Underpass [X] Pedestrian Overpass [ ] Residential Development [ ] Commercial Development

If use of existing crossing/roadway please provide agreement number:

If other or revision to existing facility Please explain (Required):

Is Crossing/Road to be Permanent or Temporary? [X] Permanent [ ] Temporary

If temporary, estimated time needed:

Number of trips over:

Number of Property Owners Crossing/Roadway will serve:

Crossing/Roadway Per Day

Section 4 - Crossing Specifications

Width of Crossing on Railroad Right-of-Way: 16 feet

Angle Crossing will Cross Tracks: (90 degrees preferred) 90 degrees

Length of Crossing on Railroad Right-of-Way: 172 feet

Material to be used: Steel/Concrete

DRAFT

Section 5 - Roadway Specifications

Width of Roadway on Railroad Right-of-Way: N/A

Length of Roadway on Railroad Right-of-Way: N/A

Distance from Center of Parallel Roadway to Nearest Track: N/A

Material to be used: N/A

Section 6 - Purpose of Crossing/Roadway

General Purpose of Crossing/Roadway: Pedestrian crossing grade separation on public multi-use trail

If the land accessed by crossing/roadway will be subdivided, please explain in detail: N/A

Will crossing/roadway be utilized by single or multiple parties? Please explain in detail: Public Pedestrian Use

Existing Agreement

Does applicant have another crossing in vicinity? ☐ Yes ☒ No If so, where: _____

If Applicant holds any Existing Agreements List Agreement Numbers and attach copies of each existing Agreement: No existing agreements as applicable to this crossing

DRAFT

IMPORTANT!

Prior to application submittal, it is recommended that any questions concerning this application should be submitted to the Real Estate Department of Genesee & Wyoming Railroad Services, Inc. All questions or requests for information submitted by email receive a rapid response. Other requests can be made by phone (904) 900-6286, or email donna.killingsworth@gwrr.com. Questions can be answered and additional contact information obtained by visiting the website at www.gwrr.com.

Plans for proposed installation of a new crossing shall be submitted to and approved by the Railroad on behalf of itself, its subsidiaries and affiliates and designated engineer before work can begin!! Material and installation are to be in strict accordance with Railway engineering specifications.

Materials and installations are to be in strict accordance with specifications of National Electrical Safety Code, AREMA, current edition, and requirements of the Railroad.

If Application is Approved:

1. Applicant agrees to sign the Railroads standard Crossing or Roadway Agreement, which will provide that the applicant will perform all grading of approach roads and install culvers and gates to meet Railroad engineering standards.

2. To reimburse railroad for any cost incurred by Railroad incident to the installation, maintenance and/or supervision necessitated by the installation, altering pole line if required and removing the crossing or roadway and gates if the crossing is temporary or if the Agreement is later cancelled.

3. To furnish liability insurance as required by Railroad in which applicant will assume all liability for accidents or injuries that arise as a result of this application.

4. Applicant will be responsible for keeping gates closed, rail flange ways free of obstruction and vegetation, cut in all four quadrants. Application will attach a location sketch showing pertinent details and a North arrow.

Upon application approval, applicant agrees to reimburse Railroad for any cost incurred by Railroad incident to the installation, maintenance and/or supervision necessitated by the installation. Applicant further agrees to assume all liability for accidents or injuries that arise as a result of this installation.

Insurance Requirements:

This section must be completed in full, signed and dated prior to submittal to the Real Estate Department for processing, Incomplete or Inaccurate Information will delay application request and may incur additional fees. Unsigned applications will be returned to the applicant for signature.

Date: _____ Signature: _____

Phone Number: _____ Printed Name: _____

Fax Number: _____ Title: _____

Contact Email Address: _____

Please make check payable to the Railroad in question. W-9 information available upon request.

Mail the application for proposed project, in duplicate along with the applicable non-refundable fee(s) in U.S. Funds (Canadian Applicants please pay in Canadian Funds plus HST) to:

Genesee & Wyoming Railroad Services, Inc.
Real Estate Department
13901 Sutton Park Dr., S., Suite 160
Jacksonville, FL 32224

DRAFT

In order for the application to be complete ALL required details pertinent to the proposed installation must be completed in full and submitted along with the following non-refundable fees:

	# of Copies	Amount Due	Description
☐	**2**	**$1,000**	Completed Road Crossing Application and processing fee.
☐	**2**	**$1,750**	Engineer review fee, plans/drawings, no larger than 11 x 17. Larger drawings may incur additional engineering fees. Public Crossing engineering ($9,000)
☐	**2**	**$1,750**	Completed Contractor's Access/Occupancy Application and Fee.
		$4,500	

Standard Application processing takes approximately 6-8 weeks. "Expedited processing" is available and will reduce the processing time to between 1-2 weeks at an additional cost of $2,500 (U.S.) plans must meet engineering specifications. Incomplete application and plans not meeting engineering specifications will cause a delay in the processing of expedited applications. Current utility specifications and checklist can be found in the application packet.

***** Canadian Applicants please pay in Canadian Funds plus HST*****

Entering or working on the railroad right of way or any other railroad property without the permission of the railroad is trespassing and illegal. Violators risk the possibility of serious, even fatal injury and will be prosecuted.

DRAFT

Oregon Department of Transportation

RAILROAD-HIGHWAY PUBLIC CROSSING SAFETY APPLICATION

STATUS
☒ Draft
☐ Final*
** Includes signature*

INSTRUCTIONS

If you need assistance in completing this form, please call the Rail and Public Transit Division in Salem at (503) 986-4321.

Check one of the following items. Complete Section 1, plus the section listed for that item. Only sections for checked items will appear on the following pages.

- ☐ 1. Closure of an existing railroad-highway public at-grade crossing. ORS 824.206
- ☐ 2. Alteration or relocation of an existing public highway at an existing railroad-highway at-grade crossing. ORS 824.206
- ☐ 3. Alteration or relocation of existing railroad track(s) at an existing public highway at-grade crossing. ORS 824.206
- ☐ 4. Alteration of an existing separated railroad-highway public crossing. ORS 824.210
- ☐ 5. Alteration of an existing railroad-highway public at-grade crossing by adding warning devices, including installation of automatic signals at a crossing. ORS 824.206
- ☐ 6. Construction of a new public highway/pathway across an existing railroad track at grade. (Includes converting a private crossing to a public crossing.) ORS 824.204
- ☐ 7. Construction of a new railroad track or tracks across an existing public highway at grade. ORS 824.204
- ☒ 8. Construction of a new public highway above or below the grade of an existing railroad track. (Includes converting a private crossing to a public crossing.) ORS 824.210
- ☐ 9. Construction of a new railroad track or tracks above or below the grade of an existing public highway. ORS 824.210

Definitions:

- "Agency" means any state board, commission, department, or division thereof, or officer authorized by law to make rules or to issue orders, except those in the legislative and judicial branches.
- "APPLICANT" means a Public Authority in Interest or Railroad entitled under ORS 824.204, ORS 824.206 and ORS 824.210 to file an application for a crossing Order, seeking authority to construct, relocate, alter or close a railroad highway crossing. An APPLICANT is a PARTY.
- "Draft application": A completed, but unsigned, application for a crossing Order submitted by an Applicant seeking advance review of the application by "staff."
- "Highway" includes all roads, streets, alleys, avenues, boulevards, parkways and other places in this state actually open and in use, or to be opened and used for travel by the public. [ORS 824.200 (2)]
- "Party" means:
  a. Any person or agency entitled as a right to a hearing before the agency.
  b. Any person or agency named by the agency to be a party; or
  c. Any person petitioning to participate before the agency as a party or in a limited party status whom the agency determines either has an interest in the outcome of the agency's proceeding or represents a public interest in such result.
- "Person," except as provided in ORS 823.037, means any individual, partnership, corporation, association, governmental subdivision or public or private organization of any character other than an agency.
- "Protective device" means a sign, signal, gate or other device to warn or protect the public, installed at or in advance of a railroad-highway crossing [ORS 824.200 (5)].
- "Public authority in interest", except in proceedings under ORS 824.236, means the state, county, municipal or other governmental body with jurisdiction over the highway crossing the railroad track. In proceedings under ORS 824.236, "public authority in interest" means the county, municipal or other governmental body that has primary zoning authority over the lands served by the crossing. [ORS 824.200 (6)].
- "Railroad" is defined in ORS 824.020, and includes logging and other private railroads.
- "Railroad Company" is defined in ORS 824.200 (8).
- "Staff" means any employee of the Department of Transportation's Rail and Public Transit Division.
- "Interested agency/person" is an individual, agency, or organization that is copied on docket information but does not have party status.

DRAFT

Oregon Department of Transportation

RAILROAD-HIGHWAY PUBLIC CROSSING SAFETY APPLICATION

DOCKET NO.
ODOT CROSSING NO.
US DOT NO.

Rail and Public Transit Division
555 13th St. NE, Ste. 3
Salem, OR 97301

SECTION 1: APPLICATION INFORMATION

This section must be filled out completely by applicant.

1.1 Applicant contact information

APPLICANT NAME				PHONE
City of Tigard, Oregon				503 718-2591
ADDRESS				FAX
8777 SW Burnham St.				
CITY	STATE	ZIP	E-MAIL	
Tigard	OR	97223		
CONTACT PERSON				PHONE

1.2 Construction contract status

☐ This project is to be constructed under a contract let by ODOT Highway Division.

1.3 Crossing information

This information can be found at http://gisintra.odot.state.or.us/TransGIS/

STREET OR HIGHWAY NAME	RAILROAD NAME
Red Rock Creek Trail	Portland and Western
CITY	NAME OF TRACK
Tigard, Oregon	Oregon Electric
COUNTY	RAILROAD MILEPOST
Washington	33
ROAD AUTHORITY	PHONE
Tigard Public Works	503 718-2591

1.4 Railroad and public authority information

List contact information for the railroad and road authority directly affected by the project. (See definitions of "party," "public authority," "railroad" and "interested agency/person.") *Note: Pursuant to ORS Chapter 824, only a railroad or a public authority may file an application seeking authority to construct, relocate, alter, or close a railroad-highway crossing.*
To add another public authority, interested agency, or interested agency/person, click the "Add Another" button.

Railroad

NAME			CONTACT PERSON NAME	TITLE
Portland and Western			Chad Mullarkey	Real Estate
ADDRESS			E-MAIL	
1200 Howard Drive			chad.mullarkey@gwrr.com	
CITY	STATE	ZIP	PHONE	
Albany	OR	97321	904 900-6257	

Public Authority

NAME			CONTACT PERSON NAME	TITLE
ADDRESS			E-MAIL	
8777 SW Burnham St				
CITY	STATE	ZIP	PHONE	
Tigard	OR	97223		

1.5 Describe or attach the scope of the proposed project in detail:

Construct a new pedestrian separated grade crossing bridge above the Portland and Western Railway approximately 525 feet north of Oregon Electric Line mile point 33.

1.6 Provide plans, profiles, and cross-section drawings of the proposed construction.

Engineered plans must be signed and sealed by a professional engineer (P.E.).

Number of plans attached .....

DRAFT

1.7 Will a separated crossing be constructed? ☒ Yes ☐ No

1.8 Is there an alternate access route to the area to be served by the crossing? ☐ Yes ☒ No

1.9 What is the purpose and need for the project?

Connection of the planned Red Rock Creek trail to connect to the logical southern terminus with the Fanno Creek trail

1.10 Upon completion of the project, will it be possible to close any existing grade crossings in the area? ☐ Yes ☒ No

EXPLAIN
All other crossings are roadway/highway oriented, the new crossing will not provide vehicular crossing

If yes, check Question 1 on Page 1 and complete Section 4.

SECTION 3: SEPARATED CROSSINGS

3.1 At the crossing, will the highway be above or below the railroad tracks? ☒ Above ☐ Below

If the highway is to be below the railroad, describe the protection for vehicles at the bridge abutments:

DESCRIBE
Pedestrian bridge above the tracks

3.2 The structure will be constructed by: ☐ Railroad ☒ Public Authority in Interest

The cost of construction will be borne by:

	NAME	% OF COST
1	City of Tigard	
2	Metro	
3	Private development (DGB Properties)	

Include detailed drawings indicating division of responsibility and describe here (Note: Drawing should include vertical and horizontal clearances.):

3.3 Maintenance of separated crossing

PORTION OF IMPROVEMENTS	MAINTENANCE WILL BE PERFORMED BY	MAINTENANCE WILL BE PAID BY
Substructure	City of Tigard	City of Tigard
Superstructure	City of Tigard	City of Tigard
At highway appurtences	City of Tigard	City of Tigard
Railroad tracks, railroad drainage, all railroad facilities	Genesee and Wyoming	Genesee and Wyoming
Damage to structure caused by motor vehicle traffic on highway	City of Tigard	City of Tigard

3.4 Temporary impairment

Describe temporary impairment (if any) of the railroad's standard clearances during construction (attach detailed drawing):

DESCRIBE
Conceptually temporary impairment will only occur as the structure is erected, plans allow for quick erection requiring minimal rail closure time (less than 4 hours), after erection no clearance impacts are anticipated

3.5 Temporary public crossing at grade

If a temporary public crossing at grade is necessary during construction, complete Section 2 and include plan, profile, and cross-section drawings.

The temporary grade crossing will be located at which railroad milepost?		RAILROAD MILEPOST: N/A
The temporary grade crossing will be in place on what dates?	BEGINNING DATE: N/A	ENDING DATE: N/A

Print Form | Save | Submit by Email

DRAFT

Appendix H

Preliminary Geotechnical Engineering Report by
Shannon & Wilson, Inc. October 2019

SUBMITTED TO:

Otak

808 SW Third Ave., Suite 300

Portland, OR 97204

BY:

Shannon & Wilson, Inc.

3990 Collins Way, Suite 100

Lake Oswego, OR 97035

(503) 210-4750

www.shannonwilson.com

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

Red Rock Creek Pedestrian Bridge Alternatives Study

TIGARD, OREGON

SHANNON & WILSON

November 2019

Shannon & Wilson No: 103274

PAGE INTENTIONALLY LEFT BLANK FOR DOUBLE-SIDED PRINTING

Submitted To: Otak
808 SW Third Ave., Suite 300
Portland, OR 97204
Attn: Scott Nettleton

Subject: PRELIMINARY GEOTECHNICAL ENGINEERING REPORT, RED ROCK CREEK PEDESTRIAN BRIDGE ALTERNATIVES STUDY, TIGARD, OREGON

Shannon & Wilson prepared this report and participated in this project as a subconsultant to Otak. Our scope of services was specified in the Professional Services Agreement with Otak dated July 9, 2019. This report presents the results of our explorations and geotechnical engineering evaluations to support the preliminary design phase of the project.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON, INC.



James Walters, PE
Senior Engineer

Risheng (Park) Piao, PE, GE
Vice President | Geotechnical Engineer

NMV:REB:JJW:/srs

CONTENTS

1 Introduction 1
2 Project Understanding 1
2.1 Site Description 1
2.2 Project Description 2
2.3 Scope of Services 3
3 Review of Existing Data 3
4 Geology and Seismic Setting 3
4.1 Regional Geology 3
4.2 Local Geology 5
4.3 Seismic Setting 5
5 Exploration Program 6
5.1 Field Explorations 6
5.2 Laboratory Testing 6
6 Summary of Subsurface Conditions 7
6.1 Geotechnical Soil Units 7
6.1.1 Fill 7
6.1.2 Soft Fill 8
6.1.3 Alluvium 8
6.1.4 Missoula Flood Deposits - Fine-Grained Facies 8
6.1.5 Upper Hillsboro Formation 8
6.1.6 Hillsboro Formation 8
6.1.7 Lower Hillsboro Formation 8
6.2 Groundwater 9
7 Seismic Hazard analysis 9
7.1 Seismic Parameters 9
7.1.1 Site Classification 9
7.1.2 "Life Safety" Criteria Response Spectrum 10
7.2 Seismic Hazards Evaluation 11
7.2.1 Liquefaction 11
7.2.2 Liquefaction-Induced Settlement 11

CONTENTS

7.2.3 Slope Instability 11
8 Preliminary Bridge Foundation Design Recommendations 12
8.1 General 12
8.2 Northeast Abutment Global Stability 12
8.3 Preliminary Southwest Abutment Design Recommendations 14
8.4 Preliminary Driven Pile Design Recommendations 15
8.4.1 General 15
8.4.2 Driven Pile Axial Resistance 15
8.4.3 Driven Pile Downdrag Loads 16
8.4.4 Driven Pile Lateral Resistance 16
8.4.5 Preliminary Southwest Abutment Assumptions 17
8.5 Preliminary Drilled Shaft Design Recommendations 17
8.5.1 Drilled Shaft Axial Resistance 17
8.5.2 Drilled Shaft Downdrag Loads 18
8.5.3 Drilled Shaft Lateral Resistance 18
9 Geotechnical Explorations for Final Design 18
10 Limitations 19
11 References 20

Exhibits

Exhibit 2-1: Project Site Development 2
Exhibit 7-1: Recommended "Life Safety" Response Spectrum 10
Exhibit 8-1: Fill Placed Behind Soldier Pile Wall 13
on June 1, 2019 in the vicinity of proposed NE bridge abutment (RhinoOne, 2019) 13
Exhibit 8-2: Northeast Abutment Global Stability Soil Parameters 14
Exhibit 8-3: Preliminary Southwest Abutment Global Stability Soil Parameters 15

Tables

Table 1: LPILE Geotechnical Input Parameters

CONTENTS

Figures

Figure 1: Vicinity Map
Figure 2: Plan of Explorations and Interpretive Subsurface Profile
Figure 3: Liquefaction Analysis Results – B-1
Figure 4: Liquefaction Analysis Results – B-2
Figure 5: Estimated Axial Resistance – NE Bent 16-Inch Diameter Driven Piles
Figure 6: Estimated Axial Resistance – NE Bent 24-Inch Diameter Driven Piles
Figure 7: Estimated Axial Resistance – SW Bent 16-Inch Diameter Driven Piles
Figure 8: Estimated Axial Resistance – SW Bent 24-Inch Diameter Driven Piles
Figure 9: Estimated Axial Resistance – NE Bent 3-Foot Diameter Drilled Shaft
Figure 10: Estimated Axial Resistance – Mid Bent 5-Foot Diameter Drilled Shaft

Appendices

Appendix A: Existing Information
Appendix B: Field Explorations
Appendix C: Laboratory Testing
Important Information

ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ASTM	ASTM International
bgs	below ground surface
bpf	blows per foot
CAPWAP	Case Pile Wave Analysis Program
CRBG	Columbia River Basalt Group
CSZ	Cascadia Subduction Zone
CSZE	Cascadia Subduction Zone Earthquake
FHWA	Federal Highway Administration
fps	feet per second
g	acceleration due to Earth's gravity
GDM	Geotechnical Design Manual
LRFD	Load and Resistance Factor Design
MFD	Missoula Flood Deposits – Fine-Grained Facies
MSE	Mechanically Stabilized Earth
ODOT	Oregon Department of Transportation
OSSC	Oregon Standard Specifications for Construction
PDA	Pile Driving Analyzer
PGA	Peak Ground Acceleration
SPT	Standard Penetration Test
USGS	United States Geological Survey

1 INTRODUCTION

Shannon & Wilson, Inc. (Shannon & Wilson) has prepared this geotechnical report in accordance with our scope of services for the Otak project Red Rock Creek Pedestrian Bridge Alternatives (project number 17052.005) for DBG Properties. This report includes the results of our evaluations to support design of the pedestrian bridge. Our evaluations are preliminary and not for construction. Evaluations were performed in accordance with the following design guidelines:

- City of Tigard Engineering Design and Development Standards
- Oregon Department of Transportation (ODOT) Bridge Design Manual (BDM) – May 2017 (ODOT, 2017a);
- ODOT Geotechnical Design Manual (GDM) – June 2018 (ODOT, 2018a);
- Federal Highway Administration (FHWA) - HRT-06-032 – Seismic Retrofitting Manual for Highway Structures: Part 1 – Bridges – January 2006 (FHWA, 2006);
- American Association of State Highway and Transportation Officials (AASHTO) Guide Specifications for Load and Resistance Factor Design (LRFD) Seismic Bridge Design – Second Edition with 2012, 2014, and 2015 Interim Revisions, 2011 (AASHTO, 2011); and
- AASHTO LRFD Bridge Design Specifications – Eighth Edition, September 2017 (AASHTO, 2017).

The recommendations in this report are based on the subsurface investigation work conducted for this project and information provided by Otak and Ken Leahy Construction on relevant existing structures.

2 PROJECT UNDERSTANDING

2.1 Site Description

The project site is located in southeast Tigard in a previously undeveloped area separated from the greater Tigard area by the Portland & Western Railroad, which runs approximately northwest to southeast. The area to the northeast of the railroad previously sloped up to the northeast toward a neighborhood at the top of the hill. Currently, this area is an active construction site and has seen extensive modification to the terrain, including the construction of a soldier pile retaining wall and the placement of up to 30 feet of engineered fill to level the site. In addition, Wall Street is being extended parallel to the railroad. The construction is in various stages of completion. At the time of drilling, the base aggregate

for Wall Street had been placed at an elevation of approximately 162 feet. The engineered fill behind the retaining wall had been placed to an elevation of approximately 186 feet.

Exhibit 2-1 displays the project site. The area to the southwest of the railroad is a flat, open field. Aerial imagery suggests the field is maintained periodically by a tractor or mower. The field is bordered by trees, and Fanno Creek runs along the west side of the trees approximately 100 to 200 feet from the field.



Exhibit 2-1: Project Site Development. Left image (July 2018), and right image (May 2019) , were retrieved from Google Earth.

2.2 Project Description

The City of Tigard and DBG Properties are examining the feasibility of pedestrian bridge structures to cross the extension of Wall Street, the Portland & Western Railroad, and the planned TriMet light rail extension. The purpose of this bridge is to connect the Fields Property (currently under development) with the proposed Red Rock Creek trail system and the regional trail system on the southwest side of the railroad. The bridge will accommodate pedestrians, runners, bicyclists, and other non-motorized trail users (excluding equestrian use).

We understand seismic design of the pedestrian bridge will be performed in accordance with the 2018 Oregon Department of Transportation (ODOT) Bridge Design Manual (BDM). However, since this bridge will not accommodate vehicular traffic, we understand it will not be designed for the "Operational" criteria.

The project is currently in the preliminary design phase to determine the feasibility of the project and to investigate structure options. The information and designs developed in this phase will be used for permitting and communications with local officials and other interested parties.

2.3 Scope of Services

Shannon & Wilson's services for the project consisted of the following tasks:

- Perform a surface reconnaissance of the site;
- Explore subsurface conditions near the northeast abutment and Center Pier with two geotechnical borings;
- Conduct laboratory testing on selected soil samples to characterize soils and develop soil properties for evaluation;
- Evaluate geologic and seismic hazards; and
- Conduct preliminary engineering analyses including ground settlement, global stability for static and seismic cases, and foundation capacities.

3 REVIEW OF EXISTING DATA

Preliminary subsurface information was provided by the City of Tigard (the City) for the Fields Property development. This information consisted of a geotechnical report by RhinoOne Geotechnical, dated May 22, 2018. The report contains exploration logs, laboratory testing, and geotechnical engineering recommendations for the property. Selected information was used to confirm our subsurface characterizations and assumptions. Select pages from the RhinoOne report are included in Appendix A.

In addition, the calculation package and construction activity reports for the newly-constructed soldier pile retaining wall was provided to improve our understanding on the new site conditions from the construction of the wall. The calculation package and construction activity reports that are relevant to this project are also included in Appendix A.

4 GEOLOGY AND SEISMIC SETTING

4.1 Regional Geology

The project area lies within the Tualatin Basin, an approximately 35-mile-long by 20-mile-wide northwest-trending, gently sloping synclinal valley (Madin, 1990). The Tualatin Basin

is one of several localized sub-basins within the Willamette Lowland, a broader regional geologic depression (Gannett and Caldwell, 1998). The basins are structural depressions, created by complex folding and faulting of the basement rocks (Schlicker and Deacon, 1967). The basement, or floor, of the basins is made up of lava flows collectively referred to as the Columbia River Basalt Group (CRBG), which flowed into the area in the middle Miocene epoch, between about 17 and 6 million years ago. Over the span of geologic time, sedimentary deposits consisting of clay, silt, sand, and gravel eroded from the surrounding uplands and settled into the basins that formed on the CRBG surface. In the Tualatin Basin, these sediments have historically been referred to by several names, including Troutdale Formation (Schlicker and Deacon, 1967), Sandy River Mudstone equivalent (Madin, 1990), and Hillsboro Formation (Wilson, 1998). The basin-fill sediments are thickest near the center of the basin and thin toward the margins.

In the project area, lavas from the Boring Volcanic Field underlie the Hillsboro Formation in some areas. The Boring Volcanic Field extends from the western Cascade Range into the southern portion of the Portland Basin and consist of multiple shield type volcanos that erupted between 3.0 and 0.5 million years ago. These relatively small volcanos erupted mostly basalt type lavas in the Tualatin Basin while sediments of the upper portion of the Hillsboro Formation were being deposited (Evarts and others, 2009).

During the late stages of the last great ice age, between about 18,000 and 15,000 years ago, a lobe of the continental ice sheet repeatedly blocked and dammed the Clark Fork River in western Montana, which then formed an immense glacial lake called Lake Missoula. The lake grew until its depth was sufficient to buoyantly lift and rupture the ice dam, which allowed the entire massive lake to empty catastrophically. Once the lake had emptied, the ice sheet again gradually dammed the Clark Fork Valley and the lake refilled, leading to 40 or more repetitive outburst floods at intervals of decades (Allen and others, 2009). During each short-lived episode, floodwaters washed across the Idaho panhandle, through the eastern Washington scablands, and through the Columbia River Gorge. When the floodwater emerged from the western end of the gorge, it spread out over the Portland and Tualatin Basins and up the Willamette Valley as far south as Junction City, depositing a tremendous load of sediment (O'Conner and others, 2001). The catastrophic floods deposited extensive gravel bars across east Portland and up to 50 feet of micaceous clay to fine sandy silt in the Tualatin Basin. In mapping by O'Connor and others (2001), these sediments are referred to as Fine-Grained Missoula Flood Deposits.

During and after the Missoula Floods, rivers, streams, and wind have moved and deposited surficial sediment throughout the Tualatin Basin. In more recent times, humans have changed the landscape, grading cuts and fills for development.

4.2 Local Geology

According to geologic mapping by Gannett and Caldwell (1998), the surface geology at the project site consists of Alluvium and Missoula Flood Deposits. Man-made Fill deposits are present due to the recent construction from the development project north of Wall Street and the construction of Wall Street itself.

4.3 Seismic Setting

Earthquakes in the Pacific Northwest occur largely as a result of the collision between the Juan de Fuca plate and the North American plate. These two tectonic plates meet along a mega thrust fault called the Cascadia Subduction Zone (CSZ). The CSZ runs approximately parallel to the coastline from northern California to southern British Columbia. The compressional forces that exist between these two colliding plates cause the denser oceanic plate to descend, or subduct, beneath the continental plate at a rate of about 1.5 inches per year. This process leads to volcanism as well as contortion and faulting of both crustal plates throughout much of the western regions of southern British Columbia, Washington, Oregon, and northern California. Stress built up between the colliding plates is periodically relieved through great earthquakes at the plate interface (Goldfinger and others, 2012).

Within our present understanding of the regional tectonic framework and historical seismicity, three broad earthquake (seismogenic) sources have been identified. These three types of earthquakes and their maximum plausible magnitudes are as follows:

- **Subduction Zone Interface Earthquakes** originate along the CSZ, which is located 25 miles beneath the coastline. Paleoseismic evidence and historic tsunami studies indicate that the most recent subduction zone thrust fault event occurred in the year 1700, probably ruptured the full length of the CSZ, and may have reached magnitude 9.
- **Deep-Focus, Intraplate Earthquakes** originate from within the subducting Juan de Fuca oceanic plate as a result of the downward bending and contortion of the plate in the CSZ. These earthquakes typically occur at a depth of 28 to 38 miles. Such events could be as large as magnitude 7.5. Examples of this type of earthquake include the 1949 magnitude 7.1 Olympia earthquake, the 1965 magnitude 6.5 earthquake between Tacoma and Seattle, and the 2001 magnitude 6.8 Nisqually earthquake. The highest rates of CSZ intraslab activity are beneath the Puget Sound area, with much lower rates observed beneath western Oregon.
- **Shallow-Focus Crustal Earthquakes** are typically located within the upper 12 miles of the continental crust. The relative plate movements along the CSZ cause not only east-west compressive strain, but dextral shear, clockwise rotation, and north-south compression of the leading edge of the North American Plate (Wells and others, 1998), which is the cause of much of the shallow crustal seismicity of engineering significance in the region. The largest known crustal earthquake in the Pacific Northwest is the 1872

North Cascades earthquake with an estimated magnitude of about 7. Other examples include the 1993 magnitude 5.6 Scotts Mill earthquake and 1993 magnitude 6 Klamath Falls earthquake.

Shallow crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). Mapped fault locations and detailed descriptions can be found in the USGS Quaternary Fault and Fold Database (USGS, 2017). The database defines four categories of faults, Classes A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (less than 1.8 million years ago). For Classes A and B, there is geologic evidence that demonstrates the existence of Quaternary deformation. However, for Class B faults, evidence of Quaternary faulting or slip is more equivocal or may not extend deep enough to be a source of significant earthquakes.

According to the USGS Fault and Fold database, the nearest mapped fault is the northwest-trending Canby-Molalla Fault. The fault trace of the Canby-Molalla Fault is shown by USGS to be located near the Lower Boones Ferry interchange. However, the probability of the fault trace being in this location is considered "good" only at a map scale of 1:100,000. The distance between the site and the actual fault location cannot be precisely established based on existing data, and therefore we assumed it to be less than 0.5 mile.

5 EXPLORATION PROGRAM

5.1 Field Explorations

The field exploration program consisted of two borings, designated B-1 and B-2. The borings were drilled on August 14 and 15, 2019. Boring B-1 was drilled to a depth of 51.5 feet and boring B-2 was drilled to a depth of 116.5 feet. Drilling was performed using a truck-mounted CME 850 drill rig operated by Holt Services, Inc. of Vancouver, Washington. Boring locations are shown on the Site and Exploration Plan, Figure 2. Details of the exploration program, including descriptions of the techniques used to advance and sample the borings, logs of the materials encountered, and backfill details are presented in Appendix B, Field Explorations.

5.2 Laboratory Testing

The samples we obtained during our field explorations were transported to our laboratory for further examination. We then selected samples for a suite of laboratory tests. The soil testing program included moisture content tests, Atterberg Limits tests, and particle-size analyses. All laboratory testing was performed by Shannon & Wilson in accordance with

applicable ASTM International (ASTM) standards. The results of the laboratory tests and brief descriptions of the test procedures are presented in Appendix C, Laboratory Test Results.

