Point Defiance Bypass Project

Point Defiance Greenfield Alternative Technical Memorandum

May 2011

Washington State
Department of Transportation

Executive Summary

Purpose of the Technical Memorandum

The intent of a technical memorandum is to capture the reasons why an alternative should or should not be carried forward for analysis in a project's environmental documentation.

The purpose of this technical memorandum is to:

- Evaluate the Greenfield Alternative's practicality and feasibility from a technical, economic, and environmental standpoint under the Federal Railroad Administration's (FRA) National Environmental Policy Act (NEPA) regulations;
- Determine whether the Greenfield Alternative will be carried forward for further evaluation in the Point Defiance Bypass Project (the project) Environmental Assessment

WSDOT staff, consisting of a multi-discipline team assigned to the delivering the project, has attempted to provide the required level of analysis to achieve an impartial review. The projected or predicted impacts of this alternative have been measured against the baseline (the existing facility and surroundings, assuming the project is not built). This technical memorandum summarizes WSDOT's review.

Point Defiance Bypass: Purpose and Need

The purpose of the project is to provide more frequent and reliable high-speed intercity passenger rail service between Tacoma and Nisqually. This proposed work addresses a number of deficiencies in the existing rail alignment around Point Defiance. The project needs are to enhance rail service frequency, reliability, efficiency and safety. The existing alignment, shared with freight rail traffic, is near capacity and is unable to accommodate additional high-speed intercity passenger rail service without substantial improvements. In addition, the existing alignment has physical and operational constraints adversely affecting both passenger and freight train scheduling and reliability.

Project Alternatives

The project team, along with members of the Point Defiance Bypass Technical Advisory Group, developed six variations of the Greenfield Alternative for analysis. The team evaluated each alternative by assessing the degree to which the route met the project purpose and need and by looking at the technical, environmental and socio-economic impacts.

The majority of the alternatives examined a combination of building new alignments and connecting to existing routes. Alternatives also proposed building a tunnel under the Point Defiance Bypass route, as well as placing the alignment in the I-5 median. Below is a summary of the cost ranges between the alternatives.

	Fredrickson	Lakewood South	Tacoma Tunnel	Rainier	Spanaway
Construction Cost	$296M - $988M	$238M - $792M	$2.4B - $7.9B	$205M - $682M	$361M - $1.2B

Two alternatives met the project Purpose and Need, but resulted in significant technical, economic, and/or environmental barriers, including considerable right of way acquisitions, tight space constraints, wetland impacts and cost concerns.

Impacts to Protected Lands

In areas containing wetlands rated as a Category I *(i.e., highest-functioning wetlands)*, mitigation costs could reach into the millions, with permits from multiple tribal and governmental jurisdictions likely taking a year or longer to acquire.

One alternative in particular was located within the Central Pierce County sole source aquifer[1] and the Pierce County critical aquifer recharge area.[2] The recharge area is in close proximity to wellhead protection areas.[3] If a project violates state or federal drinking water regulations, it cannot receive any federal funds.

A number of the alternatives potentially impacted several publicly owned parks, prehistoric and historic archaeological sites/resources eligible for the National Register of Historic Places. These resources are protected under Section 4(f), 49 U.S.C. 303, of the Department of Transportation Act. Section 4(f) resources cannot be impacted if a feasible and prudent alternative exists that would avoid Section 4(f) resources.

Recommendation

Staff's recommendation is that the Greenfield Alternative be **eliminated** from further consideration.

WSDOT staff considers this alternative both impractical and unfeasible from a technical, economic, and environmental standpoint, and will describe it as such in the project Environmental Assessment (EA). Because of the Greenfield Alternative's technical and environmental constraints and high cost, WSDOT does not intend to study this alternative in detail within the project's EA, unless new information becomes available that would change these findings.

The Greenfield Alternative has more potentially significant impacts than the Bypass Alternative, while the Bypass Alternative has fewer potentially significant impacts, and

[1] Designated by the US Environmental Protection Agency
[2] Designated by a city or county under the Growth Management Act
[3] Group A systems (Washington State Department of Health) serving 15 or more residential connections, or 25 or more people per day for 60 days or more per year

better fulfills the project's purpose and need. Project characteristics evaluated under the *Engineering and Feasibility* and *Environmental Impacts* sections of this technical memorandum present the reasons for recommending the elimination of this alternative.

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Introduction

Purpose of the Technical Memorandum

The intent of a technical memorandum is to capture the reasons why an alternative should or should not be carried forward for analysis in a project's environmental documentation.

The Federal Railroad Administration's (FRA) National Environmental Policy Act (NEPA) regulations state that the process of considering environmental impacts "should begin by identifying all reasonable alternatives to the proposed action, including 'no action' and including mitigation measures not incorporated into the design of the proposed action."

The Council on Environmental Quality describes "reasonable" alternatives as those that are practical or feasible from the technical or economic standpoint and use common sense rather than simply desirable from the standpoint of the applicant.[4]

NEPA regulations go on to state "It is entirely proper that the number of alternatives being considered should decrease as the environmental consideration process proceeds and as analysis reveals that certain alternatives would in fact be unreasonable." For alternatives eliminated from further study, a project's environmental documentation must "briefly discuss the reasons for their having been eliminated"[5]. Accordingly, this technical memorandum will be appended to the Point Defiance Bypass Project's Environmental Assessment (EA) and become a part of the permanent project record.