6 SUMMARY OF SUBSURFACE CONDITIONS

6.1 Geotechnical Soil Units

Shannon & Wilson grouped the materials encountered in our field explorations into five geotechnical units, as described below. This interpretation of the subsurface conditions is based on the explorations and regional geologic information from published sources. The geotechnical units are as follows:

- **Fill**: Primarily Silty Clay with some sand and trace gravel (CL) in B-1 and sandy Silty Clay (CL) with trace gravel in B-2;
- **Soft Fill**: Sandy Silt (ML) encountered in B-1;
- **Alluvium**: Clayey silt with some sand and gravel (MH);
- **Missoula Flood Deposits - Fine-Grained Facies**: Primarily Silt with varying amounts of sand (ML) as well as Silty Sand (SM);
- **Upper Hillsboro Formation:** Silty Clay (CL) in B-1 and Silty Clay with some sand (CL) in B-2
- **Hillsboro Formation**: Clay (CH) with varying amounts of sand; and
- **Lower Hillsboro Formation:** Silty Clay with some sand (CL) in B-2.

These geotechnical units were grouped based on their engineering properties, geologic origins, and distribution in the subsurface. Contacts between the units may be more gradational than shown on the boring logs in Appendix B. SPT N values presented on the logs and discussed below are in blows per foot (bpf) as counted in the field. No corrections have been applied. The following sections describe the geotechnical unit characteristics in greater detail, based on the drilling explorations.

6.1.1 Fill

Fill was encountered in both borings from the surface to a depth of 23 feet in B-1 and 4.5 feet in B-2. B-1 was drilled through the engineered fill embankment behind the newly constructed solider pile wall, which accounts for the large difference in fill thickness between the two borings. The Fill consisted of Silty Clay with some sand and trace gravel (CL) in B-1 and sandy Silty Clay (CL) with trace gravel in B-2. SPT N-Values in the unit ranged from 11 to 44 blows per foot (bpf).

6.1.2 Soft Fill

Soft Fill was encountered in B-1 at approximately 23 feet below the ground surface (bgs). The Soft Fill consists of moist to wet, nonplastic Sandy Silt (ML). The SPT N-Value was 3. The natural moisture content of the sample was 34 percent. A sieve analysis of the sample indicated a fines contents of 66 percent by dry weight.

6.1.3 Alluvium

Alluvium was encountered in B-2 from 4.5 feet to 7 feet bgs. The Alluvium consisted of Clayey Silt with some sand and gravel (MH). One SPT in the unit resulted in an N-Value of 8 bpf. The natural moisture content of one specimen was 30 percent.

6.1.4 Missoula Flood Deposits - Fine-Grained Facies

Missoula Flood Deposits – Fine-Grained Facies (MFD) were encountered in B-1 below the Lower Fill from 29 to 33 feet bgs, and in B-2 below the Alluvium from 7 to 19 feet bgs. MFD observed in the borings consisted primarily of Silt with varying amounts of sand (ML) as well as Silty Sand (SM). SPT N-Values in the MFD ranged from 3 to 17 bpf. Natural moisture contents of tested specimens ranged from 31 to 34 percent. Sieve analyses indicated fines contents that ranged from 47 to 95 percent by dry weight.

6.1.5 Upper Hillsboro Formation

The Upper Hillsboro Formation was observed in B-1 from 33 to 37 feet bgs and in B-2 from 19 to 25 feet bgs. The Upper Hillsboro Formation observed in the borings consisted of Silty Clay (CL) to Silty Clay with some sand (CL). SPT N-Values ranged from 9 to 24 bpf. Natural moisture content of one specimen tested was 32.4 percent.

6.1.6 Hillsboro Formation

The Hillsboro Formation was observed in B-1 from 37 to 51.5 feet and in B-2 from 25 feet to 90 feet. Boring B-1 was terminated in the unit. Hillsboro Formation soils consisted of primarily Clay (CH) with varying amounts of sand. SPT N-Values in the unit ranged from 8 to 31 bpf. Natural moisture contents of tested specimens ranged from 26 to 51 percent. An Atterberg limits test indicated a plasticity index of 17 percent.

6.1.7 Lower Hillsboro Formation

The Lower Hillsboro Formation was observed in boring B-2 from 90 to 116.5 feet bgs. The Lower Hillsboro Formation consisted of Silty Clay with some sand (CL). SPT N-Values in the unit ranged from 16 to 35 bpf.

6.2 Groundwater

The geotechnical borings performed for this study were drilled using mud rotary techniques that make it difficult to discern the depth to groundwater, because of the use of drilling fluids in the boreholes. Groundwater levels were estimated during drilling (where possible) based on sample wetness, changes in soil density, and drilling action. Based on existing information and the moisture content of samples, we estimate groundwater ranges from elevation 160 feet underneath Wall Street to elevation 170 feet north of Wall Street.

Groundwater levels across the project alignment should be expected to vary seasonally and with changes in topography and precipitation. Zones of perched water are likely to be encountered above fine-grained layers. Locally, groundwater highs typically occur in the late fall to spring and groundwater lows typically occur in the late summer and early fall.

7 SEISMIC HAZARD ANALYSIS

We understand seismic design of the pedestrian bridge span will be performed in accordance with the 2018 Oregon Department of Transportation (ODOT) Bridge Design Manual (BDM).

7.1 Seismic Parameters

The 2018 ODOT BDM requires that all bridges be designed for 1,000-year return period ground motions under "Life Safety" criteria. Under this level of shaking, the bridge and approach structures, bridge foundation, and approach fills must be able to withstand the forces and displacements without collapse of any portion of the structure.

In addition to the 1,000-year "Life Safety" criteria, ODOT requires that all bridges be designed to remain "Operational" after a full rupture Cascadia Subduction Zone Earthquake (CSZE). Under this level of shaking, the bridge and approach fills are designed to remain in service shortly after the event to provide access for emergency vehicles. However, since this bridge will not accommodate vehicular traffic, we understand it will not be designed for the "Operational" criteria.

7.1.1 Site Classification

The Seismic Site Class for the "Life Safety" seismic design criteria was developed based upon the recommended procedure, using SPT N-values from our explorations, in the 2018 ODOT GDM.

Our evaluation, based on the subsurface conditions described in Section 6, indicates that the site is classified as Class D. Site Class D corresponds to stiff soil with an average shear wave velocity between 600 and 1,200 feet per second (fps), or an average SPT blow count between 15 and 50 bpf in the upper 100 feet of soil.

7.1.2 "Life Safety" Criteria Response Spectrum

The response spectrum for the "Life Safety" criteria were derived using the ODOT Bridge Section's Excel application, ODOT_ARS.v.2014.16, which uses the three-point curve method with data from the 2014 USGS probabilistic seismic hazard maps for the 1,000-year return period. This Excel application is available through ODOT's web portal (ODOT, 2017). The period and spectral acceleration for the "Life Safety" criteria for Site Class D are presented in Exhibit 7-1:

Exhibit 7-1: Recommended "Life Safety" Response Spectrum for Site Class D

Period, T (sec)	S_a (g)
0	0.357
0.12	0.779
0.2	0.779
0.6	0.779
0.8	0.586
1.0	0.469
1.2	0.391
1.4	0.335
1.6	0.293
1.8	0.260
2.0	0.234
2.2	0.213
2.4	0.195
2.6	0.180
2.8	0.167
3.0	0.156
3.2	0.147
3.4	0.138
3.6	0.130
3.8	0.123
4.0	0.117

NOTES:
S_a = Spectral Acceleration, g = gravity acceleration

7.2 Seismic Hazards Evaluation

Seismic hazards considered in the evaluation include ground shaking, liquefaction and associated effects (e.g., flow failure, lateral spreading, and settlement), slope instability, fault rupture, tsunami, and seiche.

The primary seismic hazards at the site are ground shaking, liquefaction, and slope instability. In our opinion, the potential for fault rupture is low, given the distance between the site and the nearest potentially active fault. Seismically induced tsunami and seiche are also non-hazards at the site.

7.2.1 Liquefaction

Liquefaction is defined as a decrease of the shearing resistance of a cohesionless soil due to the buildup of excess pore pressures that can result from strong ground shaking. During liquefaction, the soil experiences a temporary transformation into a viscous fluid, which can result in significant variable ground settlement and slope deformations, see Section 6.2.2. Saturated sands and silts characterized as loose and cohesionless are typically susceptible to liquefaction.

To evaluate liquefaction potential, SPT N-values from the borings were used and corrected in accordance with the simplified procedures described by Youd (2001). These results were checked with the procedures from Boulanger & Idriss (2014) and Cetin and others (2004). The analysis indicated that the Sandy Silt Fill and MFD would likely experience liquefaction in a design earthquake M 9.0 with a PGA of 0.35g. Figures 3 and 4 show the results of our evaluations.

7.2.2 Liquefaction-Induced Settlement

As noted above, one of the potential consequences of liquefaction is significant ground settlement. The potential liquefaction-induced settlement at the site was evaluated using the Tokimatsu and Seed method (1987) and the Ishihara and Yoshimine (1992) method. The estimated liquefaction-induced settlement ranges between 1 to 5 inches.

7.2.3 Slope Instability

Earthquakes produce seismic forces that add additional loads to slopes, which can result in slope instability. We evaluated the northeast abutment for static, seismic, and post-seismic conditions. Please refer to Section 8.2, Northeast Abutment Global Stability, for a discussion and results of our analyses.

8 PRELIMINARY BRIDGE FOUNDATION DESIGN RECOMMENDATIONS

8.1 General

Preliminary design recommendations are based on conceptual information provided by Otak, our field explorations, and our review of the available existing information. If foundation types or configurations change after this report has been submitted, Shannon & Wilson should be contacted to provide updated recommendations.

8.2 Northeast Abutment Global Stability

We evaluated the global stability of the proposed northeast abutment and recently constructed solider pile wall for the static, seismic (pseudo-static), and post-seismic (liquefied soil) conditions based on the ODOT GDM and the AASHTO LRFD Bridge Design Manual. Generalized subsurface conditions and soil parameters were determined from the provided existing information, results of field explorations, and laboratory testing. Horizontal seismic loading coefficients were taken as half the peak ground acceleration for the seismic loading condition. A residual soil strength for the liquefied MFD and Fill based on Olson and Stark (2003) and modeled using an internal friction angle of 22 and 7 degrees, respectively.

Lateral resistance from the solider pile wall was incorporated into the global stability model as a point load located at one third of the retained soil height and was taken as the active earth pressure used in design of the wall. The Fields Property developer, Ken Leahy Construction, provided the calculation package submitted by Pacific Foundation and included in Appendix A, Existing Information. Based upon page 29 of the calculation, titled *"Pond 9.5 ft Wall-Seismic Cantilevered Piles"*, the wall segment below the bridge abutment was designed for a horizontal force of 31284 pounds per pile and a pile spacing of 8 feet. By dividing the horizontal design force by the pile spacing, we calculated a minimum wall resistance of 3000 pounds per linear foot.

Initial evaluation of the abutment and soldier pile wall showed a factor of safety of less than 1.1 for both the seismic and post-seismic cases. These low factors of safety were the result of assuming the soft liquefiable fill material encountered in Boring B-1 extends from the abutment to the wall face. To better define geometry and strength properties of the backfill materials in this area, the design team requested documentation of the fill placement. Exhibit 8-1 shows placement of boulders directly behind the wall. After incorporating the boulders in the stability model, the factors of safety for both the seismic and post-seismic cases increased above the minimum required factor of safety of 1.1.



Exhibit 8-1: Fill Placed Behind Soldier Pile Wallon June 1, 2019 in the vicinity of proposed NE bridge abutment (RhinoOne, 2019).

The stability analysis was performed using the Morgenstern-Price method with the aid of the computer program SLOPE/W (GEO-SLOPE International, Ltd.).

Slope stability analyses results are presented on Figure 2 and the assumed material properties are summarized in Exhibit 8-2. The analyses indicate the calculated factors of safety for static slope stability are greater than the ODOT-required minimum factor of safety of 1.5 (resistance factor of 0.65). The seismic (pseudo-static) and post-seismic stability factor of safety exceed the ODOT-required minimum factor of safety of 1.1 (resistance factor of 0.9).

Exhibit 8-2: Northeast Abutment Global Stability Soil Parameters

Material Name	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg.)
Engineered Fill	120	50	34
Missoula Flood Deposits	110	50	32
Missoula Flood Deposits (post-seismic)	110	--	22
Soft Fill	105	--	28
Boulders	130	--	38
Soft Fill (liquefied)	105	--	7
Upper Hillsboro Formation	110	50	28

NOTES:
pcf = pounds per cubic foot; psf = pounds per square foot; deg. = degrees

8.3 Preliminary Southwest Abutment Design Recommendations

We understand an approximately 25-foot-tall embankment will convey pedestrians from the existing grade south of the railroad tracks to the southwest abutment. Due to the close proximity of the abutment to the railroad right of way, a wall will be required to connect the bridge to the adjacent embankment.

It should be noted that no subsurface explorations have been performed at the southwest abutment at the time of this report and, therefore, our analysis and recommendations are subject to change.

We considered three wall and bridge abutment foundation combinations, including (1) a stem wall supported on drilled shafts; (2) an end pier with a short jump span to a mechanically stabilized earth (MSE) wall; and (3) an MSE wall with integrated pile foundations. Based on our understanding of the subsurface conditions and site constraints, we recommend option 3, an MSE wall with integrated pile foundations. This option would allow for settlement to occur prior to installation of the bridge foundation, eliminating static downdrag loads. Block-outs, or sleeves, would be installed in the MSE wall at the locations of the planned pile foundations. If this option is selected, crane access should be considered for installing the pile foundations after the embankment is constructed.

Global stability of the embankment and wall was performed using the assumed subsurface profile shown in Figure 2 and the general methods described in Section 8.2. Slope stability analyses results are presented on Figure 2 and the assumed material properties are summarized in Exhibit 8-3. The analyses indicate that the calculated factors of safety for static slope stability are greater than the ODOT-required minimum factor of safety of 1.5 (resistance factor of 0.65). The seismic (pseudo-static) and post-seismic stability factor of safety exceed the ODOT-required minimum factor of safety of 1.1 (resistance factor of 0.9).

Exhibit 8-3: Preliminary Southwest Abutment Global Stability Soil Parameters

Material Name	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg.)
Engineered Fill	120	50	34
Missoula Flood Deposits	110	50	28
Missoula Flood Deposits (post-seismic)	110	--	22
Upper Hillsboro Formation	110	50	28
Alluvium	105	--	26
Alluvium (post-seismic)	105	--	22
MSE Wall Fill (reinforced)	130	1,000	38

NOTES:
pcf = pounds per cubic foot; psf = pounds per square foot; deg. = degrees

It should be noted that large volumes of over-excavation may be required in the assumed alluvium deposits if organic material is encountered. Also, these deep over excavations may encounter the groundwater table, therefore, we recommend installing a vibrating wire piezometer with data logger at the southwest abutment to monitor ground water levels prior to construction.

8.4 Preliminary Driven Pile Design Recommendations

8.4.1 General

The following sections provide our recommendations for axial and lateral resistance of driven steel pipe piles at the northeast abutment and southwest abutments. Based on observed subsurface conditions and estimated preliminary loads, we evaluated 16-inch- and 24- inch-diameter steel pipe piles with 0.5-inch wall thickness. Boring B-1 was used to evaluate the pile axial compressive resistances for piles at the northeast abutment. Soil properties from boring B-2 and existing information were used to evaluate the pile axial compressive resistances for the southwest abutment. Further explorations are needed to confirm our assumptions for the southwest abutment.

8.4.2 Driven Pile Axial Resistance

We recommend that the steel pipe piles conform to the requirements of ASTM A252 Grade 3 specification for steel piles. Mill certification should be provided by the supplier. We expect that the compressive resistance of the driven pile will consist mostly of skin friction. We recommend the piles be driven closed-ended to create full displacement and increase pile driving resistance. All portions of pile design and construction should meet the requirements of Oregon Standard Specification for Construction (OSSC, 2018), Section 00520, and project special provisions.

The estimated nominal pile compressive resistances for the recommended pile sections for 16-inch and 24-inch diameter pipe piles are presented on the Estimated Axial Pile Resistance charts, Figures 5 through 8.

Where wave equation analysis methods are used for pile compressive resistance estimates, we recommend that a resistance factor of 0.50 be applied to the nominal compressive resistance to evaluate the strength limit state capacity of the piles. If Pile Driving Analyzer (PDA) Testing and Case Pile Wave Analysis Program (CAPWAP) will be performed for this project, a resistance factor of 0.65 may be used. The estimated settlement is less than 1 inch at the maximum loads applied to the pile under the strength limit state loading; therefore, the nominal resistance may be considered the nominal service limit state resistance, as well. We recommend a resistance factor of 1.0 be applied to the nominal resistance for the service limit state and extreme event limit state evaluations. We did not consider any resistance from the soils above the bottom of pile cap.

The estimated axial resistance assumes the piles are spaced at least 6 pile diameters apart, measured center-to-center. Based on this assumption, the pile group effects are not considered. If, during final design, the pile spacing is reduced, the appropriate pile efficiency factor must be established and applied, as recommended by the AASHTO LRFD.

The pile geotechnical resistances under strength and extreme limit state should not be greater than the pile structural resistance. The structural engineer should evaluate the pile structural resistance in accordance with Section 6.0 of the AASHTO LRFD Bridge Design Specifications (2017).

8.4.3 Driven Pile Downdrag Loads

Based upon post-liquefaction settlement analysis, the driven piles at the northeast abutment will experience seismic downdrag loads. We estimate the post-seismic downdrag force will be 10 kips per pile for both the 16- and 24-inch diameter pipe piles. A load factor of 1.0 is recommended to be applied to this post-seismic downdrag force.

8.4.4 Driven Pile Lateral Resistance

The pile foundations will be subjected to lateral loads resulting from live loads, wind and earthquake loading. We understand that the laterally loaded pile analyses will be performed with the aid of the LPILE computer program developed by Ensoft, Inc. Geotechnical input parameters for the LPILE computer program for each abutment are provided in Table 1. Groundwater is assumed to be at 14 feet bgs for the northeast abutment and 5 feet bgs for the southwest abutment.

The estimated lateral resistance parameters presented in Table 1 are recommended for driven piles with center-to-center spacing greater than five pile diameters (5D) and in a single row. Based on this assumption, the pile group effects are not considered. If pile spacing is less than 5D or multiple rows of piles are required, the appropriate P-Multiplier must be established and applied, as recommended by the AASHTO LRFD.

8.4.5 Preliminary Southwest Abutment Assumptions

We understand that a Mechanically Stabilized Earth (MSE) Wall and sloping embankment is the current concept to address the elevation difference between the bridge deck and ground surface at the southwest abutment. To allow for the use of driven piles without considering the effects of settlement-induced downdrag from the MSE wall, we assume the wall will be constructed first with sleeves so piles can be installed through the fill after settlement has occurred. Our analysis also assumes approximately 5 feet of overexcavtion for the base of the MSE wall. If this concept changes, our analyses will need to be updated. We will assess settlement and bearing resistance of the southwest abutment MSE wall during the final design phase.

8.5 Preliminary Drilled Shaft Design Recommendations

Drilled shafts have been proposed for the center bent due to the site restrictions between Wall Street and the railroad right-of-way. Our analysis included developing drilled shaft axial resistance recommendations, lateral resistance parameters for input into LPILE, and downdrag loads for 5-foot-diameter drilled shafts.

8.5.1 Drilled Shaft Axial Resistance

We performed axial resistance evaluation in general accordance with AASHTO LRFD Bridge Design Specifications (2017), Section 10.8.

We evaluated axial resistance for strength and extreme event limit states. The analyses were based on the subsurface conditions encountered in the project borings and our experience with similar soils and design conditions. We estimated unit side and tip resistance values based on the average SPT values (N-values) within each unit, laboratory tests, and our experience.

Our axial resistance analyses results are presented on Figures 9 and 10. These results are presented as plots of nominal and factored axial resistance versus depth for strength and extreme event limit states. Recommended resistance factors for each limit state are provided in the notes section of each figure.

8.5.2 Drilled Shaft Downdrag Loads

Based on our seismic hazard evaluation, drilled shafts at the center pier extend through potentially liquefiable soils that may settle following ground shaking and induce downdrag loads on the piles. We developed Life Safety level estimates of downdrag loads using the settlement estimates from the reduced unit side resistances from the axial pile resistance analyses. As per AASHTO, a load factor of 1.0 is applied for seismic design. The post-seismic downdrag force at the NE Bent 3-foot diameter drilled shaft is estimated to be 40 kips. The post-seismic downdrag force at the Mid Bent 5-foot diameter drilled shaft is estimated to be 60 kips.

8.5.3 Drilled Shaft Lateral Resistance

The proposed drilled shaft foundations will be subjected to lateral loads resulting from live loads, wind, and earthquake loading. We understand that the laterally loaded drilled shaft analyses will be performed with the aid of the LPILE computer program. Geotechnical input parameters for LPILE are provided in Table 1. Groundwater is assumed to be 14 feet bgs at the NE bent location and 5 feet bgs at the Mid bent location.

The estimated lateral resistance parameters presented in Table 1 are recommended for drilled shafts with center-to-center spacing greater than five shaft diameters (5D) and in a single row. Based on this assumption, the shaft group effects are not considered. If the shaft spacing is less than 5D, or multiple rows of shafts are required, the appropriate P-Multiplier must be established and applied, as recommended by the AASHTO LRFD Bridge Design Specifications, Section 10.7.2.4.

9 GEOTECHNICAL EXPLORATIONS FOR FINAL DESIGN

The geologic interpretation shown near the southwest abutment on Figure 2 is for preliminary design only. Explorations are necessary at the southwest abutment and along the proposed embankment and retaining walls adjacent to the southwest abutment to evaluate the subsurface conditions in this area. These explorations should consist of one deep boring, up to 75 feet deep; four shallower borings, 30 feet deep, spaced along the embankment; and a series of CPTs, one at each boring, and at a spacing of 300 feet along the embankment.

10 LIMITATIONS

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist, and further assume that the explorations are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the explorations.

Within the limitations of scope, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied.

This report was prepared for the exclusive use of the City of Tigard, DBG Properties, and their project team in the preliminary design of the proposed Red Rock Creek Pedestrian Project and should not be relied upon for final design or construction. Additional explorations are required to develop final design recommendations for this project.

The scope of our present services did not include environmental assessments or evaluations regarding the presence or absence of wetlands, or hazardous or toxic substances in the soil, surface water, groundwater, or air, on or below or around this site, or for the evaluation or disposal of contaminated soils or groundwater should any be encountered.

Please read the Important Information Section at the back of this report to reduce your project risks.

11 REFERENCES

Allen, J.E., Burns, M., and Burns, S., 2009, Cataclysms on the Columbia: The Great Missoula Floods (2nd ed.): Portland, Oregon, Ooligan Press, 204 p.

American Association of State Highway and Transportation Officials (AASHTO), 2017, AASHTO LRFD Bridge Design Specifications: Customary U.S. Units, (8th ed): Washington, D.C., AASHTO, 2 v.

American Association of State Highway and Transportation Officials, 2011, AASHTO guide specifications for LRFD seismic bridge design (2nd ed.): Washington, D. C., American Association of State Highway and Transportation Officials, 1 v.

Boulanger, R. W. and Idriss, Izzat M., 2014, CPT and SPT based liquefaction triggering procedures: Univesity of California at Davis, Center for Geotechnical Modeling, report no. UCD/CGM-14/01, 134 p.

Cetin, K. O.; Seed, R. B.; Der Kiureghian, Armen; and others, 2004, Standard penetration test-based probabilistic and deterministic assessment of seismic soil liquefaction potential: Journal of Geotechnical and Geoenvironmental Engineering, v. 130, no. 12, p. 1314-1340.

City of Tigard Engineering Department, 1998, Public Improvement Design Standards dated July 1998: Tigard, Oregon. available: https://www.tigard-or.gov/engineering/Public_Improvement_Design_Standards.pdf

Evarts, R. C., Conrey, R. M., Fleck, R. J., Hagstrum, J. T., 2009, The Boring Volcanic Field of the Portland-Vancouver area, Oregon and Washington: Tectonically anomalous forearc volcanism in an urban setting: The Geological Society of America, Field Guide 15, p. 258-370.

Federal Highway Administration (FHWA), 2006, Seismic Retrofitting Manual for Highway Structures: Part 1 – Bridges: Federal Highway Administration, Publication No. FHWA-HRT-06-032, January.

Gannett, G.W., Caldwell, R.R, 1998; Geologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington, Professional Paper 1424-A.

Goldfinger, C., Nelson, C.H., Morey, A., Johnson, J.E., Gutierrez-Pastor, J., Eriksson, A.T., Karabanov, E., Patton, J., Gracia, E., Enkin, R., Dallimore, A., Dunhill, G., and Vallier, T., 2012, Turbidite Event History: Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone: USGS Professional Paper 1661-F, 184 p, 64 Figures.

Ishihara, Kenji and Yoshimine, Mitsutoshi, 1992, Evaluation of settlements in sand deposits following liquefaction during earthquakes: Soils and Foundations, v. 32, no. 1, p. 173-188.

Madin, I.P., 1990, Earthquake-Hazard Geology Maps of the Portland Metropolitan Area, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-90-2, scale 1:24,000, 21 p.

O'Connor, J.E., Sarna-Wojcicki, A., Wozniak, K.C., Polette, D.J., and Fleck, R.J., 2001, Origin, Extent, and Thickness of Quaternary Geologic Units in the Willamette Valley, Oregon: U.S. Geological Survey Professional Paper 1620.

Oregon Department of Transportation (ODOT), 2019, Bridge Design and Drafting Manual 2004 (rev. October 2016): Salem, Oregon., 3 v., available: http://www.oregon.gov/ODOT/HWY/BRIDGE/Pages/standards_manuals.aspx.

Oregon Department of Transportation (ODOT), 2018a, Geotechnical Design Manual dated March 2018: Salem, Oregon. available: https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Geotech-Manual.aspx.

Oregon Department of Transportation, 2018b, Standard specifications for construction: Salem, Oregon, available: http://www.oregon.gov/ODOT/Business/Documents/2018_STANDARD_SPECIFICATIONS.pdf.

Oregon Department of Transportation (ODOT), 2017a, ODOT Design Response Spectrum Program ODOT_ARS.v.2014.16.xlsx: ODOT website https://www.oregon.gov/ODOT/HWY/BRIDGE/Pages/seismic.aspx, accessed 5/9/2017 10:41 AM.

Oregon Structural Specialty Code, 2018

Schlicker, H.G. and Deacon, R.J., 1967, Engineering Geology of the Tualatin Valley region, Oregon: Oregon Department of Geology and Mineral Industries Bulletin B-60, 103 p., 5 app., 45 figs., 5 tables, 4 pls., scale 1:48,000.

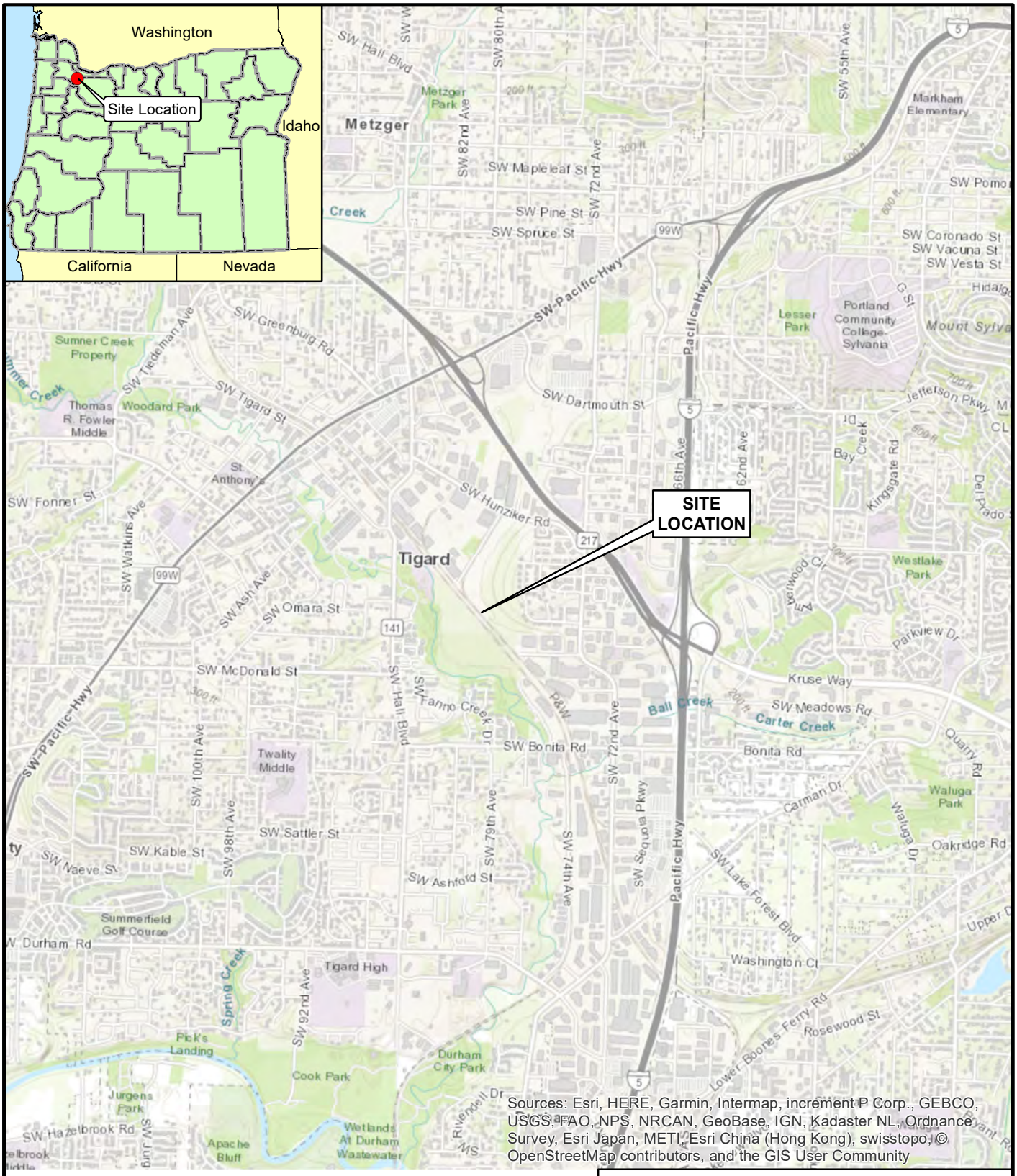
Tokimatsu, Kohji and Seed, H. B., 1987, Evaluation of settlements in sands due to earthquake shaking: Journal of Geotechnical Engineering, v. 113, no. 8, p. 861-878.

United States Geological Survey, 2017, Quaternary fault and fold database of the United States: U.S. Geological Survey website, http://earthquake.usgs.gov/hazards/qfaults/map/#qfaults

Wells, R.E., Weaver, C.S., and Blakeley, R.J., 1998, Fore-arc migration in Cascadia and its neotectonic significance: Geology, v. 26, p. 759-762.

Wilson, D. C., 1998, Post-middle Miocene geologic evolution of the Tualatin Basin, Oregon: Oregon Geology, v. 60, no. 5, p. 99-115

Youd, T. L.; Idriss, I. M.; Andrus, R. D.; and others, 2001, Liquefaction resistance of soils: summary report from the 1996 NCEER and 1998 NCEER/NSF workshops on evaluation of liquefaction resistance of soils: Journal of Geotechnical and Geoenvironmental Engineering, v. 127, no. 10, p. 817-833.



0 0.25 0.5 1

Scale in Miles

N

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tiagrd, Oregon

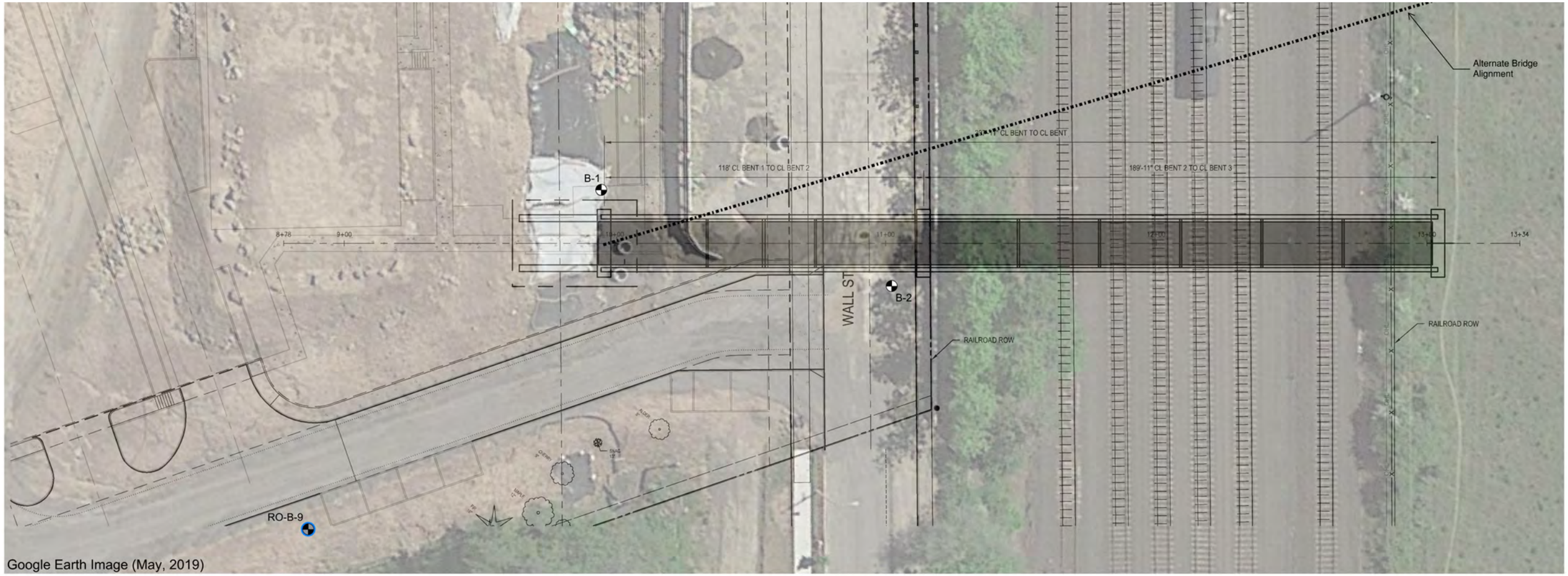
VICINITY MAP

October 2019 103274-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: T:\Projects\PDX\103000s\103274_TigardPedBridge\103274_Vicinity.mxd Date: 9/13/2019 Login: NMV

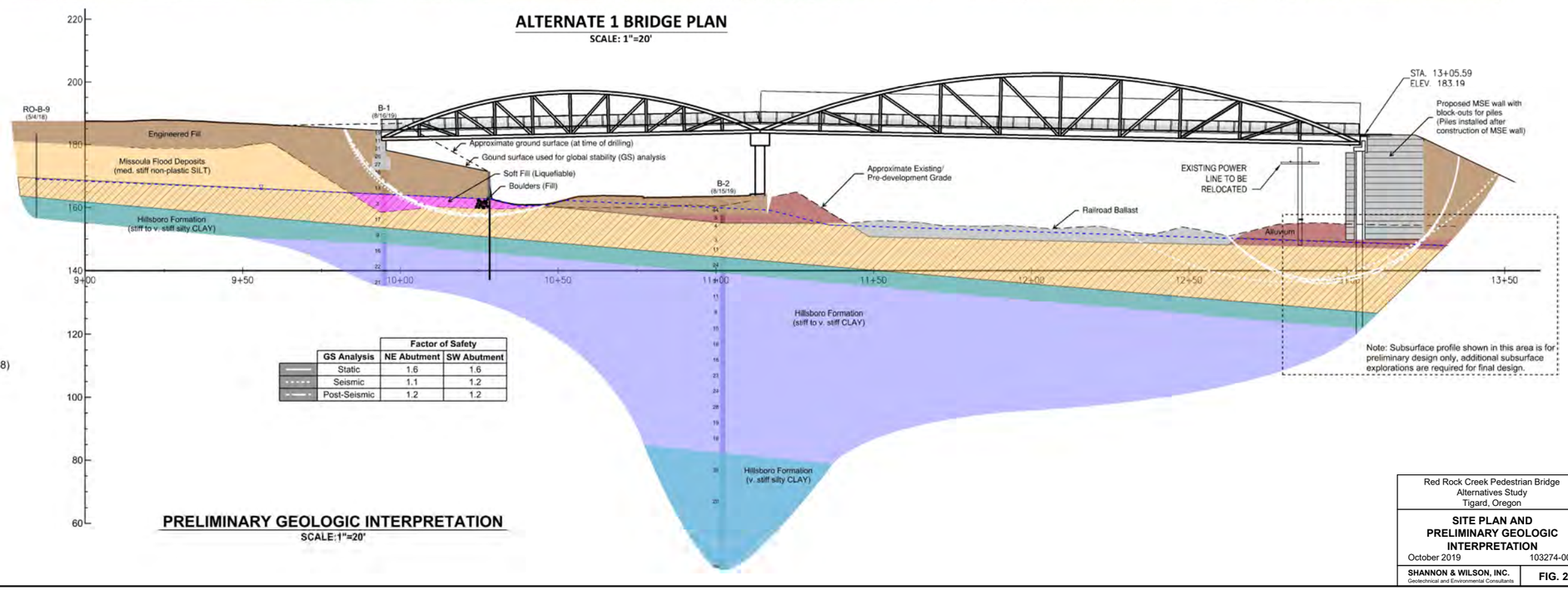


ALTERNATE 1 BRIDGE PLAN

SCALE: 1"=20'

20' 0' 20' 40'

SCALE IN FEET



LEGEND

B-1 — Designation and Location of Boring

RO-B-9 — Designation and Location of Boring (RhinoOne 2018)

Vibrating Wire Piezometer

Potentially Liquefiable Soil

GS Analysis	Factor of Safety NE Abutment	SW Abutment
Static	1.6	1.6
Seismic	1.1	1.2
Post-Seismic	1.2	1.2

PRELIMINARY GEOLOGIC INTERPRETATION

SCALE: 1"=20'

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

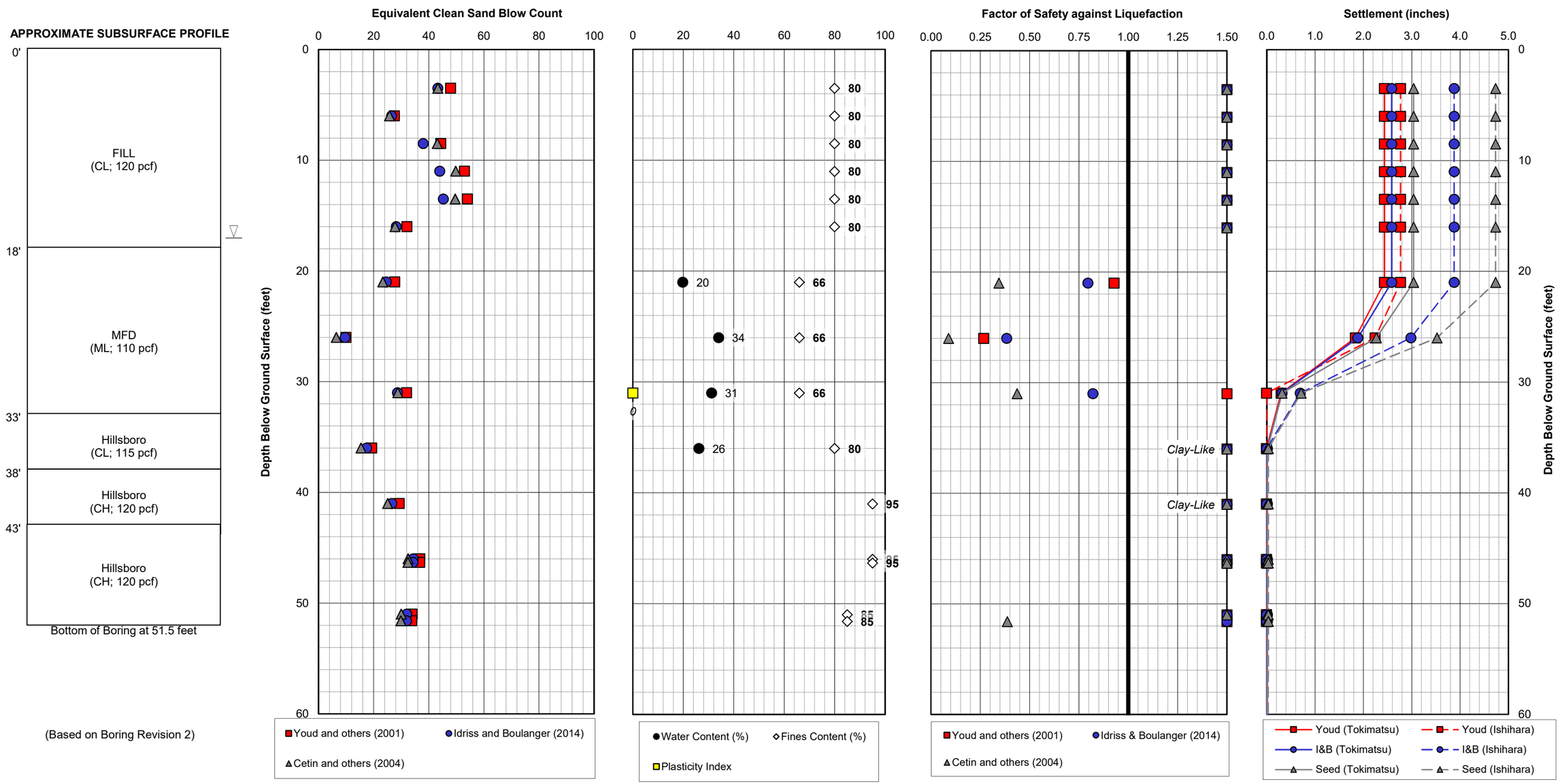
SITE PLAN AND PRELIMINARY GEOLOGIC INTERPRETATION

October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

NMV



NOTES

1. See main text for references.
2. The liquefaction resistance of a soil is based on its density and fines content. We used the results of the standard penetration testing to estimate the density, and the results of selected laboratory tests to estimate the fines content.
3. We estimated the seismic settlement below the water table using Tokimatsu and Seed (1987) and Ishihara and Yoshimine (1992). We estimated the settlement above the water table using Pradel (1998).
4. Average shear wave velocity in upper 30 feet = 566 fps
   Hammer energy ratio = 80%
   Groundwater table depth = 18 feet
5. pcf = pounds per cubic foot
   g = gravitational acceleration
   PGA = peak ground acceleration

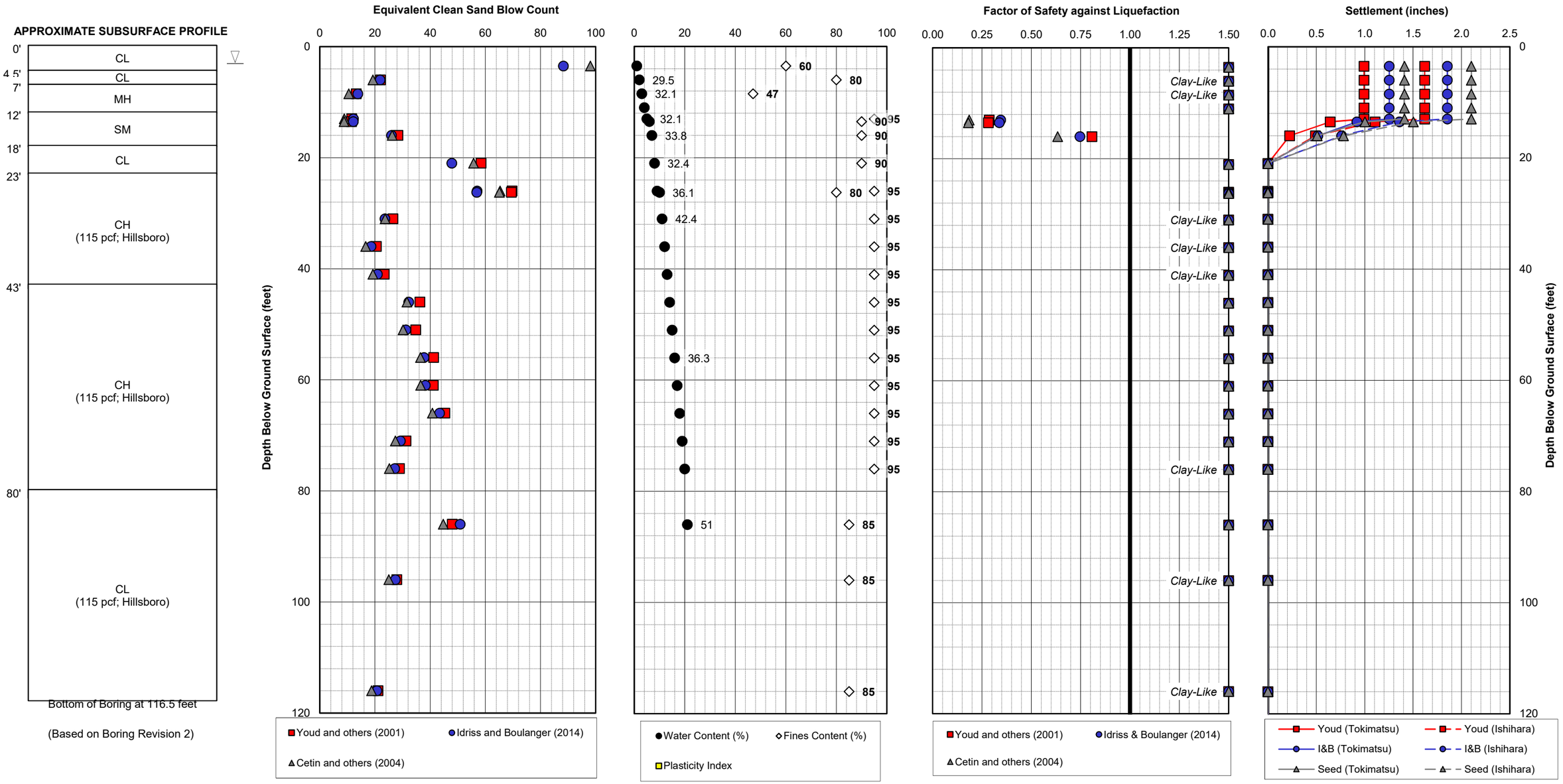
Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

LIQUEFACTION ANALYSIS SUMMARY
BORING B-1
M = 9.0, PGA = 0.35g

October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3



NOTES

1. See main text for references.
2. The liquefaction resistance of a soil is based on its density and fines content. We used the results of the standard penetration testing to estimate the density, and the results of selected laboratory tests to estimate the fines content.
3. We estimated the seismic settlement below the water table using Tokimatsu and Seed (1987) and Ishihara and Yoshimine (1992). We estimated the settlement above the water table using Pradel (1998).
4. Average shear wave velocity in upper 30 feet = 521 fps
   Hammer energy ratio = 80%
   Groundwater table depth = 5 feet
5. pcf = pounds per cubic foot
   g = gravitational acceleration
   PGA = peak ground acceleration

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

LIQUEFACTION ANALYSIS SUMMARY
BORING B-2
M = 7.7, PGA = 0.42g

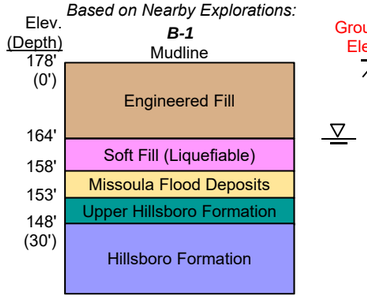
October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 4

GENERALIZED SUBSURFACE PROFILE

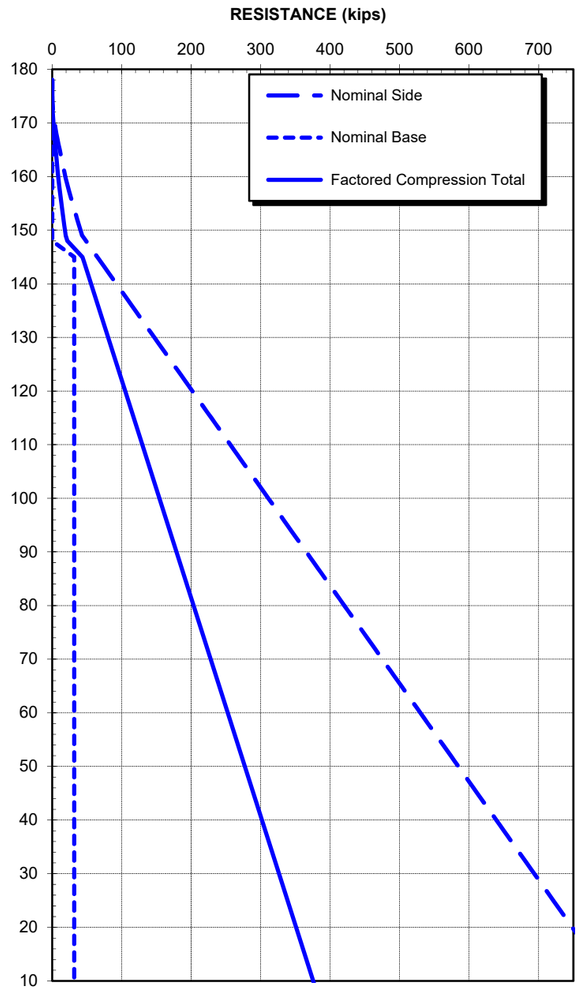
Based on Nearby Explorations:
B-1



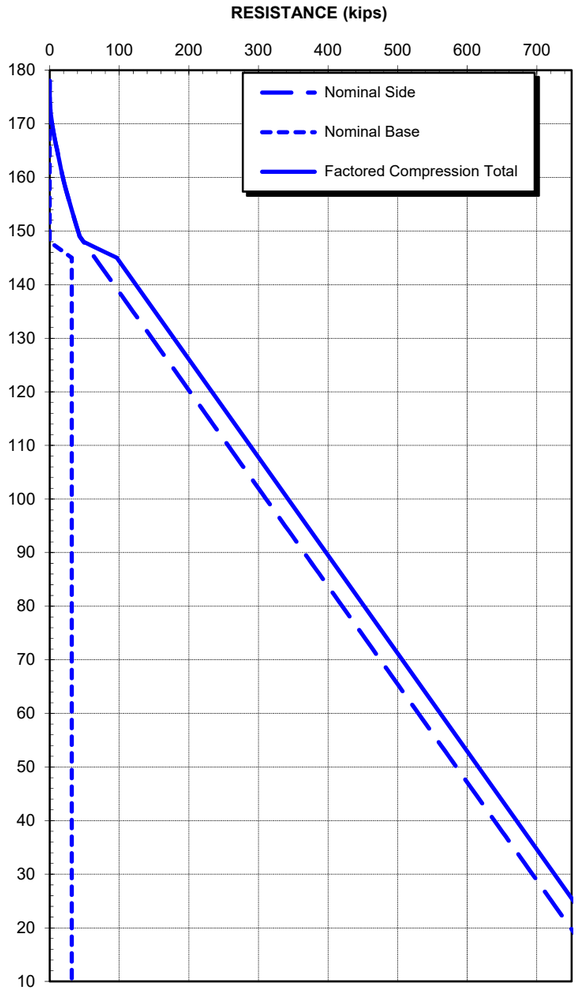
Bottom of Boring at Elev. 135.0 feet

Ground Surface Elev. +178 ft

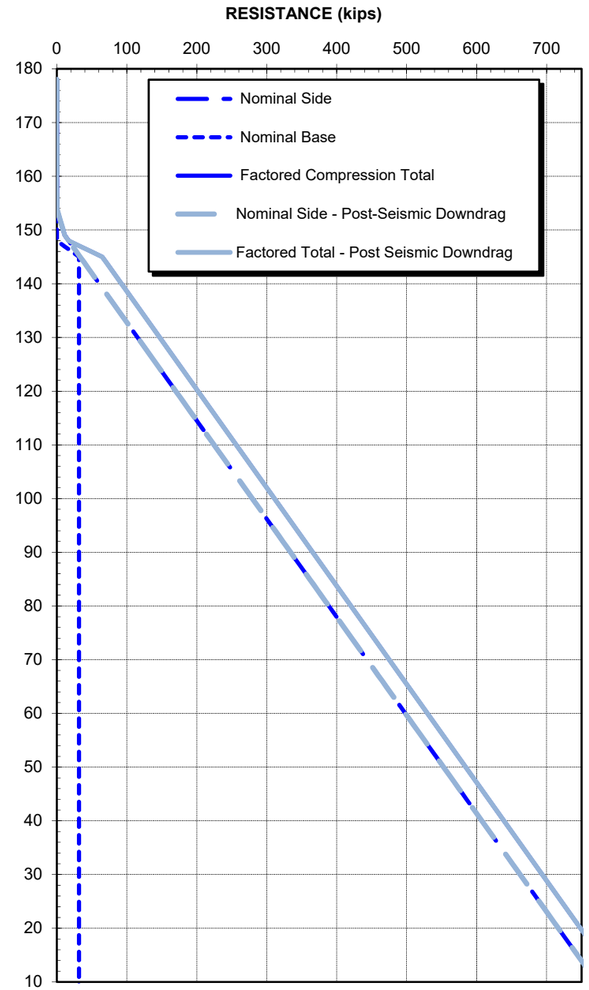
STRENGTH LIMIT



EXTREME EVENT: NON-LIQUEFIED STRENGTH



EXTREME EVENT: LIQUEFIED / REDUCED STRENGTH



NOTES

1. The analyses were performed based on guidelines included in AASHTO 2015, the ODOT GDM and local experience. The analyses are based on a single pile or a group of piles at a center to center spacing greater than or equal to 6 diameters.
2. Factored total shaft compression resistance shown on plots is determined by adding nominal side and base resistances multiplied by the corresponding resistance factor:

	Strength	Extreme: Non-Liquefied	Extreme: Liquefied/Reduced
Side Resistance - Compression	0.45	1.0	1.0
Side Resistance - Uplift	0.35	0.8	0.8
Base Resistance	0.45	1.0	1.0

3. Estimated shaft resistance for the Extreme Event: Liquefied/Reduced Strength case is based on results from our liquefaction analysis.
4. The estimated post-seismic downdrag force is 10 kips. Post-seismic downdrag forces should be considered with the post-seismic downdrag resistance curves on the Extreme Event: Liquefied/Reduced Strength plot.

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

NE BENT
ESTIMATED AXIAL RESISTANCE
16-INCH DIAMETER DRIVEN PILES

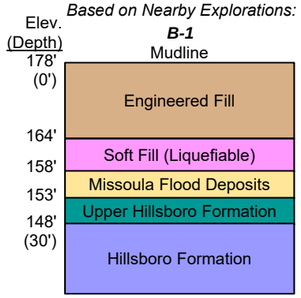
October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 5

GENERALIZED SUBSURFACE PROFILE

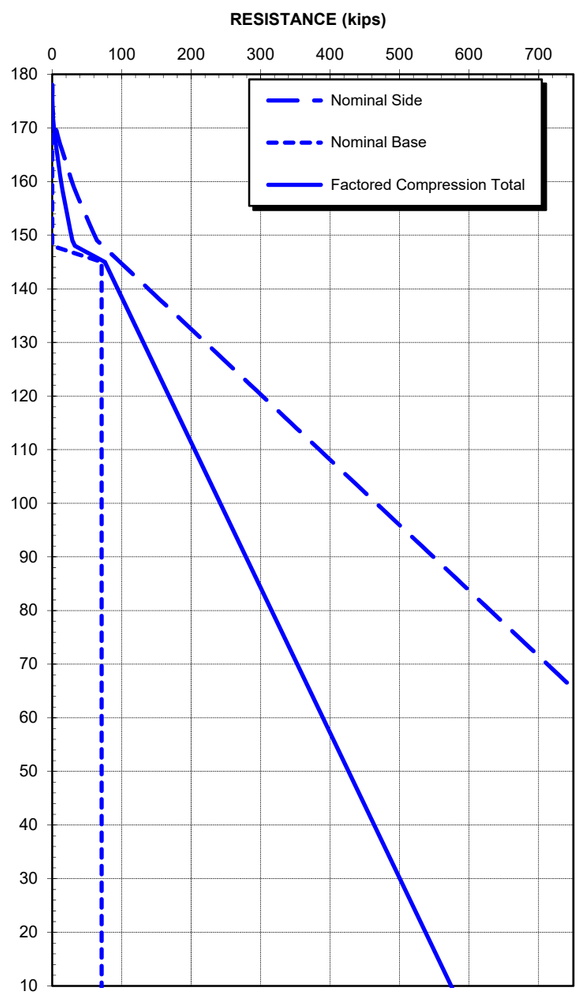
Based on Nearby Explorations:
B-1



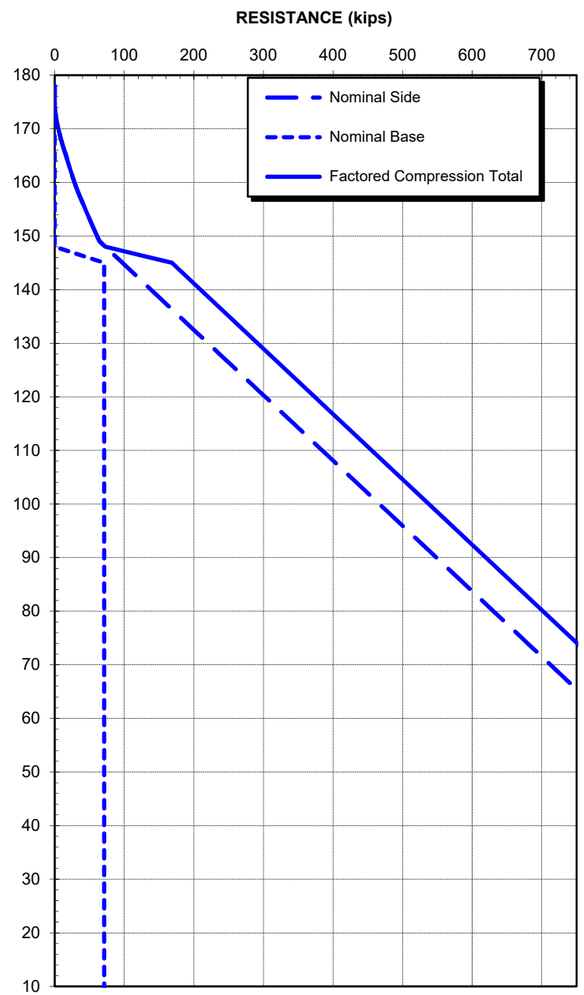
Bottom of Boring at Elev. 135.0 feet

Ground Surface Elev. +178 ft

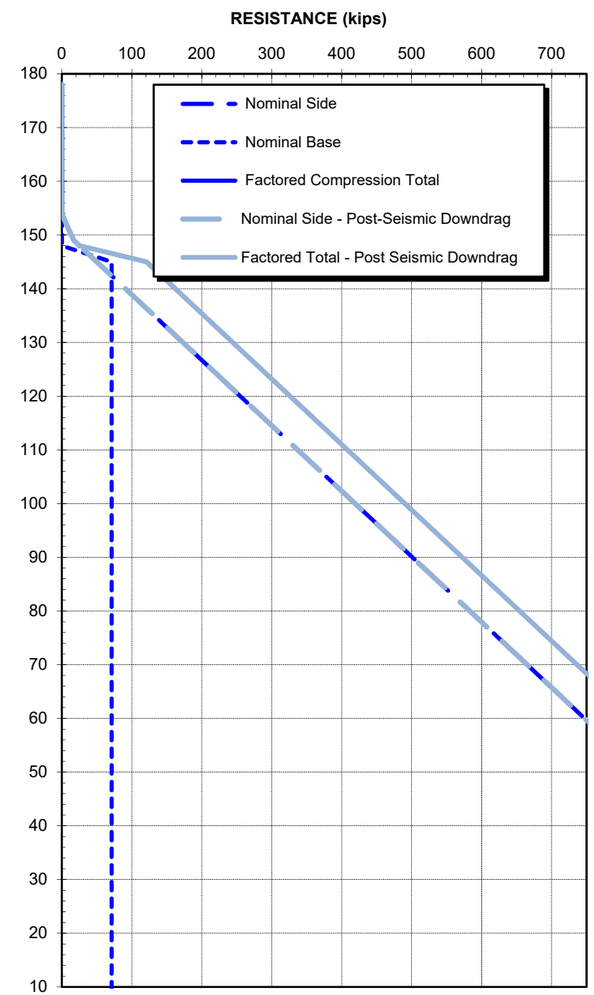
STRENGTH LIMIT



EXTREME EVENT: NON-LIQUEFIED STRENGTH



EXTREME EVENT: LIQUEFIED / REDUCED STRENGTH



NOTES

1. The analyses were performed based on guidelines included in AASHTO 2015, the ODOT GDM and local experience. The analyses are based on a single pile or a group of piles at a center to center spacing greater than or equal to 6 diameters.
2. Factored total shaft compression resistance shown on plots is determined by adding nominal side and base resistances multiplied by the corresponding resistance factor:

	Strength	Extreme: Non-Liquefied	Extreme: Liquefied/Reduced
Side Resistance - Compression	0.45	1.0	1.0
Side Resistance - Uplift	0.35	0.8	0.8
Base Resistance	0.45	1.0	1.0

3. Estimated shaft resistance for the Extreme Event: Liquefied/Reduced Strength case is based on results from our liquefaction analysis.
4. The estimated post-seismic downdrag force is 10 kips. Post-seismic downdrag forces should be considered with the post-seismic downdrag resistance curves on the Extreme Event: Liquefied/Reduced Strength plot.

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

NE BENT
ESTIMATED AXIAL RESISTANCE
24-INCH DIAMETER DRIVEN PILES

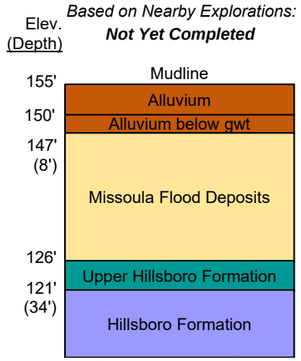
October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 6

GENERALIZED SUBSURFACE PROFILE

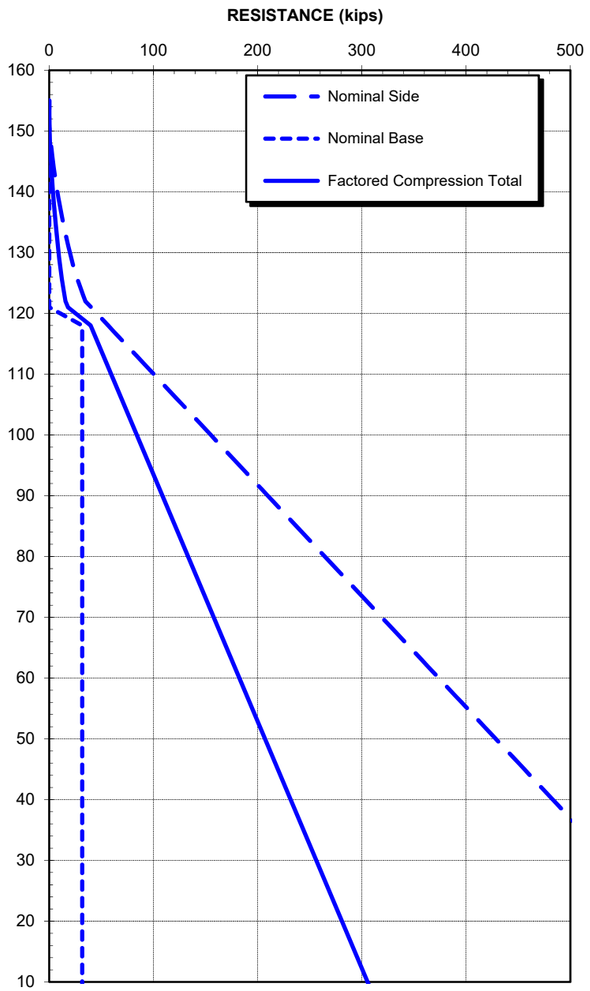
Based on Nearby Explorations:
Not Yet Completed



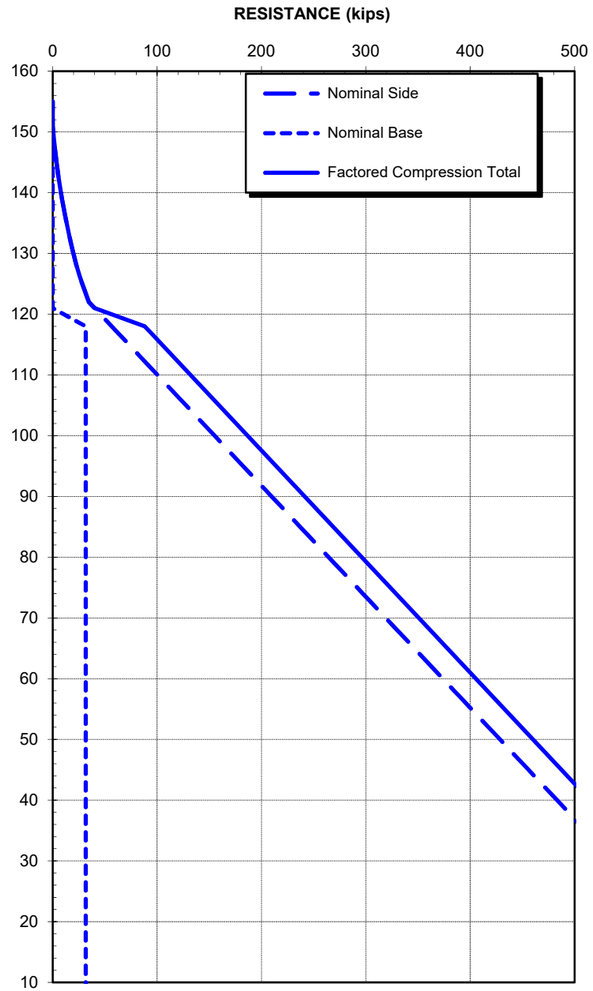
Assumed subsurface profile, explorations needed for final design



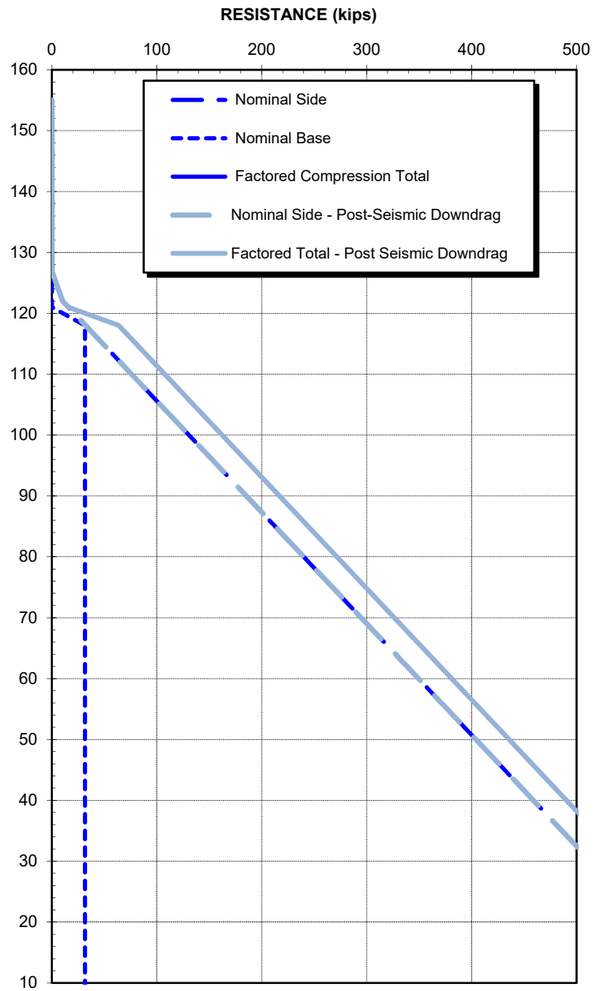
STRENGTH LIMIT



EXTREME EVENT: NON-LIQUEFIED STRENGTH



EXTREME EVENT: LIQUEFIED / REDUCED STRENGTH



NOTES

1. The analyses were performed based on guidelines included in AASHTO 2015, the ODOT GDM and local experience. The analyses are based on a single pile or a group of piles at a center to center spacing greater than or equal to 6 diameters.
2. Factored total shaft compression resistance shown on plots is determined by adding nominal side and base resistances multiplied by the corresponding resistance factor:

	Strength	Extreme: Non-Liquefied	Extreme: Liquefied/Reduced
Side Resistance - Compression	0.45	1.0	1.0
Side Resistance - Uplift	0.35	0.8	0.8
Base Resistance	0.45	1.0	1.0

3. Estimated shaft resistance for the Extreme Event: Liquefied/Reduced Strength case is based on results from our liquefaction analysis.
4. The estimated post-seismic downdrag force is 10 kips. Post-seismic downdrag forces should be considered with the post-seismic downdrag resistance curves on the Extreme Event: Liquefied/Reduced Strength plot.

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

SW BENT
ESTIMATED AXIAL RESISTANCE
16-INCH DIAMETER DRIVEN PILES

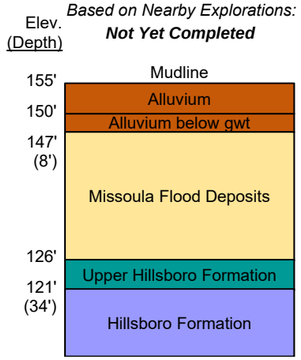
October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 7

GENERALIZED SUBSURFACE PROFILE

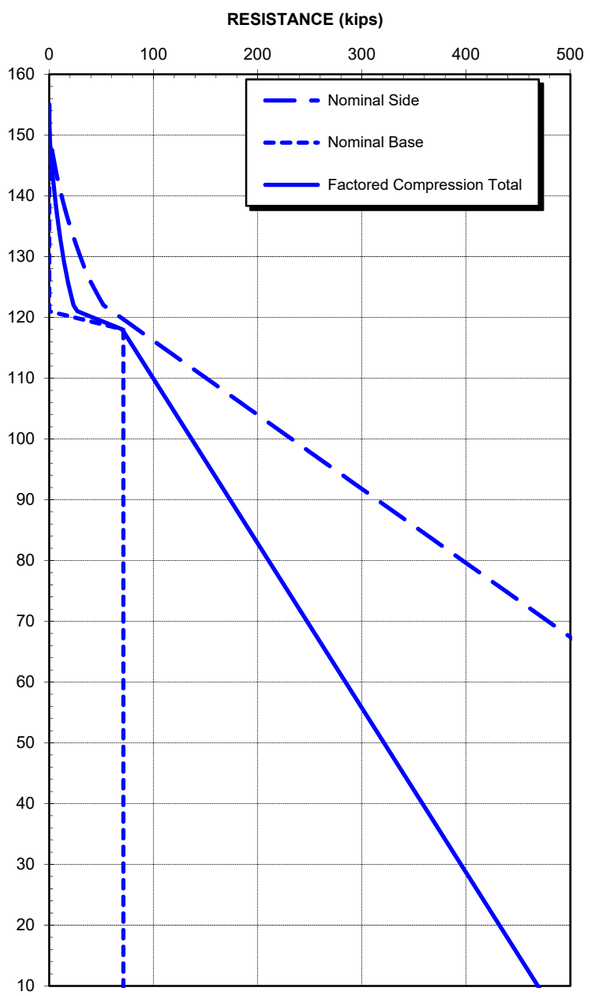
Based on Nearby Explorations:
Not Yet Completed



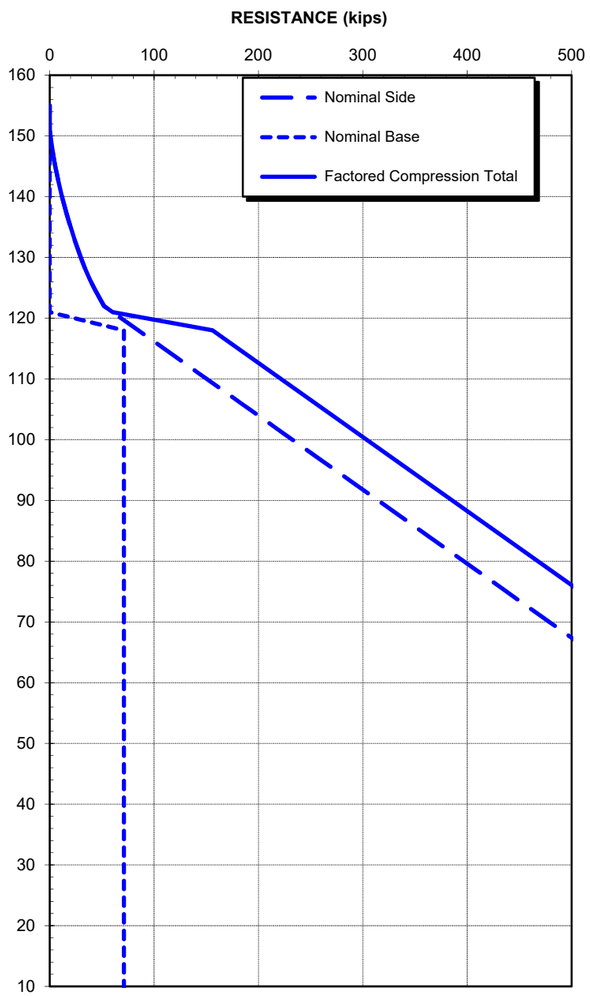
Assumed subsurface profile, explorations needed for final design



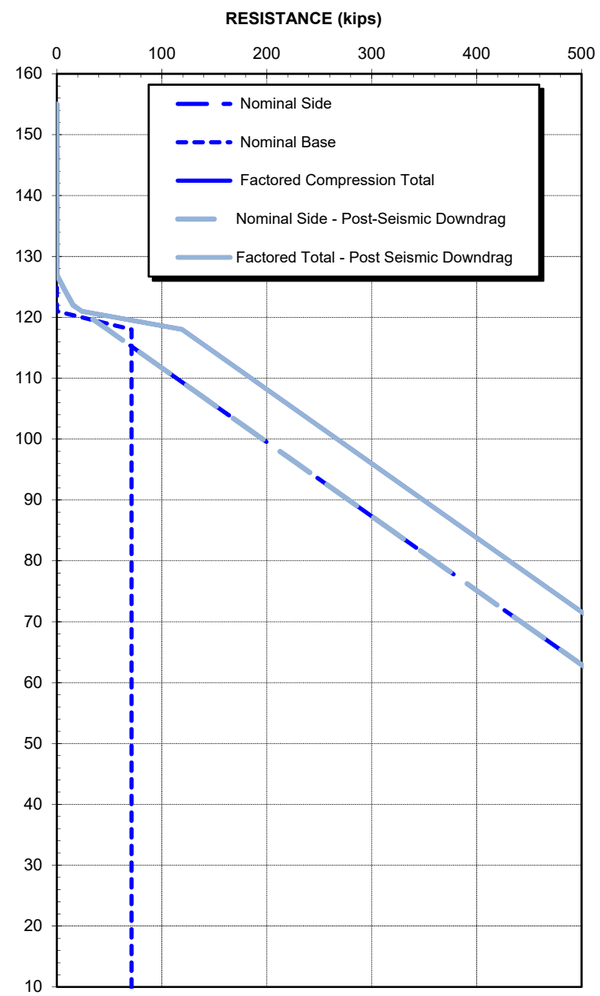
STRENGTH LIMIT



EXTREME EVENT: NON-LIQUEFIED STRENGTH



EXTREME EVENT: LIQUEFIED / REDUCED STRENGTH



NOTES

1. The analyses were performed based on guidelines included in AASHTO 2015, the ODOT GDM and local experience. The analyses are based on a single pile or a group of piles at a center to center spacing greater than or equal to 6 diameters.
2. Factored total shaft compression resistance shown on plots is determined by adding nominal side and base resistances multiplied by the corresponding resistance factor:

	Strength	Extreme: Non-Liquefied	Extreme: Liquefied/Reduced
Side Resistance - Compression	0.45	1.0	1.0
Side Resistance - Uplift	0.35	0.8	0.8
Base Resistance	0.45	1.0	1.0

3. Estimated shaft resistance for the Extreme Event: Liquefied/Reduced Strength case is based on results from our liquefaction analysis.
4. The estimated post-seismic downdrag force is 10 kips. Post-seismic downdrag forces should be considered with the post-seismic downdrag resistance curves on the Extreme Event: Liquefied/Reduced Strength plot.

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

SW BENT
ESTIMATED AXIAL RESISTANCE
24-INCH DIAMETER DRIVEN PILES

October 2019 103274-001

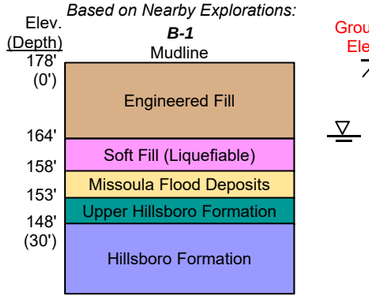
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 8

GENERALIZED SUBSURFACE PROFILE

Based on Nearby Explorations:

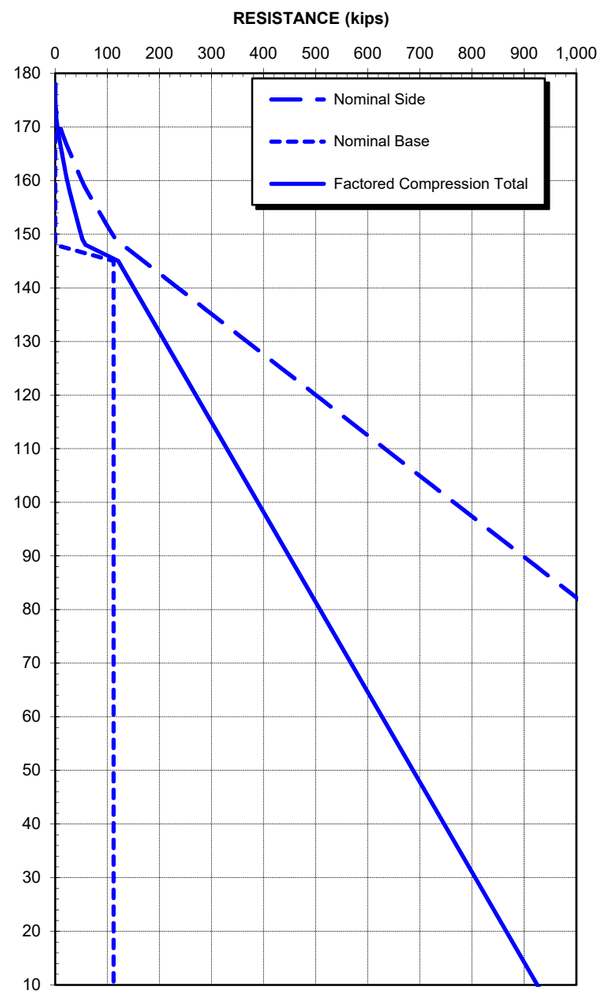
B-1



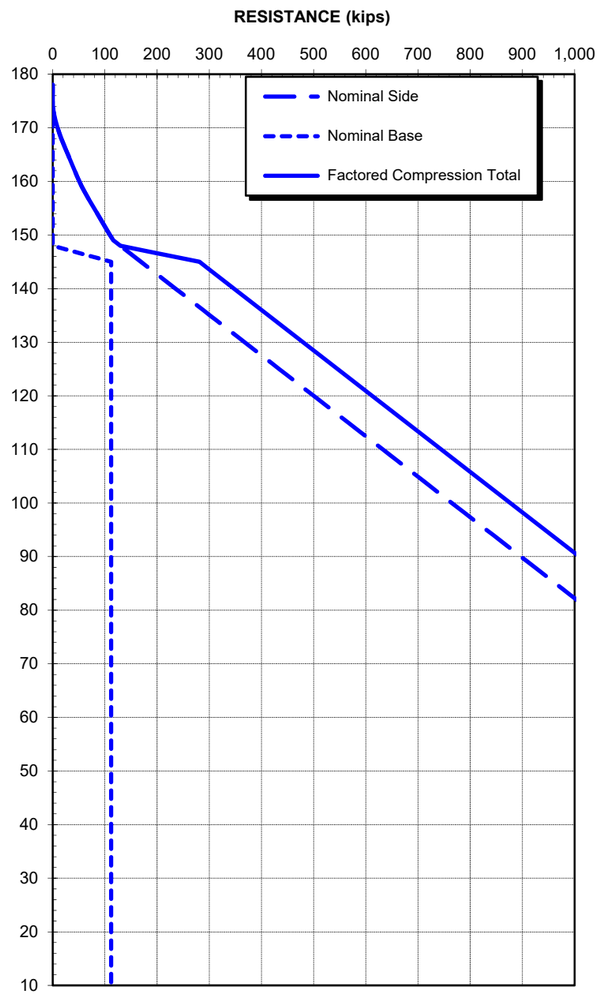
Bottom of Boring at Elev. 135.0 feet

Ground Surface Elev. +178 ft

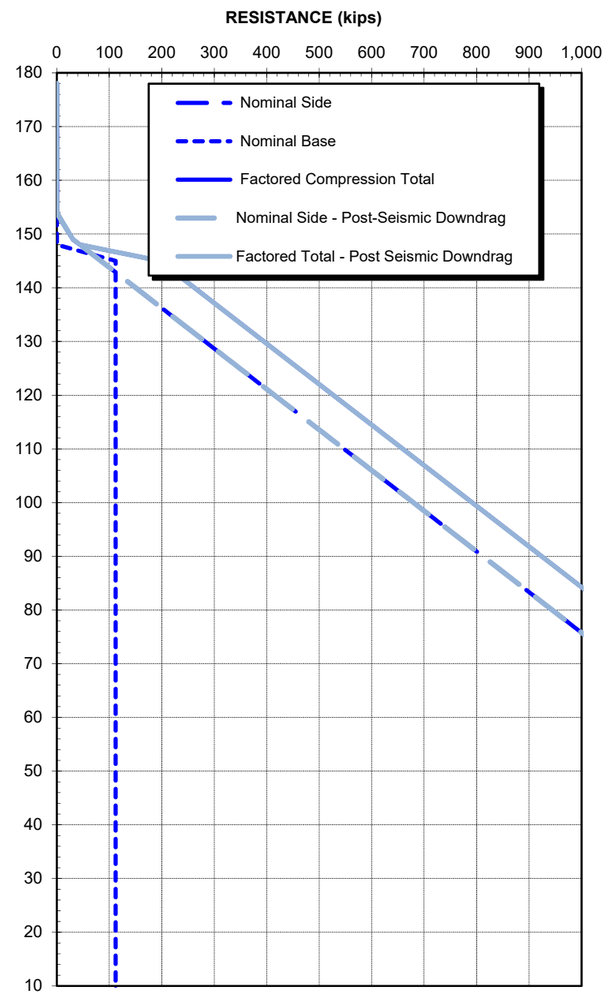
STRENGTH LIMIT



EXTREME EVENT: NON-LIQUEFIED STRENGTH



EXTREME EVENT: LIQUEFIED / REDUCED STRENGTH



NOTES

1. The analyses were performed based on guidelines included in AASHTO 2015, the ODOT GDM and local experience. The analyses are based on a single shaft or a group of shafts at a center to center spacing greater than or equal to 6 diameters.
2. Factored total shaft compression resistance shown on plots is determined by adding nominal side and base resistances multiplied by the corresponding resistance factor:

	Strength	Extreme: Non-Liquefied	Extreme: Liquefied/Reduced
Side Resistance - Compression	0.45	1.0	1.0
Side Resistance - Uplift	0.35	0.8	0.8
Base Resistance	0.40	1.0	1.0

3. **The resistance factors should be reduced by 20% for a non-redundant single shaft supporting a bridge pier.**
4. Estimated shaft resistance assumes that if casing is used, it will be removed after shaft installation.
5. Estimated shaft resistance for the Extreme Event: Liquefied/Reduced Strength case is based on results from our liquefaction analysis.
6. The estimated post-seismic downdrag force is 40 kips. Post-seismic downdrag forces should be considered with the post-seismic downdrag resistance curves on the Extreme Event: Liquefied/Reduced Strength plot.

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

NE BENT
ESTIMATED AXIAL RESISTANCE
3-FOOT DIAMETER DRILLED SHAFT

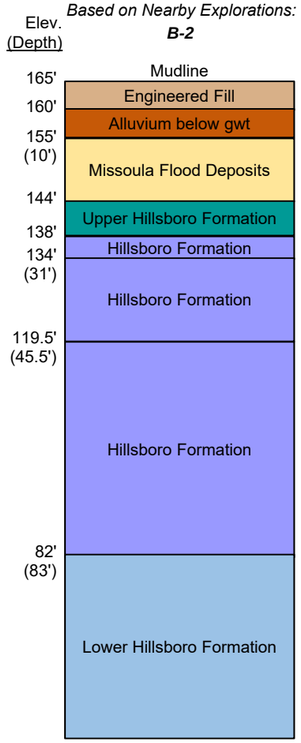
October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 9

GENERALIZED SUBSURFACE PROFILE

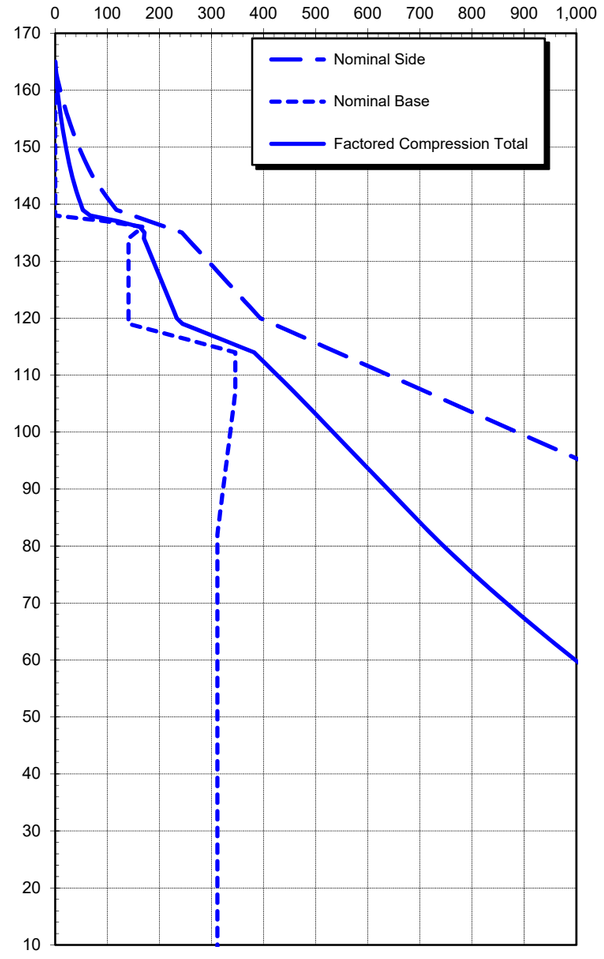
Based on Nearby Explorations:
B-2



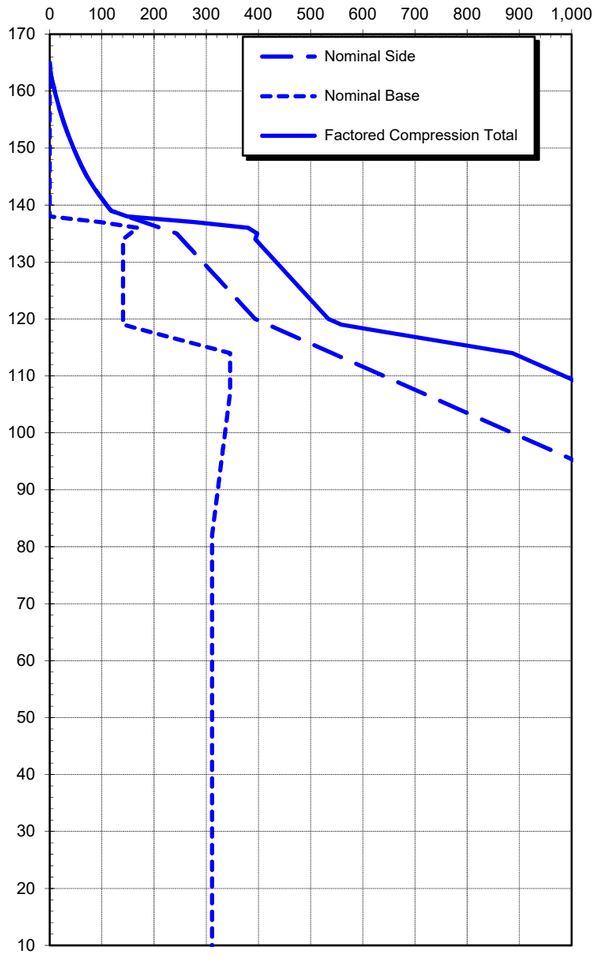
Bottom of Boring at Elev.
50.0 feet

Ground Surface
Elev. +165 ft

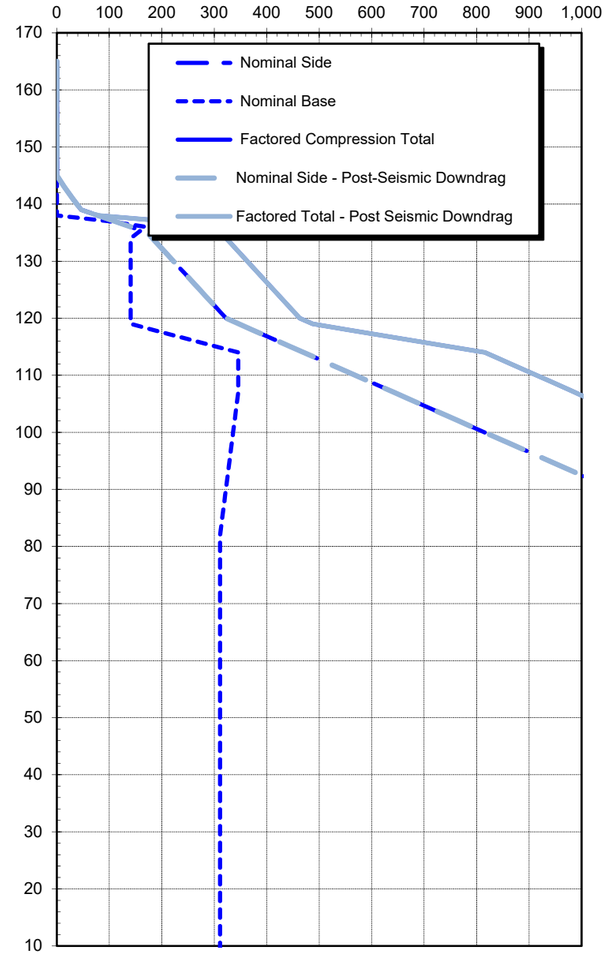
STRENGTH LIMIT



EXTREME EVENT: NON-LIQUEFIED STRENGTH



EXTREME EVENT: LIQUEFIED / REDUCED STRENGTH



NOTES

1. The analyses were performed based on guidelines included in AASHTO 2015, the ODOT GDM and local experience. The analyses are based on a single shaft or a group of shafts at a center to center spacing greater than or equal to 6 diameters.
2. Factored total shaft compression resistance shown on plots is determined by adding nominal side and base resistances multiplied by the corresponding resistance factor:

	Strength	Extreme: Non-Liquefied	Extreme: Liquefied/Reduced
Side Resistance - Compression	0.45	1.0	1.0
Side Resistance - Uplift	0.35	0.8	0.8
Base Resistance	0.40	1.0	1.0

3. **The resistance factors should be reduced by 20% for a non-redundant single shaft supporting a bridge pier.**
4. Estimated shaft resistance assumes that if casing is used, it will be removed after shaft installation.
5. Estimated shaft resistance for the Extreme Event: Liquefied/Reduced Strength case is based on results from our liquefaction analysis.
6. The estimated post-seismic downdrag force is 60 kips. Post-seismic downdrag forces should be considered with the post-seismic downdrag resistance curves on the Extreme Event: Liquefied/Reduced Strength plot.

Red Rock Creek Pedestrian Bridge
Alternatives Study
Tigard, Oregon

MID BENT
ESTIMATED AXIAL RESISTANCE
5-FOOT DIAMETER DRILLED SHAFT

October 2019 103274-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 10

APPENDIX A: EXISTING INFORMATION

Appendix A

Existing Information

CONTENTS

- RhinoOne Geotechnical Report for Fields Property
- RhinoOne Construction Observation Report for July 1, 2019
- Pacific Foundation Calculation Package for Solider Pile Retaining Wall

RhinoOne GEOTECHNICAL

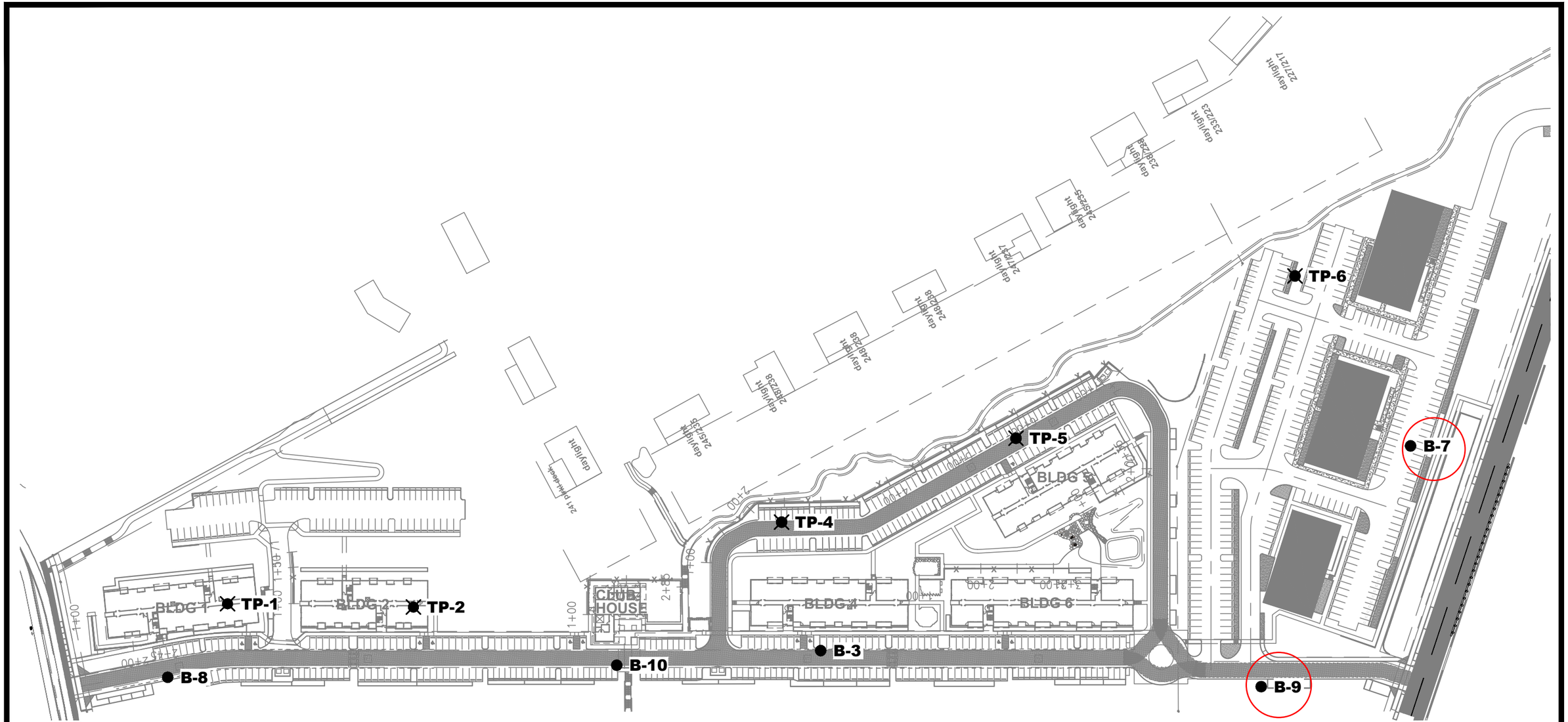
Geotechnical Investigation Report
Fields Apartments
SW Hunziker Street and SW Wall Street
Tigard, Oregon

Select Pages Only
(full report available upon request)

Prepared for:
DBG Properties LLC
Attn: Ms. Melora Banker
2164 SW Park Place
Portland, Oregon 97205

May 22, 2018
Project No. DBG-2016-003

RhinoOne Geotechnical | 4610 NE 77th Avenue #126 | Vancouver, WA 98662 | phone 360.258.1738



LEGEND

TP-1
TEST PIT NUMBER AND APPROXIMATE LOCATION

B-1
BORING NUMBER AND APPROXIMATE LOCATION

RhinoOne GEOTECHNICAL
4610 NE 77th Avenue, Suite 126
Vancouver, Washington 98662
360-258-1738

FIELDS APARTMENTS

DBG PROPERTIES, INC.

SW HUNZIKER STREET AND SW HALL STREET, TIGARD, OREGON 97XX

FIGURE 2 - SITE EXPLORATION MAP

PROJECT
DBG-2016-003

DATE
MAY 2018

RhinoOne GEOTECHNICAL

Fields Apartments
SW Hunziker Street and SW Wall Street
Tigard, Oregon

Boring Number:
B-7

Project: Fields Apartments	Driller: Dan J Fischer Excavating, Inc.
Project Number: DBG-2016-003	Date: November 17, 2016
Drilling Method: Solid-Stem Auger	Elevation: Approximately 187 feet AMSL
Diameter: 4.25-inch auger / Water Level: 9.5 feet	Logged by: Christina H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Depth (ft BGS)	Graphic Log	Materials Description	Moisture (%)	Remarks
						0	TP / ML	Brown, fine sandy SILT; moist (6-inch Root Zone) Very stiff, brown, SILT with some fine sand; damp to moist, low to medium plasticity		
1		66		5-8-8	16				18.2	
2		44		2-2-3	5	5		Becomes medium stiff, fine sandy SILT	25.8	
3		78		3-3-8	11			Becomes stiff	25.2	
4		62		3-3-4	7	10		Becomes medium stiff	31.0	
5		62		2-3-4	7	15		Becomes brown with grey mottling	29.8	
6		50		2-2-2	4	20	CL-ML	Soft, blue-grey, clayey SILT with some fine sand; moist, medium plasticity	34.4	
7		100		3-4-6	10	25	CL	Stiff, blue-grey, CLAY; moist, medium plasticity	32.6	LL = 40.3% PL = 22.8% PI = 17.5%
8		100		3-6-12	18	30		Becomes very stiff	26.1	

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\DBG-2016-003 Fields Apts Borings.log Date: 5/11/2018

RhinoOne GEOTECHNICAL

Fields Apartments
SW Hunziker Street and SW Wall Street
Tigard, Oregon

Boring Number:
B-7

Project: Fields Apartments | Driller: Dan J Fischer Excavating, Inc.

Project Number: DBG-2016-003 | Date: November 17, 2016

Drilling Method: Solid-Stem Auger | Elevation: Approximately 187 feet AMSL

Diameter: 4.25-inch auger | Water Level: 9.5 feet | Logged by: Christina H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log	Materials Description	Moisture (%)	Remarks
9		78		3-5-5	10		35	ML	Stiff, brown, fine sandy SILT; damp, medium plasticity	38.5	
10		62		3-5-5	10		40	SM	Loose to medium dense, brown, silty fine to coarse SAND; moist	36.5	
									Boring terminated at 41.5 (feet BGS): boring backfilled with bentonite chips and capped with native soil		
							45				
							50				
							55				
							60				
							65				

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\DBG-2016-003 Fields Apts Borings.log Date: 5/11/2018

RhinoOne GEOTECHNICAL

Fields Apartments
SW Hunziker Street and SW Wall Street
Tigard, Oregon

Boring Number:
B-9

Project: Fields Apartments	Driller: Dan J Fischer Excavating, Inc.
Project Number: DBG-2016-003	Date: May 4, 2018
Drilling Method: Solid-Stem Auger	Elevation: Approximately 183 feet AMSL
Diameter: 3-inch auger / Water Level: 15 feet	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log	Materials Description	Moisture (%)	Remarks
							0	TP	Brown, fine sandy SILT; moist (5-inch Root Zone)		8-inch monument constructed
								ML	Medium stiff, brown, SILT with some fine sand and clay; moist, low to medium plasticity		
1		100		3-3-4	7					25.0	
							5				
2		100		3-3-4	7				Becomes SILT with some sand, low to no plasticity	29.1	
3		100		2-3-4	7				Becomes fine sandy SILT with thin lenses of silt	28.4	
							10				
4		100		2-3-3	6					32.0	
							15		Becomes stiff and wet		
5		100		3-5-6	11					34.0	
							20	CL-ML	Stiff, blue-grey, clayey SILT with trace sand; damp to moist, medium plasticity		Vibrating Wire Piezometer (SN 45072) with automatic datalogger attached installed at 18.5 feet BGS
6		100		2-5-6	11					32.9	
								ML	Very stiff, blue-grey, fine sandy SILT; moist		
							25				
7		100		7-9-10	19				Becomes grey-brown, SILT with some fine sand, low plasticity	36.0	
									Boring terminated at 26.5 (feet BGS): boring backfilled with bentonite chips		
							30				

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\DBG-2016-003 Fields Apts Borings.log Date: 5/11/2018

RhinoOne GEOTECHNICAL

OBSERVATION AND TESTING REPORT

Project Name: Fields Apartments	Project Number: DBG-2016-003 TO03	Date/Day of Week: 07/01/19, Monday
Location: SW Hunziker Street / SW Wall Street	Permit Number:	Weather/Temperature: Sunny, 65-70F
Services Provided: Subgrade Observation/ footing preparations	Hours Present: 9:15am-11:15am	Field Staff: Luke Hughes

Documents Reviewed by Staff:

Prior Field Report ☒ Yes ☐ No
Report Date: 06/28/2019 Report By: LH

COS Project Briefing ☒ Yes ☐ No
Briefing By: Chuck Leahy (Ken Leahy Construction)

Construction Document Review ☒ Yes ☐ No
Construction Document Dated: 06/26/2018

Geotechnical Report Review ☒ Yes ☐ No
Geotechnical Report Dated: 05/22/2018

Visit Requested By (Name and Company): Mike Ober (Ken Leahy Construction)	Site Contact (Name and Company): Rob Fitzgerald (Ken Leahy Construction)
Observed Contractor (Name and Company): Ken Leahy Construction/Pacific Foundation	Contractor's Equipment Observed in Use: Scrappers, 815 Compactor, Bull dozer etc., Vibratory Hammer

Did you observe everything you expected to? ☒ Yes ☐ No - If no, who did you inform? When? What was missing?

Did you observe anything unexpected? ☐ Yes - If yes, who did you inform? When? What was it? ☒ No

Jobsite Observations: *Indicate Activities You Did and Did Not Observe, Rhino Equipment Used, Material Used*

I arrived on site at approximately 9:15 am and met with Rob Fitzgerald of Ken Leahy Construction and Jeremy White of time Frame Inc. The contractor was taking the soils and spreading the soils around to dry them in preparation for future engineered fill construction and from the prior storm from last week. The contractor was also placing boulders behind the retaining wall in the area where the future wall street will be (shown in picture 1) The foundation contractor was preparing footings and said they were going to start excavating later in the day, I'll report on that tomorrow, although the weather was supposed to take another drastic turn for the worst, including rain and thunder storms around 3:00pm.



Figure 1: View of SW Wall Street retaining wall



Figure 2: View of soils being spread

I departed the site at approximately 11:15 and will be back Monday of July 2st 2019.

Jobsite Discussions: *Indicate With Whom and What Was Discussed*
None

What in particular should be observed, checked, or tested during the next visit? Date of Next Visit: 07/02/2019
Footing areas and soil processing for fill construction.

Notice: Our firm's professionals are represented on site solely to observe operations of the contractor identified, to form opinions about the adequacy of those operations and to report those opinions to our client. The presence and activities of our field representatives do not relieve any contractor from its obligation to meet contractual requirements. No one except our client may rely on our finding and opinions. The contractor retains sole responsibility for site safety and the methods, operations and sequences of construction.

This report presents opinions formed as a result of our observation of activities relating to geotechnical engineering. We rely on the contractor to comply with the plans and specifications throughout the duration of the project irrespective of the presence of our representative. Our work does not include supervision or direction of the contractor, the contractor's employee's or agents. Our firm is not responsible for site safety.

☒ This preliminary report is provided solely as evidence that field observation was performed. Observations and/or conclusions and/or recommendations conveyed in the final report may vary from and shall take precedence over those indicated in this report.

☒ A reviewed report is an instrument of professional service. Any conclusions drawn from this report should be discussed with and evaluated by the professional involved.

By: _____
Luke Hughes

Review: _____
Rajiv Ali

DBG-2016-003-TOD3
fields apartments
Tigard, Oregon



area Observed July 1 2019

area Observed July 1 2019

GENERAL NOTES

1. EXISTING UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE AND CONTRACTOR TO VERIFY LOCATION PRIOR TO CONSTRUCTION.
2. FOR PRECISE GRADING AND GRADING DETAILS/SECTIONS SEE GRADING LAYOUT SHEETS.
3. FOR RETAINING WALL LAYOUT, PROFILES AND DETAILS SEE WALL SHEETS.
4. ALL PROPOSED ELEVATIONS SHOWN SHALL BE CONSIDERED FINISHED SURFACE ELEVATIONS UNLESS OTHERWISE NOTED. ALL SURFACES SHALL BE GRADED SMOOTH AND FREE OF IRREGULARITIES THAT MIGHT ACCUMULATE SURFACE WATER.

LEGEND

SITE	EXISTING	PROPOSED
RIGHT OF WAY		
CENTER LINE		
PROPERTY LINE		
EASEMENT LINE		
STANDARD CURB		
RETAINING WALL		
SIDEWALK		
EDGE OF PAVEMENT		

SITE SECTIONS (SEE SHEET C2.30) A — A

80' 0' 80' 160'
SCALE IN FEET

Otak
Otak, Inc.
808 SW Third Avenue, Ste. 300
Portland, OR 97204
503. 287. 6825
www.otak.com

REGISTERED PROFESSIONAL ENGINEER
91573PE
PRELIMINARY
OREGON
SEPT 13, 2016
KYLE D. CHILDERS
EXPIRES: 12/31/2019
STAMP

DBG PROPERTIES LLC

CONSULTANT

FIELDS APARTMENTS

CITY OF TIGARD, OREGON
GENERAL

OVERALL GRADING PLAN

TITLE

#	DATE	DESCRIPTION
XX		

REVISIONS

SLH DRAWN BY
KDC CHECKED BY

PFI SUBMITTAL STATUS

02/26/2018 DATE

17052 PROJECT NUMBER

C1.3

© 2018 OTAK, INC.
If this drawing is not 22" x 34", it has been reduced/enlarged. Scale accordingly.

Plotted: Apr 17, 2018 - 8:42am C:\temp\AcPublish_7936\C17052 C13.dwg Layout Name: C1.3

PACIFIC
STRUCTURAL SOLUTIONS

17 August 2018

Project # 18181

FIELDS APARTMENTS SITE WALLS

SOLDIER PILE WALL CALCULATIONS

Select Pages Only
(full cal package available upon request)



PACIFIC STRUCTURAL SOLUTIONS
1400 COLUMBIA ST.
VANCOUVER, WA 98660
PH: 360.200.6608
FX: 360.200.6611

9.5 ft Cantilevered Soldier Pile Design

Pile # Wall Street

Soil Parameters

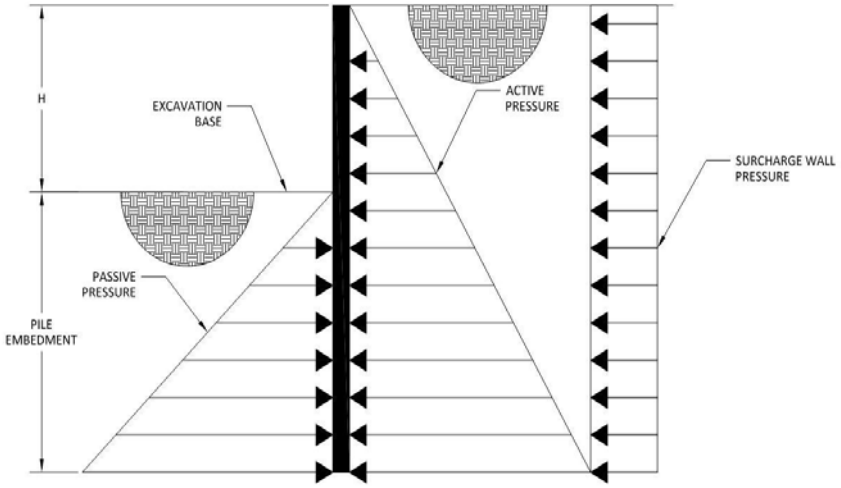
Acitve Pressure (EFP)	60	pcf
Effective Pile Width, Active (xDia)	1	pile diameters
Passive Pressure (EFP)	190	pcf
Effective Width, Passive (xDia)	2	pile diameters
Surcharge Wall Pressure	95	psf
Acitve Pressure Below Wall (EFP)	60	pcf

Pile Parameters

Depth of Excavation (H)	9.5	ft
Flange Width (bf)	1.2	ft
Pile Spacing	8	ft
Passive Soil to Neglect	2	ft
Pile Shape	HP14X89	

Pile Embedment

Active at Top of Wall	760	plf
Active at Botttom of wall	5320	plf
Active at Botttom of wall	684	plf
Active at Passive = 0	828	plf
Active below grade	72	plf/ft
Passive below grade	456	plf/ft
Depth to Zero load (H2)	4.16	ft
Horizontal Force P	31284.69	lb
Distance from P to zero load	7.32	ft
Determine depth of Passive (h')	12.76	ft
Embedment to Equilibrium	16.9	ft
Embedment to zero moment	24.6	ft
Pile Embedment	25	ft



Pile Strength

Max Moment	409.01	kip-ft	
Mn/Omega	553.03	Kip-Ft	OK
(Omega=1.1)			

APPENDIX B: FIELD EXPLORATIONS

Appendix B

Field Explorations

CONTENTS

B.1 General B-1
B.2 Mud Rotary Drilling B-1
B.3 Sampling B-1
B.3.1 Disturbed Sampling B-1
B.3.2 Undisturbed Sampling B-2
B.4 Borehole Abandonment B-2
B.5 Material Descriptions B-2
B.6 Boring Logs B-3

Figures

Figure B1: Log of Boring B-1
Figure B2: Log of Boring B-2

APPENDIX B: FIELD EXPLORATIONS

B.1 GENERAL

Drilling explorations for the Red Rock Creek Pedestrian Bridge Alternative Study included advancing two geotechnical borings to explore subsurface conditions at selected locations along the proposed bridge alignment. Completed boring locations were surveyed by the Fields Property developer, Ken Leahy Construction. Borehole locations are shown on Figure 2: Site Plan and Preliminary Geologic Interpretation. This appendix describes the techniques used to advance and sample the borings and presents logs of the materials encountered during drilling.

Exhibit B-1: Summary of Geotechnical Borehole Information

Borehole No.	Total Depth (feet)	Drill Rig	Hammer Efficiency (%)
B-1	51.5	CME 850 Track Rig #522	87
B-2	116.5	CME 850 Track Rig #522	87

B.2 MUD ROTARY DRILLING

The geotechnical borings included in Figures B1 and B2 were drilled on August 15 and 16, 2019 by Holt Services, Inc. of Vancouver, Washington. The borings were advanced using open-hole, mud rotary drilling techniques. A geologist was present during the explorations to locate the borings, observe the drilling, collect soil samples, and log the materials encountered. Exhibit B-1 (above) summarizes borehole details for drilling explorations.

B.3 SAMPLING

B.3.1 Disturbed Sampling

Disturbed samples were collected in the borings, typically at 2.5-foot intervals to 15 feet and 5-foot intervals thereafter using a standard 2-inch- outside-diameter (O.D.) split spoon sampler in conjunction with Standard Penetration Testing standards. In a Standard Penetration Test (SPT), ASTM D1586, the sampler is driven 18 inches into the soil using a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler the last 12 inches is defined as the standard penetration resistance, or N-value. The SPT N-value provides a measure of in situ relative density of cohesionless soils (silt, sand, and gravel), and the consistency of cohesive soils (silt and clay). All disturbed samples were

visually identified and described in the field, sealed in a labeled plastic jar to retain moisture, and returned to our laboratory for additional examination and testing.

SPT N-values can be significantly affected by several factors, including the efficiency of the hammer used. The hammer efficiencies of the hammers used are summarized in Exhibit B-1 (above). Automatic hammers generally have higher energy transfer efficiencies than cathead driven hammers. For reference, cathead hammers are typically assumed to have an average energy efficiency of 60 percent. All N-values presented in this report are in blows per foot, as counted in the field. No corrections of any kind have been applied.

An SPT was considered to have met refusal where more than 50 blows were required to drive the sampler 6 inches. If refusal was encountered in the first 6-inch interval (for example, 50 for 1.5"), the count is reported as 50/1st 1.5". If refusal was encountered in the second 6-inch interval (for example, 48, 50 for 1.5"), the count is reported as 50/1.5". If refusal was encountered in the last 6-inch interval (for example, 39, 48, 50 for 1.5"), the count is reported as 98/7.5". Sample recovery is identified as a percentage of material retained for the length the sampler was driven.

B.3.2 Undisturbed Sampling

Undisturbed samples were collected in 3-inch-O.D. thin-wall Shelby tubes, which were hydraulically pushed into the undisturbed soil at the bottoms of boreholes. The soils exposed at the ends of the tubes were examined and described in the field. After examination, the ends of the tubes were sealed to preserve the natural moisture of the samples. The sealed tubes were stored in the upright position, and care was taken to avoid shock and vibration during their transport and storage in our laboratory.

B.4 BOREHOLE ABANDONMENT

All boreholes were backfilled with bentonite cement grout or bentonite chips in accordance with Oregon Water Resource Department regulations.

B.5 MATERIAL DESCRIPTIONS

In the field, soil samples were described and identified visually in accordance with the ODOT Soil and Rock Classification Manual (1987). The ASTM International (ASTM) D2488 Visual-Manual method was also used as a guide in determining the key diagnostic properties of soils. Consistency, color, relative moisture, degree of plasticity, peculiar odors, and other distinguishing characteristics of the samples were noted. Once returned to our laboratory, the samples were re-examined, various standard laboratory tests were

conducted, and the field descriptions and identifications were modified where necessary. Please refer to the ODOT Soil and Rock Classification Manual (1987) for definitions of descriptive terminology used in the Drill Logs.

B.6 BORING LOGS

Summary logs of the borings are presented in Figures B1 and B2. Soil descriptions and interfaces on the logs are interpretive, and actual changes may be gradual. The left-hand portion of the drill logs gives individual sample intervals, percent recovery, Standard Penetration Test data, and natural moisture content measurements. Material descriptions and geotechnical unit designations are shown in the center of the drill log, and the right-hand portion provides a graphic log, miscellaneous comments, and a graphic depicting hole backfill details. Laboratory testing notes are included in the remarks column of the boring logs.

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

			Hole No. **B-01**
Project **Red Rock Creek Pedestrian Bridge**		Purpose **Pedestrian Bridge**	E.A. No. **N/A**
Highway **N/A**		County **Washington**	Key No. **N/A**
Hole Location Northing: **~ 648,375**	Easting: **~ 7,622,921**		Start Card No. **N/A**
Equipment **CME 850 Track Rig #522**		Driller **Holt Services, Inc.**	Bridge No. **N/A**
Project Geologist **Nathan M. Villeneuve, RG**		Recorder **Christine M. Maher**	Ground Elev. **~ 187 ft.**
Start Date **August 16, 2019**	End Date **August 16, 2019**	Total Depth **51.50 ft**	Tube Height **N/A**

Test Type
"A" - Auger Core "GP" - GeoProbe®
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 18.00 Silty CLAY with some sand and trace gravel; CL; Brown; Low to medium plasticity; Moist; Stiff to very stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)**		Boring advanced using mud rotary drilling techniques (5-inch dia. hole)	
	N1	67	6-9-10		N- 1 (2.50-4.00) Silty CLAY with some sand and trace gravel; CL; Brown; Low to medium plasticity; Moist; Very stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)				
5	N2	67	8-4-7		N- 2 (5.00-6.50) Silty CLAY with some sand and trace gravel; CL; Brown; Medium plasticity; Moist; Stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)				
	N3	67	6-8-13		N- 3 (7.50-9.00) Silty CLAY with some sand and trace gravel; CL; Brown; Low to medium plasticity; Moist; Very stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)				
10	N4	67	7-12-14		N- 4 (10.00-11.50) Silty CLAY with some sand and trace gravel; CL; Brown; Low to medium plasticity; Moist; Very stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)				
	N5	73	11-13-14		N- 5 (12.50-14.00) Silty CLAY with some sand and trace gravel; CL; Brown; Low to medium plasticity; Moist; Stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)				
15	N6	80	4-7-9		N- 6 (15.00-16.50) Silty CLAY with some sand and trace gravel; CL; Brown; Low to medium plasticity; Moist; Stiff; Fine, angular gravel; Fine sand; Micaceous; (Fill)				
						18.00 - 29.00 Sandy SILT; ML; Brown; Nonplastic; Moist to wet; Very loose to medium dense; Fine sand; Micaceous; (Lower Fill)			
20	N7	73	7-7-6	20	N- 7 (20.00-21.50) Sandy SILT; ML; Brown; Nonplastic; Moist; Medium dense; Fine sand; Micaceous; (Lower Fill)				
25	N8	100	0-1-2	34	N- 8 (25.00-26.50) Sandy SILT; ML; Brown; Nonplastic; Wet; Very loose; Fine sand; Micaceous; (Lower Fill)			N8: 66.3% fines	
	U1	0			U- 1 (28.00-30.00) No recovery				
30	N9	100	3-8-9	31	N- 9 (30.00-31.50) Sandy SILT; ML; Brown; Nonplastic; Moist to wet; Medium Dense; Fine sand; Micaceous; (Missoula Flood Deposits - Fine)	**29.00 - 33.00 Sandy SILT; ML; Brown; Nonplastic; Moist to wet; Very loose to medium dense; Fine sand; Micaceous; (Missoula Flood**		Atterberg Limits N9: Nonplastic	
35									

ODOT DRILL LOG - FOR SW REVIEW 103274.GPJ ODOT_MANWITHSWLAB.GDT 9/17/19

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
35	N10	100	1-4-5		N- 10 (35.00-36.50) Silty CLAY; CL; Gray; Low to medium plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)	**Deposits - Fine)**			
						33.00 - 38.00 Silty CLAY; CL; Gray; Medium plasticity; Moist; Very stiff; Micaceous; (Hillsboro Formation)			
	U2	100			U- 2 (38.00-40.00) CLAY; CH; Gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
40	N11	100	5-7-9	26	N- 11 (40.00-41.50) CLAY; CH; Gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)	**38.00 - 43.00 CLAY; CH; Gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)**			
45	N12A	100	6-8-14		N- 12A (45.00-45.33) CLAY with some sand; CH; Gray; High plasticity; Moist; Very stiff; Fine to medium sand; Micaceous; (Hillsboro Formation)	**43.00 - 51.50 CLAY with some sand; CH; Brown; High plasticity; Moist; Very stiff; Fine to medium sand; Micaceous; Trace to heavy iron oxidation staining; Interbeds of Sandy CLAY (CH) with heavy iron oxidation staining; (Hillsboro Formation)**			
	N12B				N- 12B (45.33-46.50) Sandy CLAY; CH; Brown; High plasticity; Moist; Very stiff; Fine to medium sand; Micaceous; Slight iron oxidation staining; (Hillsboro Formation)				
50	N13A	100	6-7-14		N- 13A (50.00-50.60) CLAY with some sand; CH; Brown with orange mottling; High plasticity; Moist; Very stiff; Fine to medium sand; Micaceous; Heavy iron oxidation staining; (Hillsboro Formation)				
	N13B				N- 13B (50.60-51.50) CLAY; CH; Light brown; High plasticity; Moist; Very stiff; Micaceous; (Hillsboro Formation)	**51.50 End of hole.**			
55									
60									
65									
70									
75									
80									
85									
88									

ODOT DRILL LOG - FOR SW REVIEW 103274.GPJ ODOT_MANWITHSWLAB.GDT 9/17/19

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

			Hole No. **B-02**
Project **Red Rock Creek Pedestrian Bridge**		Purpose **Pedestrian Bridge**	E.A. No. **N/A**
Highway **N/A**		County **Washington**	Key No. **N/A**
Hole Location Northing: **~ 648,333**	Easting: **~ 7,622,816**		Start Card No. **N/A**
Equipment **CME 850 Track Rig #522**		Driller **Holt Services, Inc.**	Bridge No. **N/A**
Project Geologist **Nathan M. Villeneuve, RG**		Recorder **Christine M. Maher**	Ground Elev. **~ 162 ft.**
Start Date **August 15, 2019**	End Date **August 15, 2019**	Total Depth **116.50 ft**	Tube Height **N/A**

Test Type
"A" - Auger Core "GP" - GeoProbe®
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 4.50 Sandy silty CLAY with trace gravel; CL; Brown fines and gray sand; Low to medium plasticity; Moist; Hard; Fine, angular gravel; Fine to coarse sand; Some concrete pieces, wood debris; (Fill)**		Boring advanced using mud rotary drilling techniques (5-inch dia. hole)	
	N1	67	21-34-10		N- 1 (2.50-4.00) Sandy silty CLAY with trace gravel; CL; Brown fines and gray sand; Low to medium plasticity; Moist; Hard; Fine, angular gravel; Fine to coarse sand; Some concrete pieces, wood debris; (Fill)			
5	N2	67	2-3-5	30	N- 2 (5.00-6.50) Clayey SILT with some sand and gravel; MH; Brown with dark brown mottling; Low to medium plasticity; Moist; Medium stiff; Fine, rounded gravel; Fine sand; Micaceous; (Alluvium)			
	N3	67	3-2-2	32	N- 3 (7.50-9.00) Silty SAND with trace gravel; SM; Brown; Nonplastic fines; Wet; Loose; Fine, subangular to rounded gravel; Fine sand; Micaceous; (Missoula Flood Deposits - Fine)	**4.50 - 7.00 Clayey SILT with some sand and gravel; MH; Brown with dark brown mottling; Low to medium plasticity; Moist; Medium stiff; Fine, rounded gravel; Fine sand Micaceous; (Alluvium)**		N3: 47.1% fines
10	U1	100			U- 1 (10.00-12.00) Sandy SILT; ML; Brown to gray; Nonplastic to low plasticity; Moist to wet; Very Loose; Fine to medium sand; Micaceous; trace iron oxidation staining; (Missoula Flood Deposits - Fine)			
	N4A	100	1-1-2	32	N- 4A (12.00-12.50) Sandy SILT; ML; Brown to gray; Nonplastic to low plasticity; Moist to wet; Very Loose; Fine to medium sand; Micaceous; trace iron oxidation staining; (Missoula Flood Deposits - Fine)			
	N4B				N- 4B (12.50-13.50) SILT with trace sand; ML; Gray; Nonplastic to low plasticity fines; Moist to wet; Very Loose; Fine sand; Micaceous; (Missoula Flood Deposits - Fine)			
15	N5	100	4-4-7	34	N- 5 (15.00-16.50) SILT with trace sand; ML; Dark gray; Nonplastic to low plasticity fines; Moist to wet; Medium dense; Fine sand; Micaceous; (Missoula Flood Deposits - Fine)	**7.00 - 12.50 Silty SAND with trace gravel to Sandy SILT; SM to ML; Brown; Nonplastic fines; Wet; Loose; Fine, subangular to rounded gravel; Fine sand; Micaceous; (Missoula Flood Deposits - Fine)**		N5: 94.9% fines
20	N6	100	7-12-12	32	N- 6 (20.00-21.50) Silty CLAY with some sand; CL; Dark gray; Medium plasticity; Moist; Very stiff; Fine to medium sand; Micaceous; (Hillsboro Formation)			Atterberg Limits N6: LL=41.7, PL=24.4, PI=17.3
25	N7A	100	9-11-20	36	N- 7A (25.00-25.25) CLAY with trace sand; CH; Dark gray; High plasticity; Moist; Hard; Fine to medium sand; Micaceous; (Hillsboro Formation)	**12.50 - 19.00 SILT with trace sand; ML; Gray; Nonplastic to low plasticity fines; Moist to wet; Very Loose to Medium Dense; Fine sand; Micaceous; (Missoula Flood Deposits - Fine)**		
	N7B				N- 7B (25.25-26.50) SILT with some sand; ML; Brown; Low plasticity; Moist; Hard; Fine sand; Micaceous; Iron oxidation staining; (Hillsboro Formation)			
30	N8	100	3-5-6	42	N- 8 (30.00-31.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)	**19.00 - 23.00 Silty CLAY with some sand; CL; Dark gray; Medium plasticity; Moist; Very stiff; Fine**		
35								

ODOT DRILL LOG - FOR SW REVIEW 103274.GPJ ODOT_MANWITHSWLAB.GDT 9/17/19

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
35	N9	100	2-3-5		N- 9 (35.00-36.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)	**to medium sand; Micaceous; (Hillsboro Formation)**			
						23.00 - 43.00 CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)			
40	N10	100	3-5-5		N- 10 (40.00-41.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
						43.00 - 80.00 CLAY; CH; Dark gray; High plasticity; Moist; Very Stiff; Micaceous; (Hillsboro Formation)			
45	N11	100	4-9-9		N- 11 (45.00-46.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
50	N12	100	5-9-9		N- 12 (50.00-51.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
55	N13	100	9-10-13	36	N- 13 (55.00-56.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
60	N14	100	6-10-14		N- 14 (60.00-61.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
65	N15	100	8-13-15		N- 15 (65.00-66.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
70	N16	100	5-6-13		N- 16 (70.00-71.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
75	N17	100	5-10-8		N- 17 (75.00-76.50) CLAY; CH; Dark gray; High plasticity; Moist; Stiff; Micaceous; (Hillsboro Formation)				
80						**80.00 - 116.50 Silty CLAY with some sand; CL; Green gray to gray; Low to medium plasticity; Dry to moist; Very stiff; Fine sand; Micaceous; (Hillsboro Formation)**			
85	N18	100	13-16-19	51	N- 18 (85.00-86.50) Silty CLAY with some sand; CL; Dark gray to green gray; Medium plasticity; Dry to moist; Very stiff; Fine sand; Micaceous; (Hillsboro Formation)				
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
88									
90									
95	N19	100	7-7-13		N- 19 (95.00-96.50) Silty CLAY with some sand; CL; Gray to green gray; Low to medium plasticity; Dry to moist; Very stiff; Fine sand; Micaceous; (Hillsboro Formation)				
100									
105									
110									
115	N20	100	5-6-10		N- 20 (115.00-116.50) Silty CLAY with some sand; CL; Gray; Low to medium plasticity; Dry to moist; Very stiff; Fine sand; Micaceous; (Hillsboro Formation)	**116.50 End of hole.**			
120									
125									
130									
135									
140									

Material Description: SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.

APPENDIX C: LABORATORY TEST RESULTS

Appendix C

Laboratory Test Results

CONTENTS

C.1 General....C-1
C.2 Soil Testing....C-1
C.2.1 Moisture (Natural Water) Content....C-1
C.2.2 Atterberg Limits....C-1
C.2.3 Particle-Size Analyses....C-2

Figures

Figure C1: Atterberg Limits Results
Figure C2: Grain Size Distribution

APPENDIX C: LABORATORY TEST RESULTS

C.1 GENERAL

The soil samples obtained during the field explorations were described and identified in the field in accordance with the ODOT Soil and Rock Classification Manual (1987). The samples were then reviewed in the laboratory. Physical characteristics of the samples were noted, and field descriptions and identifications were modified as necessary. During the course of the examination, representative samples were selected for further testing. We refined our descriptions and identifications based on the results of the laboratory tests, in accordance with the ODOT Soil and Rock Classification Manual (1987).

The soil testing program included moisture content analyses, Atterberg limits determinations, and particle-size analyses. All testing was performed by Shannon & Wilson, Inc. in accordance with applicable ASTM International standards. General descriptions of the tests are summarized in the following paragraphs.

C.2 SOIL TESTING

C.2.1 Moisture (Natural Water) Content

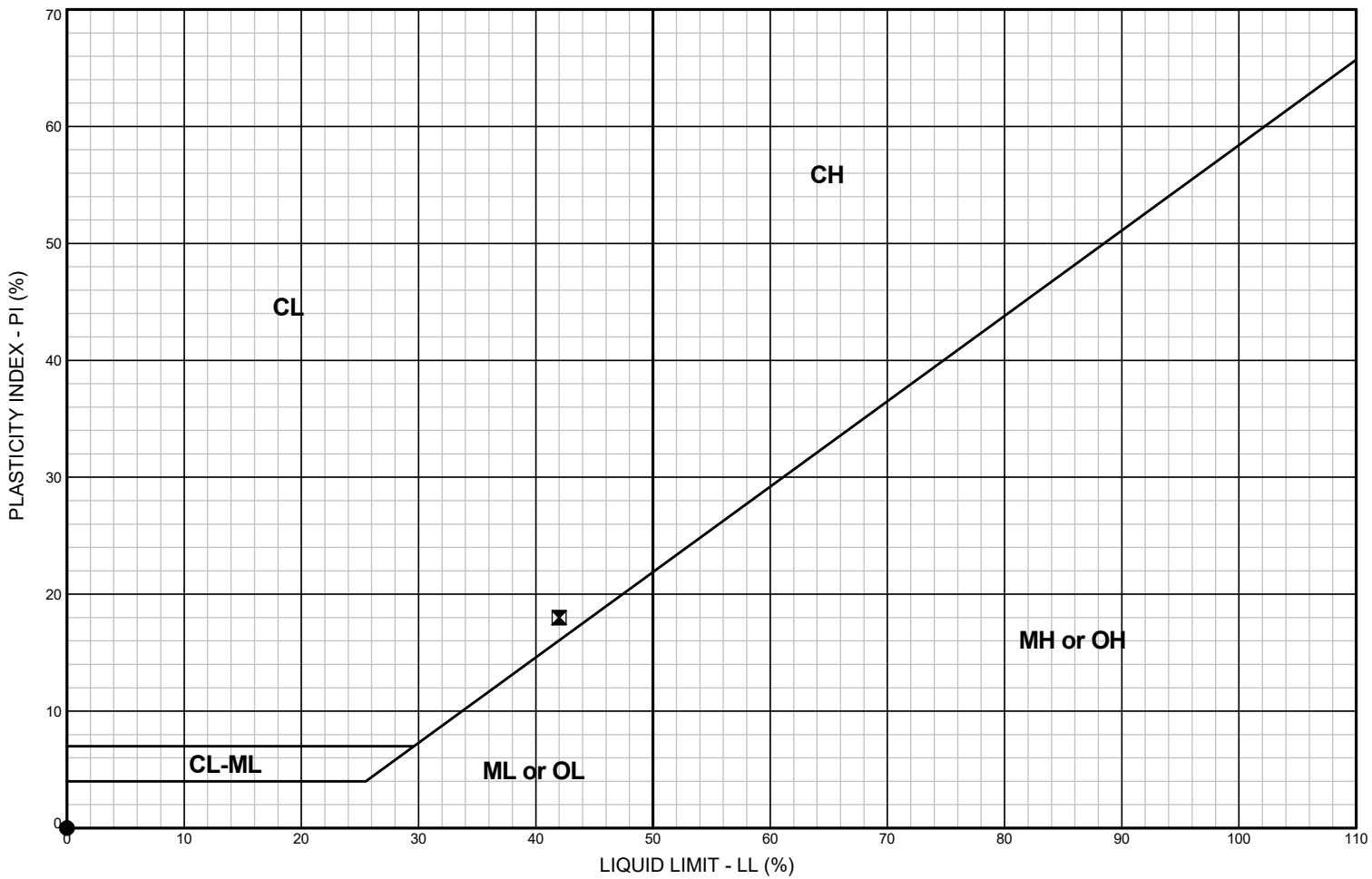
Natural moisture content analyses were performed in accordance with ASTM D2216 on selected soil samples. The natural moisture content is a measure of the amount of moisture in the soil at the time the explorations are performed and is defined as the ratio of water weight to dry soil weight, expressed as a percentage. The results of the moisture content analyses are presented on the Logs of Borings in Appendix B.

C.2.2 Atterberg Limits

Atterberg limits were determined on selected samples in accordance with ASTM D4318. This analysis yields index parameters of the soil that are useful in soil identification, as well as in a number of analyses, including liquefaction analysis. An Atterberg limits test determines a soil's liquid limit (LL) and plastic limit (PL). These are the maximum and minimum moisture contents at which the soil exhibits plastic behavior. A soil's plasticity index (PI) can be determined by subtracting PL from LL. The LL, PL, and PI of tested samples are presented on Figure C1, Atterberg Limits Results. The results are also shown on the Logs of Borings in Appendix B. For the purposes of soil description, Shannon & Wilson uses the term nonplastic to refer to soils with a PI less than 4, low plasticity for soils with a PI range of 4 to 10, medium plasticity for soils with a PI range of 10 to 20, high plasticity for soils with a PI greater than 20.

C.2.3 Particle-Size Analyses

Particle-size analyses were conducted on selected samples to determine their grain-size distributions. Grain size distributions were determined in accordance with ASTM D6913, D1140, as applicable. For all samples, a wet sieve analysis was performed to determine the percentage (by weight) of each sample passing the No. 200 (0.075 mm) sieve. For select samples, the material retained on the No. 200 sieve was shaken through a series of sieves to determine the distribution of the plus No. 200 fraction (ASTM D6913). For some samples, only the percentage of the sample passing the No. 200 (0.075mm) sieve was determined (ASTM D1140). Results of all particle-size analyses are presented on Figure C2, Grain Size Distribution. The percentage of each sample passing the No. 200 sieve is also shown on the Logs of Borings in Appendix B.



NOTES

1) Atterberg limits tests were performed in general accordance with ASTM D4318 unless otherwise noted in the report.

2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

3) Plasticity adjectives used in sample descriptions correspond to plasticity index as follows:
- Nonplastic (NP) (< 3%)
- Low Plasticity (3 to 15%)
- Medium Plasticity (15 to 30%)
- High Plasticity (> 30%)

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	LL %	PL %	PI %[3]	NAT. W.C. %	FINES %
B-01, N9	30.0			NP	NP	NP	31	
⊠ B-02, N6	20.0			42	24	18	32	

Red Rock Creek Pedestrian Bridge
Tigard, Oregon

ATTERBERG LIMITS RESULTS

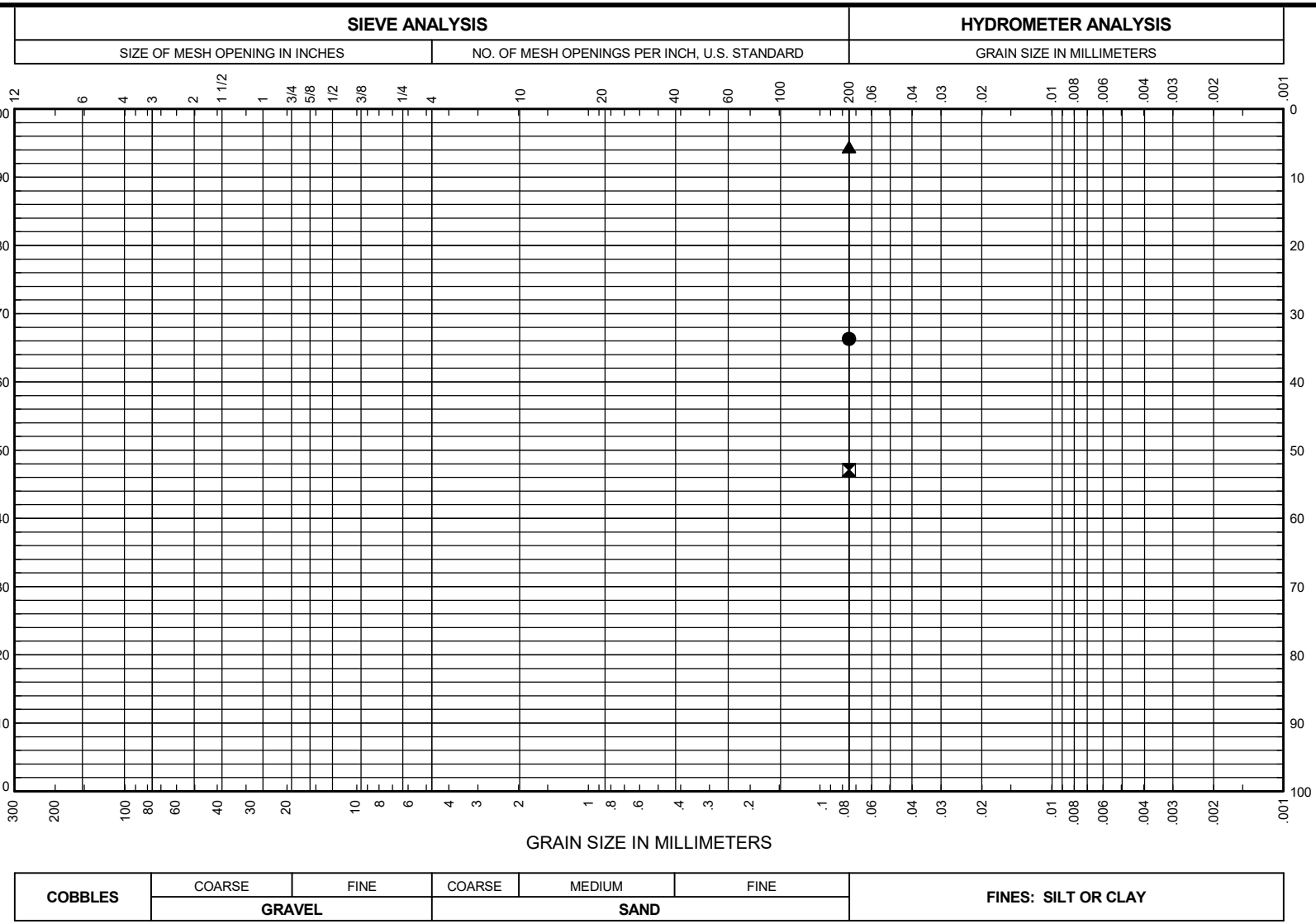
October 2019 103274

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C1

FIG. C1

ATT MAIN 103274.GPJ SHAN WIL.GDT 9/5/19



NOTES:
1) Sieve analyses were performed in general accordance with ASTM D6913, sieve with hydrometer analyses were performed in general accordance with ASTM D422, and amount finer than #200 sieve analyses were performed in general accordance with ASTM D1140 unless otherwise noted in the report.
2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	GRAVEL %	SAND %	FINES %	NAT. W.C. %	DRY DENSITY PCF
● B-01, N8	25.0			-	-	66	34	
⊠ B-02, N3	7.5			-	-	47	32	
▲ B-02, N5	15.0			-	-	94	34	

Red Rock Creek Pedestrian Bridge
Tigard, Oregon

GRAIN SIZE DISTRIBUTION

October 2019 103274

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C2

FIG. C2

GSA MAIN 103274.GPJ SHAN WIL.GDT 9/5/19

IMPORTANT INFORMATION

Important Information

About Your Geotechnical Engineering Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

IMPORTANT INFORMATION

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always

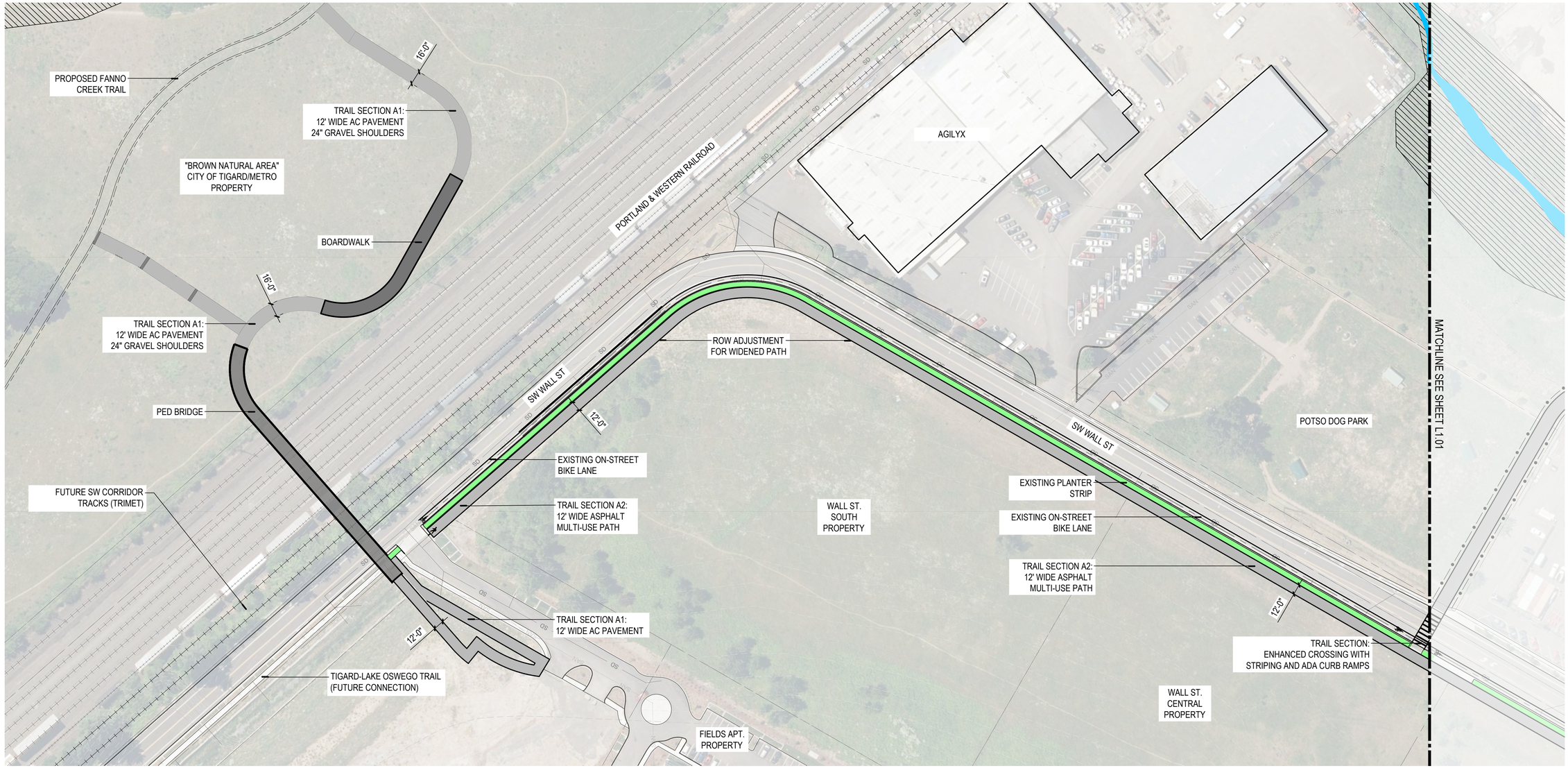
insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Appendix F: Schematic Design Plans and Profiles



LEGEND

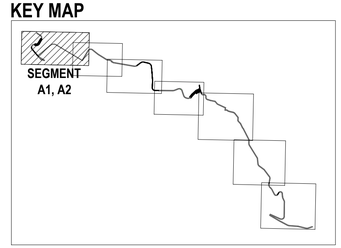
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



NORTH

SCALE: 1" = 60'-0"

0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"
0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

Sheet Title: SEGMENT A1, A2

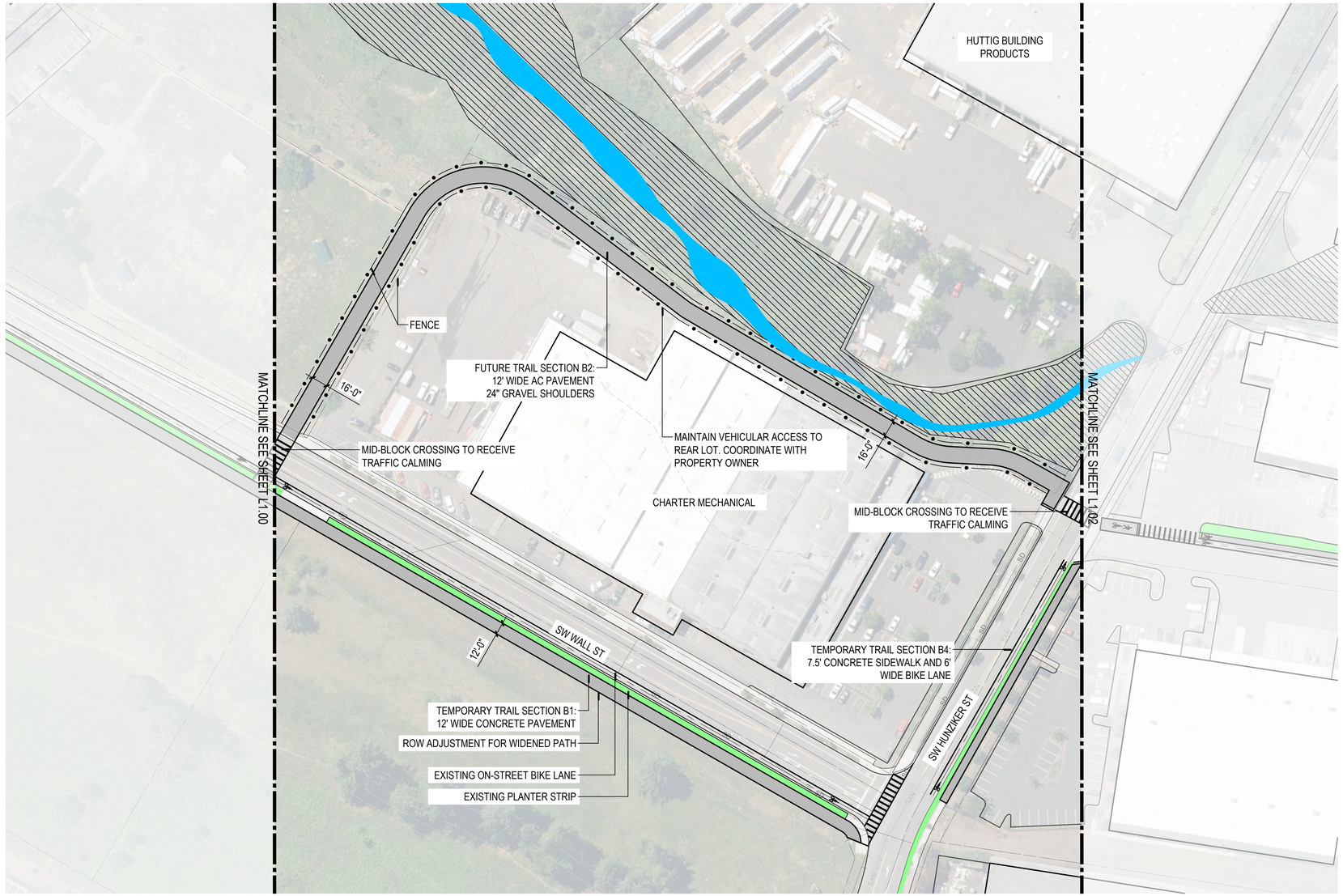
© GREENWORKS, P.C. 2022. ALL RIGHTS RESERVED
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.00

Sheet No. 1 of X

\\GREENWORKSPC\LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG



LEGEND

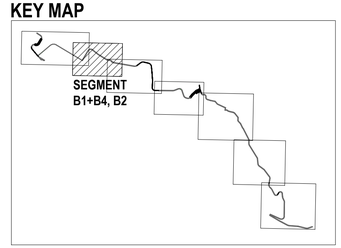
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



SCALE: 1" = 60'-0"

NORTH 0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"
0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

Sheet Title: SEGMENT B1+B4, B2

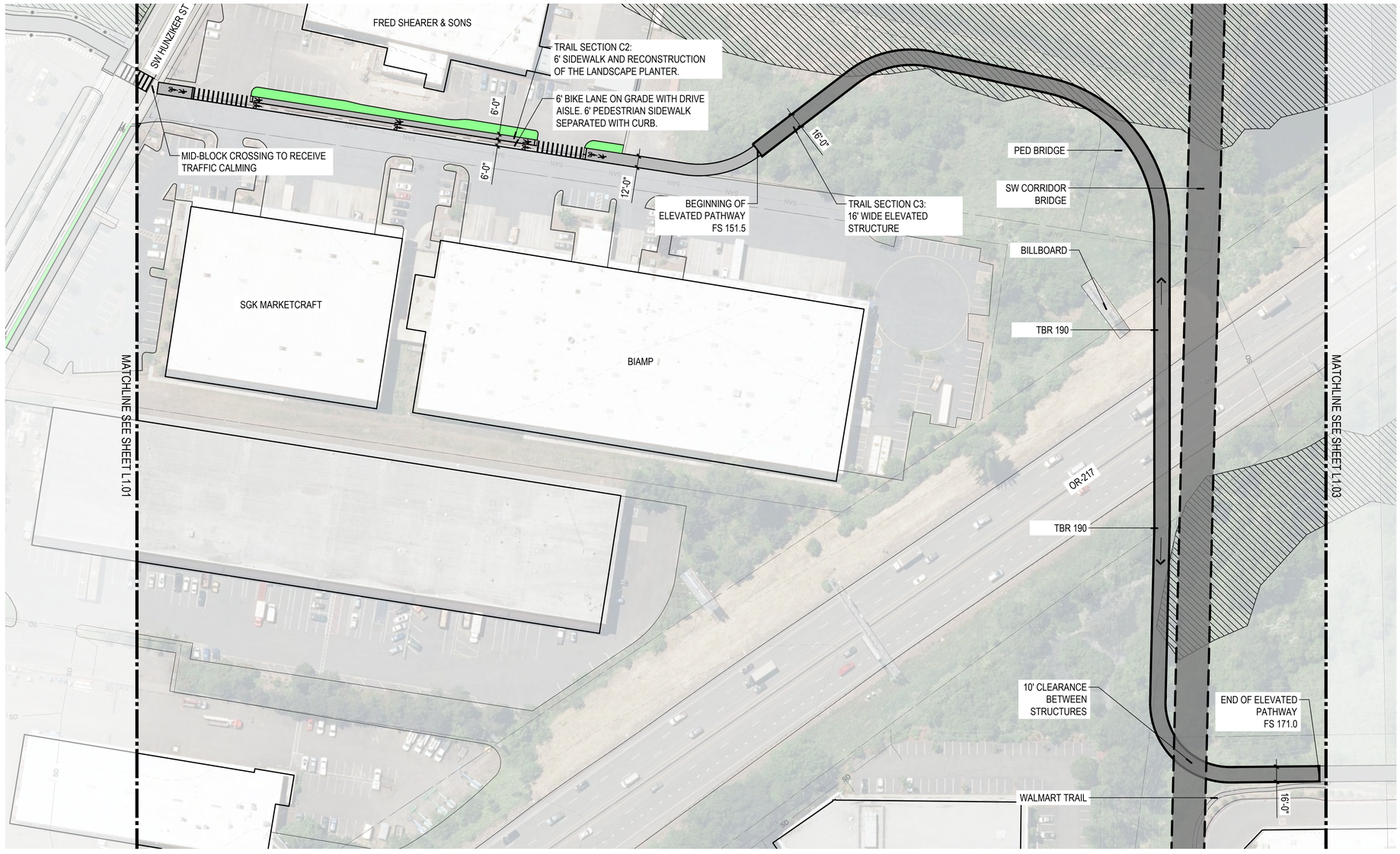
© GREENWORKS, P.C.
2022, ALL RIGHTS RESERVED
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.01

Sheet No. 2 of X

\\GREENWORKSPC.LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG



LEGEND

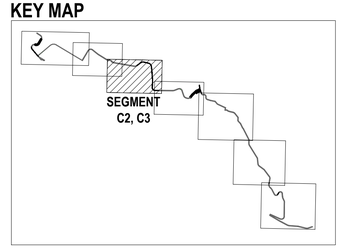
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



NORTH

SCALE: 1" = 60'-0"

0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"

0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

Sheet Title: SEGMENT C2, C3

© GREENWORKS, P.C. 2022, ALL RIGHTS RESERVED

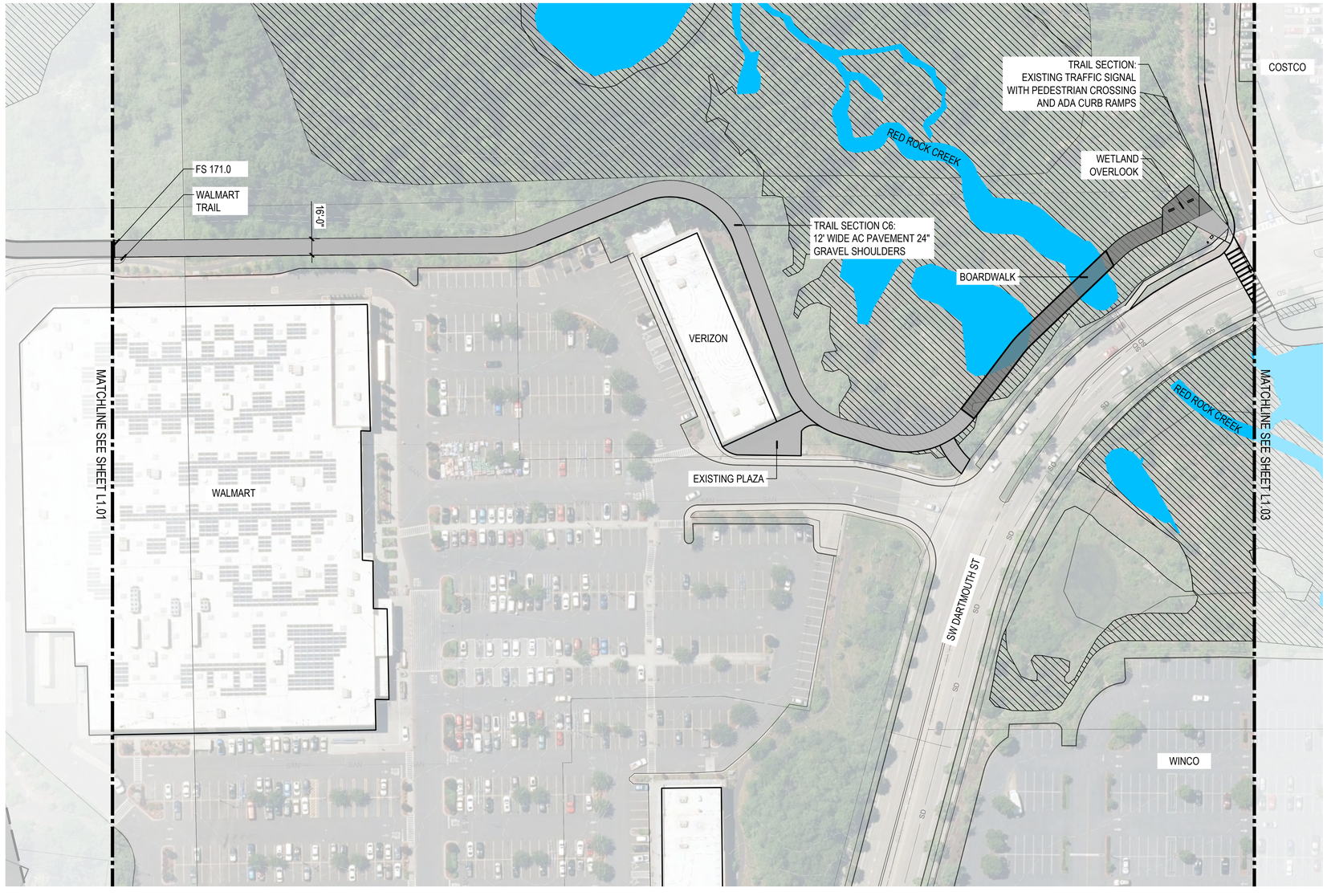
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.02

Sheet No. 3 of X

\\GREENWORKSPC.LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG



LEGEND

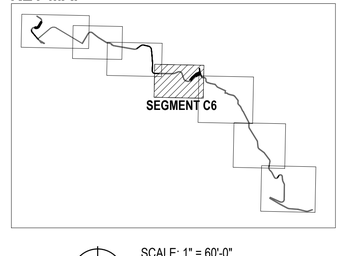
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



NORTH

SCALE: 1" = 60'-0"

0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"

0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

Sheet Title: SEGMENT C6

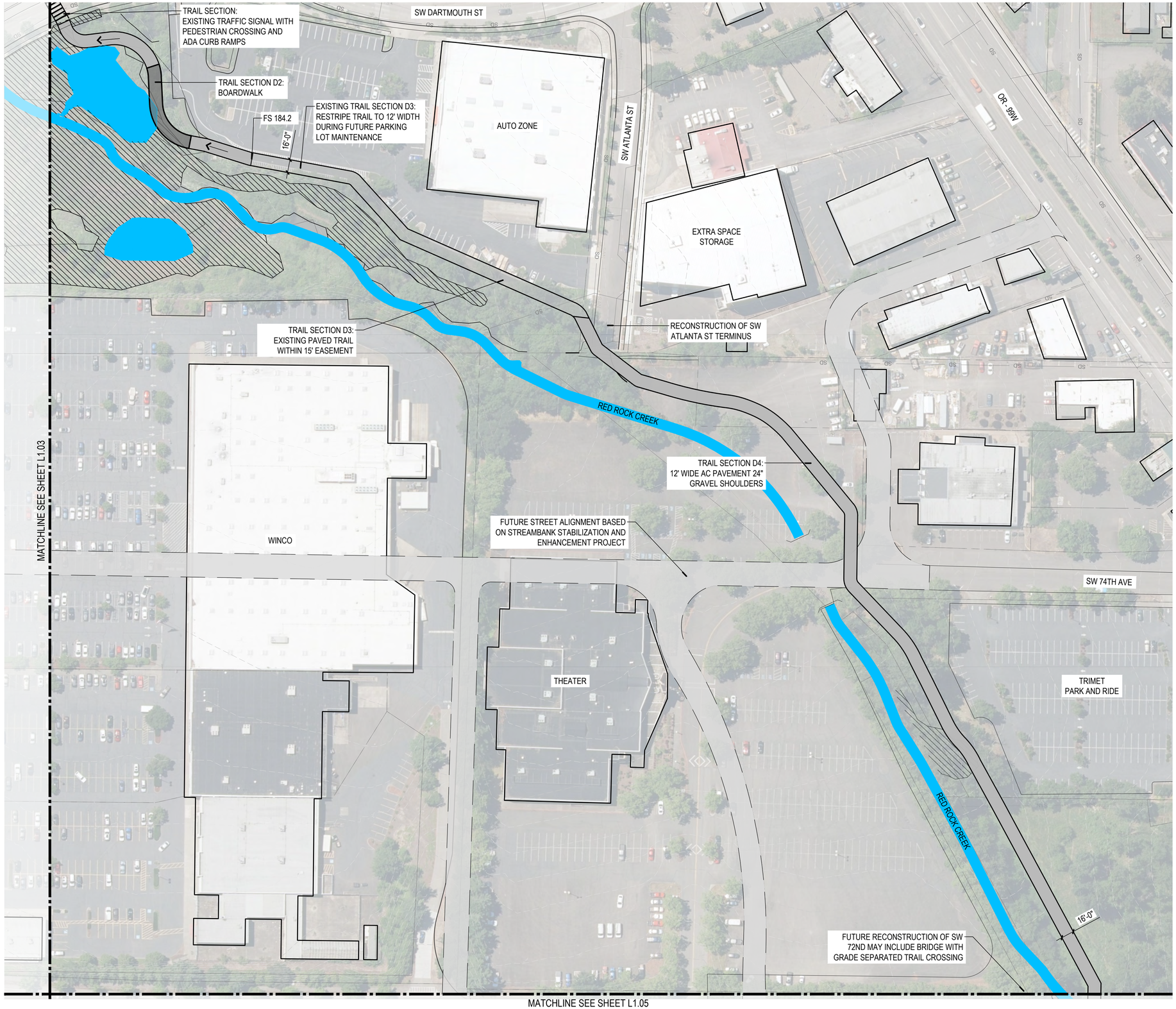
© GREENWORKS, P.C.
2022, ALL RIGHTS RESERVED
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.03

Sheet No. 4 of X

\\GREENWORKSPC.LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG



\\GREENWORKSPC\LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG

LEGEND

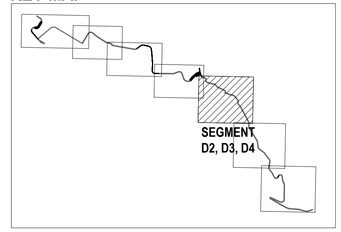
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



NORTH

SCALE: 1" = 60'-0"
0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"
0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

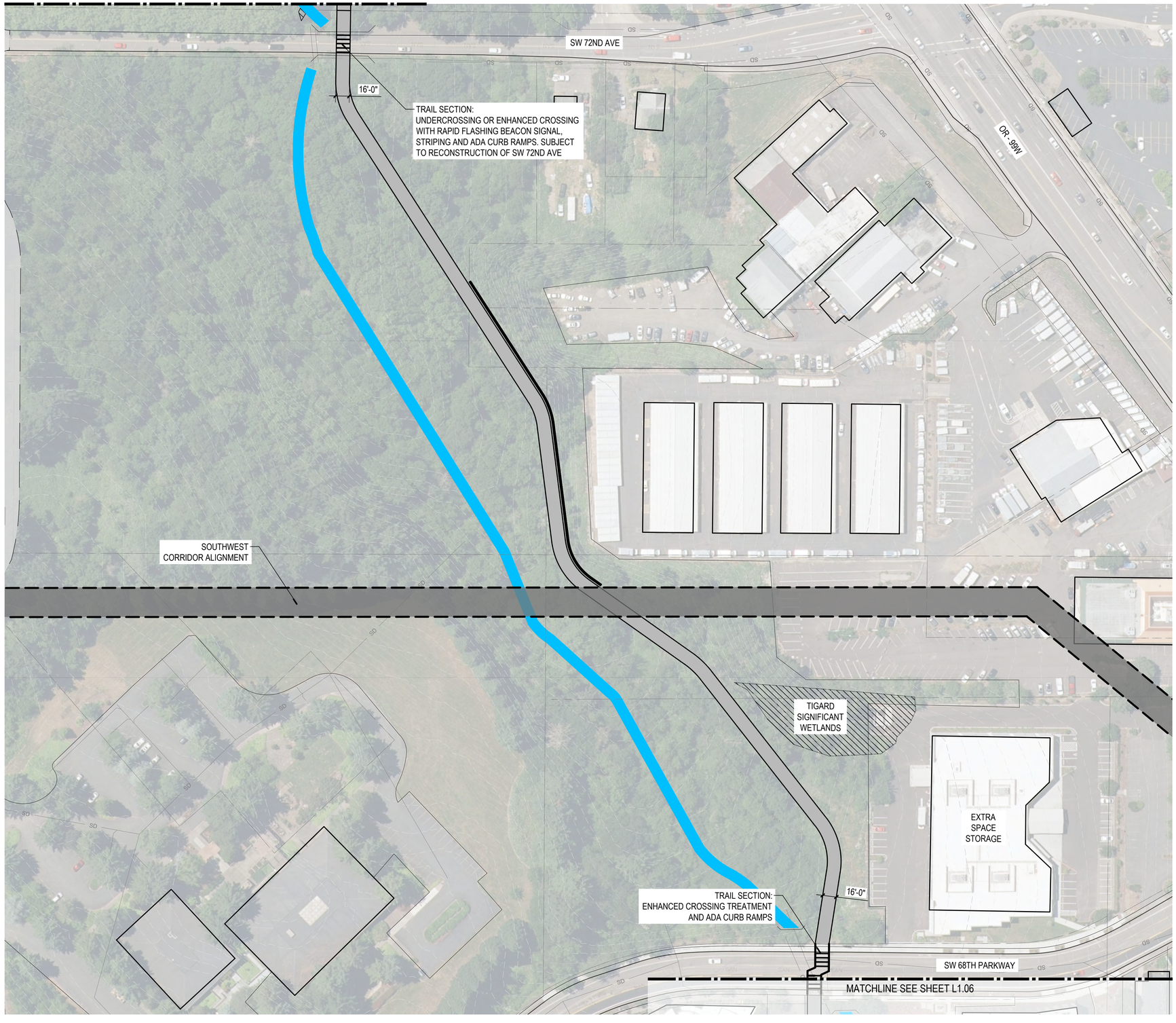
Sheet Title: SEGMENT D2, D3, D4

© GREENWORKS, P.C.
2022, ALL RIGHTS RESERVED
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.04

Sheet No. 5 of X



LEGEND

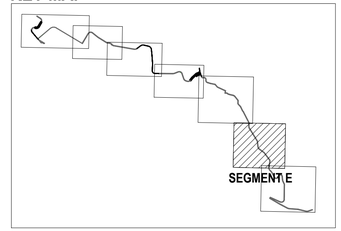
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



SCALE: 1" = 60'-0"

NORTH 0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"

0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

Sheet Title: SEGMENT E

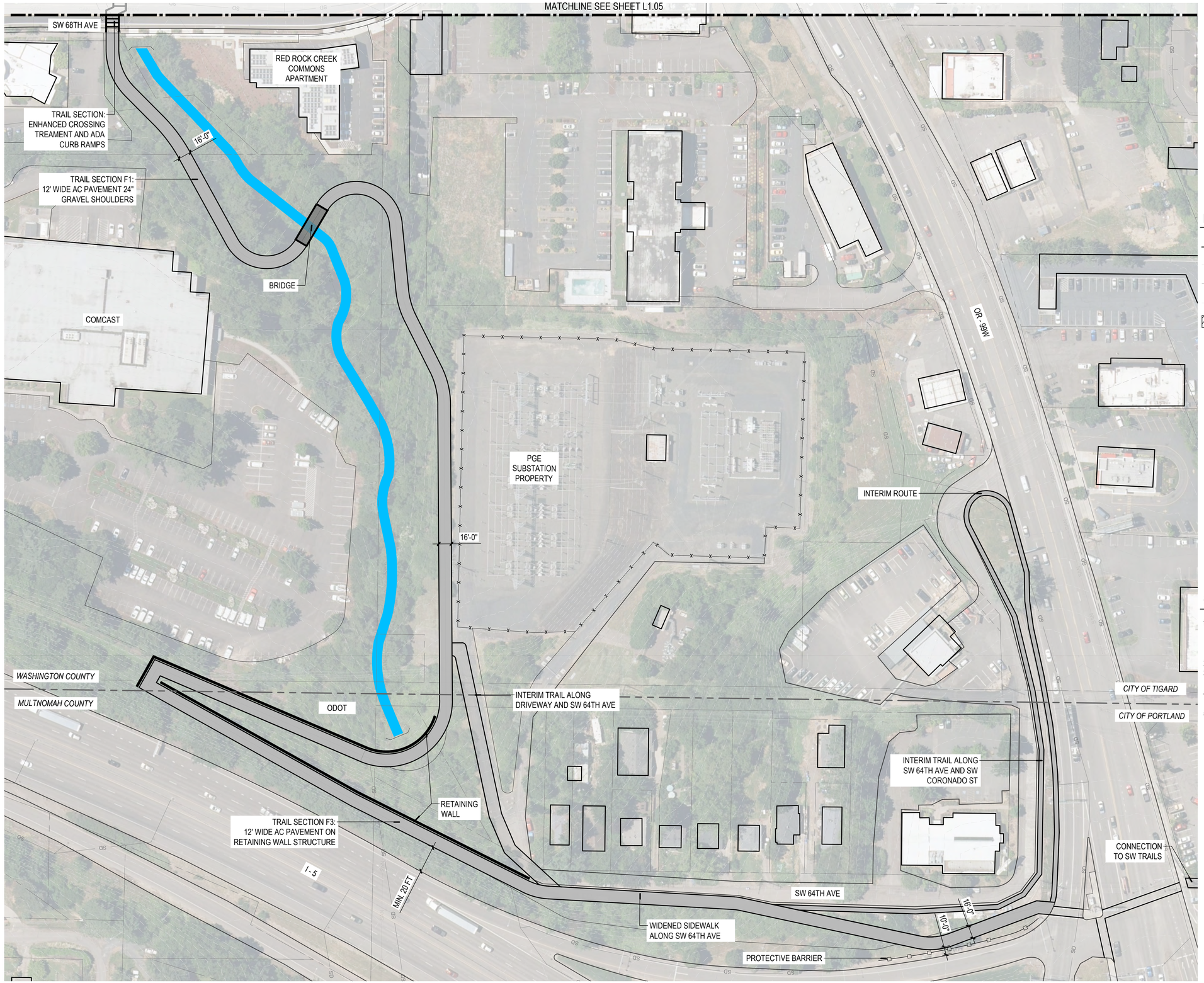
© GREENWORKS, P.C. 2022, ALL RIGHTS RESERVED
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.05

Sheet No. 6 of X

\\GREENWORKSPC.LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG



LEGEND

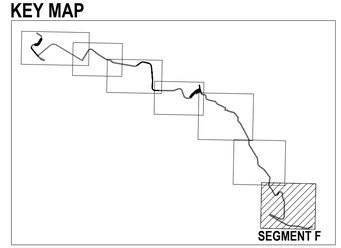
- TAXLOT
- EXISTING SANITARY SEWER
- EXISTING STORMWATER SYSTEM
- 2' CONTOUR
- TIGARD LWI WETLANDS

FS	FINISH SURFACE
TBR	TOP OF BRIDGE
TBW	TOP OF BOARDWALK
TW	TOP OF WALL
XX'R	RADIUS

GENERAL NOTES

1. 16' TRAIL SECTION SHALL INCLUDE 12' WIDE PAVEMENT AND 2' WIDE SHOULDERS EXCEPT WHERE INDICATED. SHOULDERS MAY BE GRAVEL, LOW GROWING GROUNDCOVER, OR SEED.
2. BRIDGE AND BOARDWALK SHALL HAVE 14' CLEAR WIDTH.
3. SELECTION OF ROADWAY CROSSING TREATMENTS SHALL BE DETERMINED THROUGH FINAL DESIGN.
4. SELECTION AND LOCATION OF TRAIL LIGHTING SHALL BE DETERMINED THROUGH FINAL DESIGN.
5. ALIGNMENT OF SOUTHWEST CORRIDOR LIGHT RAIL PROJECT IS BASED ON 30% PRELIMINARY DESIGN SET DATED JULY 31, 2020 FROM TRIMET.

KEY MAP



NORTH

SCALE: 1" = 60'-0"
0' 30' 60' 120'

GREENWORKS
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL DESIGN
110 SE Main St., Suite 100
Portland, OR 97214
Ph: 503 222 5612
Fax: 503 222 2283
Email: info@greenworkspc.com

VERIFY SCALE: DRAWINGS ARE TO SCALE IF BAR MEASURES 1"
0" 1/2" 1"

Otak

Project: RED ROCK CREEK TRAIL

Otak
808 SW Third Avenue, Suite 800
Portland, OR 97204
(503) 415-2381
amanda.owings@otak.com

Submittal: SCHEMATIC DESIGN PLANS

Sheet Title: SEGMENT F

© GREENWORKS, P.C. 2022, ALL RIGHTS RESERVED
THESE DRAWINGS ARE THE PROPERTY OF GREENWORKS, P.C., AND ARE NOT TO BE USED OR REPRODUCED IN ANY MANNER, EXCEPT WITH THE PRIOR WRITTEN PERMISSION OF GREENWORKS, P.C.

Date:	02/12/2024
Revisions:	
Drawn By:	YC/CH
Checked By:	####
Job No.	210026.1
Approved:	####

L1.06
Sheet No. 7 of X

\\GREENWORKSPC.LOCAL\PUBLIC\PROJECTS\210026.1_RED_ROCK_TRAIL\02_PRODUCTION\01_CAD\01_PLOT_SHEETS\210026_DSGN_BASE.DWG

Appendix G: Cost Estimate

Red Rock Creek Trail Alignment Study

OPINION OF PROBABLE CONSTRUCTION COST
2022 Estimated Design and Construction Costs

ITEM	CONSTRUCTION ITEM	UNIT COST	UNIT	SEGMENT A Quantity	SEGMENT A Total	SEGMENT: B2 Quantity	SEGMENT: B2 Total	SEGMENT C Quantity	SEGMENT C Total	SEGMENT D Quantity	SEGMENT D Total	SEGMENT: E1 Quantity	SEGMENT: E1 Total	SEGMENT F Quantity	SEGMENT F Total
1	MOBILIZATION, SURVEY, EROSION CONTROL	20%	%	2	$ 1,270,009	1	$ 162,433	3	$ 2,188,443	2	$ 550,719	1	$ 263,493	2	$ 593,582
2	CLEARING & GRUBBING	$40,000.00	AC	1	$ 30,670	0.47	$ 18,916	3	$ 131,019	1.08	$ 43,140	1.00	$ 40,000	1.54	$ 61,524
3	TREE REMOVAL	$100,000.00	AC	0	$ 25,000	0.47	$ 47,291	3	$ 327,548	1.08	$ 107,851	1.00	$ 100,000	1.54	$ 153,811
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	$150.00	SY	1010	$ 151,500	86	$ 12,833	952	$ 142,833	0	$ -	0	$ -	0	$ -
5	EXCAVATION/EMBANKMENT	$65.00	CY	13077	$ 849,983	635	$ 41,275	2850	$ 185,250	0	$ -	1825	$ 118,625	4800	$ 312,000
6	DRAINAGE PIPE	$50.00	LF	596.25	$ 29,813	258	$ 12,875	398	$ 19,875	342.5	$ 17,125	319	$ 15,938	705.75	$ 35,288
7	TRAIL SURFACING (CONCRETE)	$16.00	SF	8580	$ 137,280	500	$ 8,000	9000	$ 144,000	2500	$ 40,000	0	$ -	7272	$ 116,352
8	TRAIL SURFACING (ASPHALT)	$6.00	SF	9550	$ 57,300	12360	$ 74,160	13080	$ 78,480	12840	$ 77,040	15300	$ 91,800	33876	$ 203,256
9	GRAVEL SHOULDERS	$6.00	SF	6680	$ 40,080	2747	$ 16,480	3960	$ 23,760	4280	$ 25,680	5100	$ 30,600	11292	$ 67,752
10	ACCESSIBLE RAMPS	$15,000.00	EA	4	$ 60,000	2	$ 30,000	3	$ 45,000	4	$ 60,000	2	$ 30,000	2	$ 30,000
11	ROAD CROSSING - SIGNALIZED	$40,000.00	EA	0	$ -	1	$ 40,000	0	$ -	0	$ -	0	$ -	0	$ -
12	ROAD CROSSING - SIGN & STRIPE	$10,000.00	EA	2	$ 20,000	0	$ -	3	$ 30,000	2	$ 20,000	1	$ 10,000	1	$ 10,000
13	BRIDGE STRUCTURE	$425.00	SF	4960	$ 2,108,000	0	$ -	4000	$ 1,700,000	1600	$ 680,000	0	$ -	600	$ 255,000
14	BOARDWALK or VIADUCT STRUCTURE	$300.00	SF	5190	$ 1,557,000	0	$ -	20320	$ 6,096,000	2520	$ 756,000	0	$ -	0	$ -
15	RETAINING WALL	$150.00	SF	0	$ -	400	$ 60,000	4500	$ 675,000	1050	$ 157,500	1624	$ 243,600	5815	$ 872,250
16	PEDESTRIAN RAILING	$175.00	LF	1160	$ 203,000	0	$ -	2720	$ 476,000	640	$ 112,000	0	$ -	955	$ 167,125
17	TRAIL LIGHTING	$50.00	LF	1535	$ 76,750	1030	$ 51,500	2240	$ 112,000	1280	$ 64,000	1275	$ 63,750	2823	$ 141,150
18	STREET LIGHTING	$20,000.00	EA	1	$ 20,000	1	$ 20,000	5	$ 100,000	4	$ 80,000	0	$ -	1	$ 20,000
19	BOLLARDS	$1,000.00	EA	4	$ 4,000	2	$ 2,000	9	$ 9,000	6	$ 6,000	2	$ 2,000	6	$ 6,000
20	CHAINLINK FENCING	$80.00	LF	0	$ -	515	$ 41,200	0	$ -	0	$ -	0	$ -	0	$ -
21	SPLIT RAIL FENCING	$40.00	LF	1910	$ 76,400	1545	$ 61,800	930	$ 37,200	1260	$ 50,400	1275	$ 51,000	1778	$ 71,120
22	REGULATORY & WARNING SIGNAGE	$400.00	EA	0	$ -	0	$ -	2	$ 800	0	$ -	0	$ -	0	$ -
23	WAYFINDING SIGNAGE	$800.00	EA	7	$ 5,600	2	$ 1,600	8	$ 6,400	4	$ 3,200	4	$ 3,200	5	$ 4,000
24	LANDSCAPING & VEG. CORR. MITIGATION	$10.00	SF	8590	$ 85,900	24510	$ 245,100	40950	$ 409,500	29820	$ 298,200	37650	$ 376,500	23238	$ 232,380
25	OUTFALL RESTORATION	$5,000.00	EA	0	$ -	4	$ 20,000	8	$ 40,000	8	$ 40,000	5	$ 25,000	8	$ 40,000
26	PHASE 1 HAZMAT STUDY	$7,000.00	LS	2	$ 14,000	1	$ 7,000	3	$ 21,000	2	$ 14,000	1	$ 7,000	2	$ 14,000
27	MITIGATION (WETLANDS+ENHANCEMENT)	$1.00	LS	1	$ 2,400	8550	$ 8,550	31550	$ 31,550	7100	$ 7,100	33450	$ 33,450	8900	$ 8,900
28	ENVIRONMENTAL PERMITTING	$1.00	LS	1	$ 8,500	10500	$ 10,500	80000	$ 80,000	17500	$ 17,500	25000	$ 25,000	23001	$ 46,000
29	UTILITY RELOCATION	$50,000.00	EA	16	$ 800,000	0	$ -	6	$ 300,000	2	$ 100,000	1	$ 50,000	2	$ 100,000
	Subtotal of Construction Cost				**$ 7,633,185**		**$ 993,514**		**$ 13,410,659**		**$ 3,327,456**		**$ 1,580,955**		**$ 3,561,489**
A	CONTINGENCY	40%			$ 3,053,274		$ 397,405		$ 5,364,264		$ 1,330,982		$ 632,382		$ 1,424,596
B	ENGINEERING & DESIGN	30%			$ 2,289,956		$ 298,054		$ 4,023,198		$ 998,237		$ 474,287		$ 1,068,447
C	CONSTRUCTION ENGINEERING, INSPECTION	25%			$ 1,908,296		$ 248,378		$ 3,352,665		$ 831,864		$ 395,239		$ 890,372
D	PROJECT ADMINISTRATION	15%			$ 1,144,978		$ 149,027		$ 2,011,599		$ 499,118		$ 237,143		$ 534,223
	Subtotal of Contingencies				**$ 8,396,504**		**$ 1,092,865**		**$ 14,751,725**		**$ 3,660,202**		**$ 1,739,051**		**$ 3,917,638**
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	$5.75	SF	5290	$ 30,418	0	$ -	15850	$ 91,138	20800	$ 119,600	20670	$ 118,853	29890	$ 171,868
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	$0.33	SF	0	$ -	7930	$ 2,617	41190	$ 13,593	8430	$ 2,782	6460	$ 2,132	8988	$ 2,966
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	$23.00	SF	10450	$ 240,350	14110	$ 324,530	27690	$ 636,870	0	$ -	0	$ -	0	$ -
	TOTAL				**$ 16,300,456**		**$ 2,413,526**		**$ 28,903,984**		**$ 7,110,039**		**$ 3,440,990**		**$ 7,653,961**
		Total Length	$ / LF	2965.0	$ 5,498	$ 1,030	$ 2,343	3200.0	$ 9,032	1580.0	$ 4,500	1275.0	$ 2,699	2873.0	$ 2,664

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

ALIGNMENT A1

Description:
From Fanno Creek Trail, RRCT rises on embankment and structure to cross rail tracks. Recorded public access esmt for east bridgehead. Utilize driveway to access Wall St.

On-Grade Length (ft)	955
Structure Length (ft)	580
Total Length (ft)	1535

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference/source
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 1,044,109		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.44	$ 17,539		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.25	$ 25,000	not many trees	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	30	$ 4,500	rmv ex. ramps at Wall St / Fields property private drive	ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	12600	$ 819,000	Cost and Quantity from OTAK "alternatives analysis 2019"	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	239	$ 11,938	25' drain crossing/100' of new trail	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	0	$ -	Incl. 4" concrete, 5" aggregate	Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	9550	$ 57,300	Incl. 3" AC, 8" aggregate, geotextile	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	3820	$ 22,920	Incl. 11" aggregate depth	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	2	$ 30,000	two ramps at Wall St / Fields property private drive	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -	assumes RRFB	ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	1	$ 10,000	Signage and striping along driveway	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	4960	$ 2,108,000	310' bowstring 2-span bridge per TS&L, no contingencies	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	5190	$ 1,557,000	Viaduct appproaches to RR bridge crossing	Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	0	$ -	Included in structure costs	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	1160	$ 203,000		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	1535	$ 76,750	Pedestrian level lighting, assume $50k min.	consultant
18	STREET LIGHTING	EA	$20,000.00	1	$ 20,000	New streetlight at road crossing	Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000		Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	1910	$ 76,400		local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	5	$ 4,000	unique sign, includes 1 sign at each Trail intersection	double cost of std sign
24	LANDSCAPING	SF	$10.00	5730	$ 57,300		Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	0	$ -		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	2400	$ 2,400	No wetlands; may require enhancement to natural area.	consultant
29	ENVIRONMENTAL PERMITTING	LS	$1.00	8500	$ 8,500	Minimal impact to natural area west of RR tracks.	consultant
29	UTILITY RELOCATION	LS	$50,000.00	2	$ 100,000	Relocate PGE poles west of RR during construction	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 6,264,656**		
A	CONTINGENCY	%	40%		$ 2,505,862		Canemah Trail, Fanno Creek Trail
B	ENGINEERING & DESIGN	%	30%		$ 1,879,397		Canemah Trail, Fanno Creek Trail
C	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 1,566,164		Canemah Trail
D	PROJECT ADMINISTRATION	%	15%		$ 939,698		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 6,891,121**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	5290	$ 30,418	Easement over RR. Current easements on Fields property	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	0	$ -	Metro/Tigard joint ownership of natural area west of RR, no cost.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -	None	Commonstreet: RRCSEP, 2023
	TOTAL			total	**$ 13,186,195**		
				cost/LF	**$ 13,808**		

Trail Type	LF
Off Road	790
Boardwalk	165
On-Road	0
Sidewalk expansion	0

Objects of Interest

1 unsignalized ped crossing

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

ALIGNMENT A2

Description:

Trail uses a widened concrete sidewalk on one side of Wall St. Street lighting to be relocated. One mid-block crossing to Potso Dog Park. Mostly at grade already. Requires ROW/Esmt acquisition.

On-Grade Length (ft)	1430
Structure Length (ft)	0
Total Length (ft)	1430

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 225,900		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.33	$ 13,131		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.00	$ -	No Trees in this area	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	980	$ 147,000	removal of two Wall St ramps; removal of existing 6' sidewalk	ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	477	$ 30,983	6' x 1.5' on one side of trail to grade out to SW level	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	358	$ 17,875	25' drain crossing every 100' of new trail	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	8580	$ 137,280	Includes 6" concrete, 5" aggregate, 8' trail on east side	Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	0	$ -	Includes 3" AC, 8" aggregate, geotextile	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	2860	$ 17,160	Includes 11" aggregate depth	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	2	$ 30,000	ramps on each side of Wall St crossing to Potso Dog Park	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	1	$ 10,000		Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -		consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	0	$ -		Washington County
16	PEDESTRIAN RAILING	LF	$175.00	0	$ -		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	0	$ -	Street Lighting already in place	consultant
18	STREET LIGHTING	EA	$20,000.00	0	$ -	Street Lighting already in place, to be relocated (below)	Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000	one at each end of widened sidewalk	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	0	$ -		local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	2	$ 1,600	unique sign, includes 1 sign at each entry/exit location	double cost of std sign
24	LANDSCAPING	SF	$10.00	2860	$ 28,600	includes 2' landscaping behind sidewalk	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	0	$ -		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	0	$ -	No wetlands, sidewalk widening only.	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	0	$ -	No impacts	consultant
29	UTILITY RELOCATION	EA	$50,000.00	14	$ 700,000	Relocate street lights	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 1,368,529**		
	CONTINGENCY	%	40%		$ 547,412		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 410,559		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 342,132		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 205,279		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 1,505,382**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	10450	$ 240,350	ROW acquisition to widen sidewalk along SW Wall St.	Commonstreet: RRCSEP, 2023
	TOTAL			total	**$ 3,114,262**		
				cost/LF	**$ 2,178**		

Trail Type	LF
Off Road	0
Boardwalk	0
On-Road	0
Sidewalk expansion	0

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

ALIGNMENT SEGMENT: B2

Description:
Trail runs adjacent to industrial property, dog park, and stream. Includes fencing to protect both sides. Likely impacts to stream corridor. Rebuild private driveway. Enhanced mid-block crossing at Hunziker.

On-Grade Length (ft)	1030
Structure Length (ft)	0
Total Length (ft)	1030

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 162,433		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.47	$ 18,916		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.47	$ 47,291	Minor Trees for a portion of trail	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	86	$ 12,833	Removal of the Hunziker Rd driveway for Charter Mechanical.	ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	635	$ 41,275	From profiles	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	258	$ 12,875	25' drain crossing every 100' of trail	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	500	$ 8,000	Rebuild the Hunziker Rd driveway for Charter Mechanical.	Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	12360	$ 74,160	12' of AC pavement trail	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	2747	$ 16,480	2' of gravel shoulder on each side, 2/3 of trail with shoulder	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	2	$ 30,000	New ramps on each side of Hunziker Rd	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	1	$ 40,000	RRFB for trail crossing Hunziker (35 mph)	ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	0	$ -		Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -	None in this segment	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -	None in this segment	Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	400	$ 60,000	100' of 4' wall	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	0	$ -		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	1030	$ 51,500	Variable 20-50	consultant
18	STREET LIGHTING	EA	$20,000.00	1	$ 20,000	New light at Hunziker St mid-block crossing	Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000	Two on south side to prevent cars entering trail	Washington County
20	CHAINLINK FENCING	LF	$80.00	515	$ 41,200	Fencing to separate trail from dog park	ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	1545	$ 61,800	Fencing separating walkway from stream corridor	local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	2	$ 1,600	unique sign, includes 1 sign at each entry/exit location	double cost of std sign
24	LANDSCAPING	SF	$10.00	24510	$ 245,100	LF of trail impacting wetlands: 611' x 30' additional for wetland Mit.	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	4	$ 20,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	8550	$ 8,550	Significant VC impact	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	10500	$ 10,500	Mitigate for VC impact	consultant
29	UTILITY RELOCATION	EA	$50,000.00	0	$ -		Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 993,514**		
	CONTINGENCY	%	40%		$ 397,405		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 298,054		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 248,378		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 149,027		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 1,092,865**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	7930	$ 2,617	Acquisition of area nearest creek.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	14110	$ 324,530	ROW acquisition at Charter Mechanical. No cost for Potso Park.	Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 2,413,526**		
			$ / LF		**$ 2,343**		

Trail Type	LF
Off Road	0
Boardwalk	0
On-Road	0
Sidewalk expansion	1030

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

ALIGNMENT SEGMENT: C2

Description:
Adaptation of industrial vehicular area for trail.
Reconstruction of landscaped island for 8' sidewalk.
Sharrow smarkings in drive aisle.

On-Grade Length (ft)	600
Structure Length (ft)	0
Total Length (ft)	600

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 58,660		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.28	$ 11,019		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.28	$ 27,548	Minor Trees for a portion of trail	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	222	$ 33,333	Remove curbs and 2' of drive aisle pavement	ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	420	$ 27,300	Fill from profiles	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	150	$ 7,500	Drainage improvements for Parking lot	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	4000	$ 64,000	500' of 8' concrete trail along the landscaped median, adjacent to d	Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	1200	$ 7,200	100' of 12' of AC pavement trail, Repave/resurface ex pavement	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	0	$ -	No Gravel shoulder for this segment	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	0	$ -	Ramp on north end leaving parking lot grade calc'd in C3	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	2	$ 20,000	Crosswalks and sharrow markings throughout parking lot.	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -		consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	0	$ -		Washington County
16	PEDESTRIAN RAILING	LF	$175.00	0	$ -		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	0	$ -	Parking lot lighting already in place	consultant
18	STREET LIGHTING	EA	$20,000.00	0	$ -	Parking lot lighting already in place	Washington County
19	BOLLARDS	EA	$1,000.00	0	$ -	No bollards needed on this narrower sidewalk	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	0	$ -		local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	2	$ 800	STOP signs at driveway crossings	ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	2	$ 1,600	unique sign, includes 1 sign at each entry/exit location	double cost of std sign
24	LANDSCAPING	SF	$10.00	3600	$ 36,000	Landscaping enhancement along concrete trail in median	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	0	$ -		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000	3' of Landscaping on each side of trail	consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	0	$ -	No wetland or VC impacts	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	0	$ -	Section in parking lot	consultant
29	UTILITY RELOCATION	EA	$50,000.00	1	$ 50,000	Approx. cost per structure (pole, vault, MH)	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 351,961**		
	CONTINGENCY	%	40%		$ 140,784		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 105,588		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 87,990		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 52,794		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 387,157**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	15850	$ 91,138	Easement straddles two properties.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -		Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 830,256**		
			$ / LF		**$ 1,384**		

Trail Type	LF
Off Road	0
Boardwalk	0
On-Road	0
Other	600

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: C3

Description:
Elevate trail with viaduct over wetland/vegetated corridor. Long span bridge to cross Highway 217. Structure turns north to pass under SWC, touching down at trail behind Walmart building.

On-Grade Length (ft)	60
Structure Length (ft)	1250
Total Length (ft)	1310

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 1,590,372		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	2.00	$ 80,000	Extra for dense veg.	Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	2.00	$ 200,000	extra for dense veg.Trees in part of segment	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	0	$ -		ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	1400	$ 91,000	West end, raising to structure: 150' x 16' x 30' fill	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	15	$ 750	Drainage improvements for Parking lot	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	0	$ -		Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	720	$ 4,320	12' of AC pavement trail at east landing	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	240	$ 1,440	2' shoulder each side	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	1	$ 15,000	Ramp on south end leaving parking lot grade	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	0	$ -		Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	4000	$ 1,700,000	Bridge + Viaduct cost by LF from "Grade Separations" report	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	16000	$ 4,800,000	Bridge + Viaduct cost by LF from "Grade Separations" report	Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	4500	$ 675,000	Retaining wall for rasied approaches	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	2000	$ 350,000	Railing along viaduct	Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	1310	$ 65,500		consultant
18	STREET LIGHTING	EA	$20,000.00	5	$ 100,000	Additional Lighting throughout parking lot.	Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000	Viaduct entrance from parking lot grade and transition to Walmart p	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -	included in bridge cost	ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	0	$ -		local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	2	$ 1,600	unique sign, includes 1 sign at each entry/exit location	double cost of std sign
24	LANDSCAPING	SF	$10.00	6360	$ 63,600	3' on each side of at-grade trail; includes space under viaduct	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	4	$ 20,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	14650	$ 14,650	From PHS Report 9-20-23	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	40000	$ 40,000	From PHS Report 9-20-23	consultant
29	UTILITY RELOCATION	EA	$50,000.00	0	$ -		Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 9,822,232**		
	CONTINGENCY	%	40%		$ 3,928,893		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 2,946,670		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 2,455,558		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 1,473,335		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 10,804,455**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	25090	$ 8,280	Natural area west of Hwy 217, small amount east of Hwy 217.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	17100	$ 393,300	Esmt or ROW purchase along rear of Walmart property.	Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 21,028,267**		
			$ / LF		**$ 350,471**		

Trail Type	LF
Off Road	60
Bridge	250
Viaduct	1000

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: C6B

Description:
Utilize trail behind Walmart building, reconstruct to 12' width. Trail on boardwalk between wetland and Dartmouth St. Plaza at Dartmouth/Costco intersection. Use existing signalized crossing.

On-Grade Length (ft)	930
Structure Length (ft)	360
Total Length (ft)	1290

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 539,411		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	1.00	$ 40,000		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	1.00	$ 100,000	Minor Trees for a portion of trail	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	730	$ 109,500	Removal of existing trail surfacing	ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	1030	$ 66,950	Cut from profiles	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	233	$ 11,625	25' drain crossing every 100' of trail	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	5000	$ 80,000	Assume 50'x50' plaza spaces	Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	11160	$ 66,960	12' of AC pavement trail, Repave/resurface ex pavement	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	3720	$ 22,320	2' shoulder each side	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	2	$ 30,000	Rebuild existing ramps crossing SW Dartmouth	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	1	$ 10,000	restripe crosswalk markings	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -	No bridge this segment	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	4320	$ 1,296,000	Boardwalk along Dartmouth St	Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	0	$ -		Washington County
16	PEDESTRIAN RAILING	LF	$175.00	720	$ 126,000	Rail along boardwalk	Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	930	$ 46,500	Lighting near buildings	consultant
18	STREET LIGHTING	EA	$20,000.00	0	$ -		Washington County
19	BOLLARDS	EA	$1,000.00	7	$ 7,000	Bollards at trail intersections, plaza spaces	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	930	$ 37,200	Fencing separating walkway from stream corridor	local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	4	$ 3,200	unique sign, includes 1 sign at each entry/exit location, extra for exi	double cost of std sign
24	LANDSCAPING	SF	$10.00	30990	$ 309,900	LF of trail impacting wetlands: 847' x 30' additional wetland Mit.	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	4	$ 20,000		consultant
26	PHASE 1 HAZMAT STUDY	LS	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	16900	$ 16,900	From PHS Report 9-20-23	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	40000	$ 40,000	From PHS Report 9-20-23	consultant
29	UTILITY RELOCATION	EA	$50,000.00	5	$ 250,000	Street lights along Walmart trail	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 3,236,466**		
	CONTINGENCY	%	40%		$ 1,294,586		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 970,940		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 809,117		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 485,470		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 3,560,113**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	16100	$ 5,313	Esmt or ROW along DSK property adjacent to Dartmouth St.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	10590	$ 243,570	Esmt or ROW purchase along DSK property.	Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 7,045,462**		
			$ / LF		**$ 7,576**		

Trail Type	LF
Off Road	930
Boardwalk	360
On-Road	0
Bridge	0

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: D2

Description:
Segment of off-road trail along creek. Connects Dartmouth/Costco intersection to AutoZone parking lot trail. Trail weaves between WQ facility and creek, requiring retaining walls, pedestrian rail.

On-Grade Length (ft)	110
Structure Length (ft)	210
Total Length (ft)	320

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 259,647		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.50	$ 20,000		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.50	$ 50,000	Minor Trees for a portion of trail	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	0	$ -		ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	0	$ -		ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	28	$ 1,375	25' drain crossing every 100' of trail	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	2500	$ 40,000	Assume 50'x50' plaza spaces	Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	1320	$ 7,920	12' of AC pavement trail	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	440	$ 2,640	2' shoulder each side	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	0	$ -		Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	0	$ -		Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -	Bridge cost by structural as LS/EA, No bridge this segment	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	2520	$ 756,000		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	1050	$ 157,500	Assumes 150' of new wall, paralleling parking lot wall	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	640	$ 112,000		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	320	$ 16,000		consultant
18	STREET LIGHTING	EA	$20,000.00	0	$ -		Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000	One at each end of trail segment.	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -	fence along both sides of at-grade portion between wetlands	ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	0	$ -		local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	2	$ 1,600	unique sign, includes 1 sign at each entry/exit location	double cost of std sign
24	LANDSCAPING	SF	$10.00	3960	$ 39,600	LF of trail impacting wetlands: 110' x 30' for additional wetland Mit.	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	2	$ 10,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	7100	$ 7,100	From PHS Report 9-20-23	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	17500	$ 17,500	From PHS Report 9-20-23, revision to existing reports.	consultant
29	UTILITY RELOCATION	EA	$50,000.00	1	$ 50,000	Manhole adjustment or relocation	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 1,557,882**		
	CONTINGENCY	%	40%		$ 623,153		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 467,365		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 389,471		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 233,682		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 1,713,670**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	8430	$ 2,782	Esmt or ROW between WQ facility and creek.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -		Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 3,274,334**		
			$ / LF		**$ 29,767**		

Trail Type	LF
Off Road	110
Boardwalk	210
On-Road	0
Bridge	0

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: D4

Description:
Trail grading occurred through RRC Stabilization and Enhancement project. Includes two, at-grade street crossings. Assumes undercrossing improvements at SW 72nd Ave.

On-Grade Length (ft)	1260
Structure Length (ft)	0
Total Length (ft)	1260

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 291,072		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.58	$ 23,140		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.58	$ 57,851	Minor Trees for a portion of trail	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	0	$ -	Already graded	ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	0	$ -	Already graded	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	315	$ 15,750	25' drain crossing every 100' of trail, Retrofit of parking lot SD	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	0	$ -		Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	11520	$ 69,120	12' of AC pavement trail, Repave/resurface ex pavement	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	3840	$ 23,040	2' shoulder each side of off road trail	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	4	$ 60,000	2 ramps at 74th/private commercial crossing, 2 at SW 72nd Ave	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	2	$ 20,000	Two crossings	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	1600	$ 680,000	80'x20' bridge/undercrossing at 72nd	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	0	$ -		Washington County
16	PEDESTRIAN RAILING	LF	$175.00	0	$ -		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	960	$ 48,000		consultant
18	STREET LIGHTING	EA	$20,000.00	4	$ 80,000	One light at 74th/private crossing, 3 at SW 72nd Ave	Washington County
19	BOLLARDS	EA	$1,000.00	4	$ 4,000	Atlanta, 74th/private crossing, 72nd Ave	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	1260	$ 50,400	Fencing separating walkway from stream corridor	local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	2	$ 1,600	unique sign, includes 1 sign at each entry/exit location	double cost of std sign
24	LANDSCAPING	SF	$10.00	25860	$ 258,600	LF of trail impact to wetlands: 610' x 30' add'l wetland mit.	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	6	$ 30,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	0	$ -	Impacts included in Stream Stabilization and Enhcm't project	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	0	$ -	Impacts included in Stream Stabilization and Enhcm't project	consultant
29	UTILITY RELOCATION	EA	$50,000.00	1	$ 50,000		Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 1,769,574**		
	CONTINGENCY	%	40%		$ 707,830		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 530,872		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 442,393		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 265,436		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 1,946,531**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	20800	$ 119,600	McD,TriMet, PacTrust properties north of creek	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	0	$ -	Esmt acquired with RRC bank Stabilz'n & Enhancm't project, 2023	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -		Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 3,835,705**		
			$ / LF		**$ 3,044**		

Trail Type	LF
Off Road	960
Boardwalk	0
On-Road	300
Bridge	0

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: E1

Description:
Trail though undeveloped property along north side of creek. Retaining walls where trail cuts into slope. Includes at-grade crossing at SW 68th Pkwy.

On-Grade Length (ft)	1275
Structure Length (ft)	0
Total Length (ft)	1275

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 263,493		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	1.00	$ 40,000		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	1.00	$ 100,000		consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	0	$ -		ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	1825	$ 118,625	Combo of Cut and Fill for section	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	319	$ 15,938	25' drain crossing every 100' of trail, Retrofit of parking lot SD	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	0	$ -		Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	15300	$ 91,800	12' of AC pavement trail	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	5100	$ 30,600	2' shoulder each side of off road trail	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	2	$ 30,000	2 at SW 68th Pkwy crossing	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	1	$ 10,000	One crossing at 68th	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -	Bridge cost by structural as LS/EA, No bridge this segment	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	1624	$ 243,600	Assuming 4' wall	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	0	$ -		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	1275	$ 63,750		consultant
18	STREET LIGHTING	EA	$20,000.00	0	$ -		Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000	At street grade, no SW. Bollards to keep veh off trail	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	1275	$ 51,000	Fencing separating trail from stream corridor	local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	4	$ 3,200		double cost of std sign
24	LANDSCAPING	SF	$10.00	37650	$ 376,500	incl extra for adjacent mitigation	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	5	$ 25,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	33450	$ 33,450	LF of trail impacting wetlands: 1000' x 30 add'l for wetland mit.	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	25000	$ 25,000	From PHS Report 9-20-23	consultant
29	UTILITY RELOCATION	EA	$50,000.00	1	$ 50,000	potential MH in trail ROW	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 1,580,955**		
	CONTINGENCY	%	40%		$ 632,382		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 474,287		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 395,239		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 237,143		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 1,739,051**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	20670	$ 118,853	Easements on OEA property. Extg esmt on Extra Storage property.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	6460	$ 2,132	North side of creek through vegetated corridor.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -		Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 3,440,990**		
			$ / LF		**$ 2,699**		

Trail Type	LF
Off Road	1275
Boardwalk	0
On-Road	0
Bridge	0

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: F1

Description:
Trail through property along south side of creek, crosses creek with bridge, traverses uphill to PGE property. Fencing to separate trail from vegetated corridor. Trail terminates at base of PGE driveway.

On-Grade Length (ft)	1172
Structure Length (ft)	50
Total Length (ft)	1222

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 185,279		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	0.54	$ 21,524		Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	0.54	$ 53,811	Minor Trees for a portion of trail	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	0	$ -		ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	2400	$ 156,000	Combo of Cut and Fill for section	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	293	$ 14,650	25' drain crossing every 100' of trail, Retrofit of parking lot SD	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	0	$ -		Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	14064	$ 84,384	12' of AC pavement trail	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	4688	$ 28,128	2' shoulder each side of off road trail	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	0	$ -	2 at 68th	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	0	$ -	One crossing at 68th	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	600	$ 255,000	Bridge cost by structural as LS/EA, No bridge this segment	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	0	$ -	Assuming 4' wall	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	0	$ -		Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	1172	$ 58,600		consultant
18	STREET LIGHTING	EA	$20,000.00	0	$ -		Washington County
19	BOLLARDS	EA	$1,000.00	2	$ 2,000	At street grade connections.	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	1172	$ 46,880	Fence separating trail from vegetated corridor	local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	4	$ 3,200	unique sign, includes 1 sign at each entry/exit location Extra through	double cost of std sign
24	LANDSCAPING	SF	$10.00	13332	$ 133,320	LF of trail impacting wetlands: 210' x 30' add'l for wetland mit.	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	6	$ 30,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	8900	$ 8,900	From PHS Report 9-20-23	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	23000	$ 23,000	From PHS Report 9-20-23	consultant
29	UTILITY RELOCATION	EA	$50,000.00	0	$ -		Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 1,111,677**		
	CONTINGENCY	%	40%		$ 444,671		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 333,503		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 277,919		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 166,751		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 1,222,844**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	29890	$ 171,868	Acquisition on Comcast property, dental biz, PGE property.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	5228	$ 1,725	ROW along Vet Clinic, in vegetated corridor.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -		Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 2,508,114**		
			$ / LF		**$ 2,140**		

Trail Type	LF
Off Road	1172
Boardwalk	0
On-Road	0
Bridge	50

Red Rock Creek Trail Alignment Study
OPINION OF PROBABLE CONSTRUCTION COST

SEGMENT: F3

Description:
Trail traverses uphill along I-5 freeway. Retaining walls where trail cuts into slope. Coincides at base of SW 64th Ave before traversing open space along I-5 SB on-ramp to Hwy 99. Safety barrier for separation.

On-Grade Length (ft)	1651
Structure Length (ft)	0
Total Length (ft)	1651

ITEM	CONSTRUCTION ITEM	UNIT	UNIT COST	Quantity	Total	Estimator Notes	Cost reference
1	MOBILIZATION, SURVEY, EROSION CONTROL	%	20%	1	$ 408,302		10% mob, 10%: surv+TCP+ERC
2	CLEARING & GRUBBING	AC	$40,000.00	1.00	$ 40,000	Dense vegetation.	Fanno Ck Trail study, bid tabs
3	TREE REMOVAL	AC	$100,000.00	1.00	$ 100,000	Heavily treed area.	consultant
4	REMOVAL OF STRUCTURES & OBSTRUCTIONS	SY	$150.00	0	$ -		ODOT 2022 bid item prices
5	EXCAVATION/EMBANKMENT	CY	$65.00	2400	$ 156,000	Combo of Cut and Fill for section F	ODOT 2022 bid item prices
6	DRAINAGE PIPE	LF	$50.00	413	$ 20,638	25' drain crossing every 100' of trail, Retrofit of parking lot SD	Washington County
7	TRAIL SURFACING (CONCRETE)	SF	$16.00	7272	$ 116,352		Fanno Ck Trail study, bid tabs
8	TRAIL SURFACING (ASPHALT)	SF	$6.00	19812	$ 118,872	12' of AC pavement trail	Fanno Creek Trail study
9	GRAVEL SHOULDERS	SF	$6.00	6604	$ 39,624	2' shoulder each side of off road trail	ODOT 2022 bid item prices
10	ACCESSIBLE RAMPS	EA	$15,000.00	2	$ 30,000	Ramp at SW 64th Ave. Revise ramp at Hwy 99W	Washington County
11	ROAD CROSSING - SIGNALIZED	EA	$40,000.00	0	$ -		ODOT 2022 bid item prices
12	ROAD CROSSING - SIGN & STRIPE	EA	$10,000.00	1	$ 10,000	One crossing at SW 64th Ave	Astoria bid tabs
13	BRIDGE STRUCTURE	SF	$425.00	0	$ -	Bridge cost by structural as LS/EA.	consultant
14	BOARDWALK STRUCTURE	SF	$300.00	0	$ -		Fanno Creek Trail study
15	RETAINING WALL	SF	$150.00	5815	$ 872,250	See wall Estimate in spreadsheet tab	Washington County
16	PEDESTRIAN RAILING	LF	$175.00	955	$ 167,125	Railing for raised walkway	Washington Co, ODOT 2022
17	TRAIL LIGHTING	LF	$50.00	1651	$ 82,550		consultant
18	STREET LIGHTING	EA	$20,000.00	1	$ 20,000	Light at end of SW 64th Ave	Washington County
19	BOLLARDS	EA	$1,000.00	4	$ 4,000	At street grade connections.	Washington County
20	CHAINLINK FENCING	LF	$80.00	0	$ -		ODOT 2022 bid item prices
21	SPLIT RAIL FENCING	LF	$40.00	606	$ 24,240	Fencing separating walkway from stream corridor	local price review
22	REGULATORY & WARNING SIGNAGE	EA	$400.00	0	$ -		ODOT, Tillamook
23	WAYFINDING SIGNAGE	EA	$800.00	1	$ 800	unique sign, includes 1 sign at each entry/exit location Extra through	double cost of std sign
24	LANDSCAPING	SF	$10.00	9906	$ 99,060	3' of Landscaping on each side of trail	Tualatin bid tabs
25	OUTFALL RESTORATION	EA	$5,000.00	2	$ 10,000		consultant
26	PHASE 1 HAZMAT STUDY	EA	$7,000.00	1	$ 7,000		consultant
27	MITIGATION (WETLANDS+ENHANCEMENT)	LS	$1.00	0	$ -	no wetland or areas to enhance	consultant
28	ENVIRONMENTAL PERMITTING	LS	$1.00	23000	$ 23,000	From PHS Report 9-20-23	consultant
29	UTILITY RELOCATION	LS	$50,000.00	2	$ 100,000	Assumes one manhole adjustment or relocation, safety barrier	Fanno Ck Trail Study
	Subtotal of Construction Cost				**$ 2,449,813**		
	CONTINGENCY	%	40%		$ 979,925		Canemah Trail, Fanno Creek Trail
	ENGINEERING & DESIGN	%	30%		$ 734,944		Canemah Trail, Fanno Creek Trail
	CONSTRUCTION ENGINEERING, INSPECTION	%	25%		$ 612,453		Canemah Trail
	PROJECT ADMINISTRATION	%	15%		$ 367,472		Canemah Trail, consultant
	Subtotal of Contingencies				**$ 2,694,794**		
	EASEMENT ACQUISITION - COMMERCIAL USE (greenway use)	SF	$5.75	0	$ -		Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (sensitive lands)	SF	$0.33	3760	$ 1,241	Small acq'n near PGE property. No cost for ODOT and PBOT ROW.	Commonstreet: RRCSEP, 2023
	ROW ACQUISITION - COMMERCIAL USE (unlimited use)	SF	$23.00	0	$ -		Commonstreet: RRCSEP, 2023
	TOTAL		**$**		**$ 5,145,847**		
			$ / LF		**$ 3,117**		

Trail Type	LF
Off Road	1651
Boardwalk	
On-Road	606
Bridge	0

Appendix H: Letters of Support, Acknowledgement

March 4, 2024

Gary Pagenstecher, City of Tigard
13125 SW Hall Blvd.
Tigard, OR 97223

Re: Red Rock Creek Trail Preferred Alignment Acknowledgement

Dear Gary Pagenstecher:

On behalf of TriMet, we are offering support to the City of Tigard's Red Rock Creek Trail Project and appreciate the efforts that have gone towards the selection of the Preferred Alignment.

TriMet supports the City's strategic vision of an accessible and desirable pedestrian network and its expansion along the Red Rock Creek greenway through the Tigard Triangle to the Fanno Creek Regional Trail's connection by the Tigard Public Library. The City is planning a multi-use path that will provide a much-needed active transportation corridor for a safe place to walk and bike and allow residents to experience nature. The proposed two-mile-long Red Rock Creek Trail (RRCT) will provide an off-street active transportation alternative in Tigard's rapidly urbanizing Metro-designated Town Center area and overcome significant highway and railroad barriers to connectivity.

TriMet provides bus, light rail and commuter rail service in the Portland, Oregon, region. TriMet's mission is to connect people with valued mobility options that are safe, convenient, reliable, accessible, and welcoming for all. The RRCT will further complement both existing and planned transit by providing a safe, active transportation connection for transit riders. As a member of the Stakeholder Working Group during the Alignment Study in 2024, TriMet participated in several meetings, field visits, public events and one-on-one interviews. We contributed to the consensus building and feel our input helped shape the preferred alignment location. Additionally, TriMet acknowledges that changes will be made as the trail advances through final design, and that continued coordination regarding existing and future transit investments will be needed in order to maximize connections between the RRCT and transit.

We look forward to partnering on implementation of the Red Rock Creek Trail, as it enhances active transportation options while contributing to the preservation and enhancement of the natural environment in Tigard.

Sincerely,

Fiona Lyon
TriMet, Transit-Oriented Development Design Manager

February 22, 2024
Megan Garvey
The Wetland Conservancy
2540 NE Martin Luther King Jr. Blvd.
Portland, OR 97212

Re: Red Rock Creek Trail Preferred Alignment Acknowledgement

Dear Gary Pagenstecher:

On behalf of The Wetland Conservancy, we are offering support to the City of Tigard's Red Rock Creek Trail Project and appreciate the efforts that have gone towards the selection of the Preferred Alignment.

The Wetland Conservancy supports the City's strategic vision of an accessible and desirable pedestrian network and its expansion along the Red Rock Creek greenway through the Tigard Triangle to the Fanno Creek Regional Trail's connection by the Tigard Public Library. The City is developing a multi-use path that will provide a much-needed active transportation corridor for a safe place to walk and bike and allow residents to experience nature. The proposed two-mile-long Red Rock Creek Trail (RRCT) will provide an off-street active transportation alternative in Tigard's rapidly urbanizing Metro-designated Town Center area and overcome significant highway and railroad barriers to connectivity for people.

The Wetland Conservancy conserves and manages wetlands which are incredibly important ecosystems that provide a wide range of ecological, economic, and social benefits. The Wetland Conservancy's mission is to ensure protection of these vital habitats for the health and well-being of both wildlife and humans. There are wetlands within the Red Rock Creek basin that are owned and managed by The Wetland Conservancy. As a member of the Stakeholder Working Group during the Red Rock Creek Trail Alignment Study in 2024, The Wetland Conservancy participated in several meetings, public events and one-on-one interviews. We provided data regarding our stewardship area and the recommendations should the construction of RRCT impact areas under The Wetland Conservancy management. We contributed to the consensus building and feel our input shaped the preferred alignment location. Additionally, The Wetland Conservancy acknowledges that changes may be made as the trail advances through final design, and mitigation opportunities will evolve. We hope to be included in changes that may affect our sensitive wetlands as this process continues.

We look forward to partnering on implementation of the Red Rock Creek Trail, as it provides active transportation options while potentially contributing to the preservation and enhancement of the natural environment in Tigard.
Sincerely,

Megan Garvey, Stewardship Director
The Wetlands Conservancy

COMMUNITY PARTNERS FOR AFFORDABLE HOUSING
P.O. Box 23206 * Tigard, OR 97281-3206 * cpahoregon.org
Tel: 503.293.4038 * Fax: 503.293.4039 * TTY/VCO: 800.735.2900

February 26, 2024

Gary Pagenstecher
City of Tigard, Community Development

Re: Red Rock Creek Trail Preferred Alignment Acknowledgement

Dear Gary Pagenstecher:

On behalf of Community Partners for Affordable Housing (CPAH), we are offering support to the City of Tigard's Red Rock Creek Trail Project and appreciate the efforts that have gone towards the selection of the Preferred Alignment.

CPAH supports the City's strategic vision of an accessible and desirable pedestrian network and its expansion along the Red Rock Creek greenway through the Tigard Triangle to the Fanno Creek Regional Trail's connection by the Tigard Public Library.

The City is developing a multi-use path that will provide a much-needed active transportation corridor for a safe place to walk and bike and allow residents to experience nature. The proposed two-mile-long Red Rock Creek Trail (RRCT) will provide an off-street active transportation alternative in Tigard's rapidly urbanizing Metro-designated Town Center area and overcome significant highway and railroad barriers to connectivity.

CPAH is dedicated to addressing the shortage of affordable housing options for low- to moderate-income individuals and families. As a member of the Stakeholder Working Group during the Alignment Study in 2024, CPAH participated in several meetings, public events and one-on-one interviews. We contributed to the consensus building and feel our input shaped the preferred alignment location. Additionally, CPAH acknowledges that this multi-use path will enhance the quality of life for the residents who reside at Red Rock Creek Commons and will foster a sense of community and belonging.

We look forward to partnering on implementation of the Red Rock Creek Trail, as it provides active transportation options while contributing to the preservation and enhancement of the natural environment in Tigard.

Sincerely,

Rachael Duke

Rachael Duke
Executive Director