The purpose of this technical memorandum is to:

- Evaluate the Greenfield Alternative's practicality and feasibility from a technical, economic, and environmental standpoint
- Determine whether the Greenfield Alternative will be carried forward for further evaluation in the project EA

WSDOT staff, consisting of a multi-discipline team assigned to deliver this project, has attempted to provide the required level of analysis to achieve an impartial review. The projected or predicted impacts of this alternative have been measured against the baseline (the existing facility and surroundings, assuming the project is not built). The following information summarizes this review.

[4] Forty Most Asked Questions Concerning CEQ's NEPA Regulations
[5] Council on Environmental Quality Regulations, Sec. 1502.14(a)

Point Defiance Bypass: Purpose and Need

The purpose of the project is to provide more frequent and reliable high-speed intercity passenger rail service between Tacoma and Nisqually. This project addresses the deficiencies in the existing rail alignment around Point Defiance. The project needs are to enhance rail service frequency, reliability, efficiency and safety. The existing alignment, shared by freight and passenger rail traffic is near capacity and is therefore unable to accommodate additional high-speed intercity passenger rail service without substantial improvements. In addition, the existing alignment has physical and operational constraints adversely affecting both passenger and freight train scheduling and reliability. See the *Shoreline Technical Memo* for an analysis of the technical and economic feasibility of improving the existing alignment.

Specific elements of the project needs include:

- Enhanced frequency: Increase Amtrak *Cascades* round-trips from four to six by 2017 in order to meet projected service demands.
- Enhanced efficiency: Enhance the efficient movement of people by reducing the amount of time passenger and freight trains spend yielding to other freight movements.
- Improved reliability: Reduce or eliminate passenger rail service interruptions caused by natural factors (e.g., landslides) or operational limitations (e.g., drawbridge closures).
- Improved safety: Construct at-grade crossings with improved safety features including wayside horns, median barriers, advanced warning signals, and traffic signal improvements.

Description of Greenfield Alternative

During the project's October 2010 Technical Advisory Group (TAG) meeting, the TAG brainstormed a rough alignment (the Greenfield Alternative). The Technical Advisory Group member jurisdictions consist of the City of Tacoma, City of Lakewood, City of Dupont, Pierce County, Joint Base Lewis-McChord, Clover Park School District, Washington National Guard – Camp Murray, Sound Transit, and WSDOT. Based on suggestions by TAG members following the meeting and additional research, WSDOT staff developed several variations of the rough alignment for analysis. The following six routes were analyzed as part of the Greenfield Alternative. See Appendix B for the location of the routes.

<u>Greenfield Alternative - Lakewood South Route</u>

The Greenfield Alternative – Lakewood South route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then

turns north and follows the existing BNSF route to Lakewood and continues on the baseline route to the Freighthouse Square vicinity.

The length of the improved route is approximately 29 miles with 10 miles of track on a new alignment, 10 miles of reconstruction of the existing alignment, and 9 miles on the baseline route. The overall route would be single track with a four mile-long segment of double track required between Roy and Lakewood. The 10 miles of reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Two existing curves slightly over two degrees totally about 0.4 mile would need to be realigned to two degrees or less. Two public at-grade crossings between Roy and Lakewood would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilt track, centralized traffic control, grade crossings, new Nisqually River Valley bridge, and other miscellaneous items.

This alternative would require a number of right-of-way acquisitions and residential relocations.

The estimated cost of this alternative ranges from $238 million to $792 million and is included in the Appendix A.

Greenfield Alternative - Spanaway Route

The Greenfield Alternative – Spanaway route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns northeast and follows the existing Tacoma Rail Mountain Division route to just south of the junction of State Highway 507 and State Highway 7. The alignment then travels north on a new alignment through the Spanaway/Brookdale area to a point where the Tacoma Rail Mountain Division line passes over State Highway 512 where it rejoins the existing rail line to the Freighthouse Square vicinity.

The length of the improved route is approximately 30 miles with 19 miles of track on a new alignment and 11 miles of reconstructed existing alignment. The overall route would be single track with a four mile-long segment of double track required somewhere in the vicinity of the new segment through the Spanaway/Brookdale area. The 11 miles of reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Ten existing curves, as sharp as six degrees, and totaling about 1.7 miles would need to be realigned to two degrees or less. Twenty-four (24) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilt track, centralized traffic control, upgraded existing grade crossings, new Nisqually River Valley bridge, and other miscellaneous items.

This alternative would require a number of right-of-way acquisitions, residential relocations, and commercial relocations.

The estimated cost of this alternative ranges from $361 million to $1.2 billion and is included in the Appendix A.

Greenfield Alternative - Fredrickson Route

The Greenfield Alternative – Fredrickson route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns northeast and follows the existing Tacoma Rail Mountain Division route over State Highway 507 and on to Fredrickson. The existing alignment then turns and follows the existing Tacoma Rail Mountain Division route north – northwest to the Freighthouse Square vicinity.

The length of the improved route is approximately 32.5 miles with 10.5 miles of track on a new alignment and 22 miles of reconstructed existing alignment. The overall route would be single track with a four mile-long segment of double track required somewhere between Fredrickson and State Highway 512. The 10.5 miles of reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Fifteen (15) existing curves, as sharp as six degrees, totaling about 2.9 miles would need to be realigned to two degrees or less. Thirty-three (33) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilt track, centralized traffic control, upgraded existing grade crossings, new Nisqually River Valley bridge, and other miscellaneous items.

This alternative would require a number of right-of-way acquisitions and residential relocations.

The estimated cost of this alternative ranges from $296 million to $988 million and is included in the Appendix A.

Greenfield Alternative - Rainier Route

The Greenfield Alternative – Rainier route would reconstruct an existing route. This alternative leaves the BNSF main near Offutt Lake (south of Olympia/Lacey station), which is not consistent with Amtrak's service objectives for the rail corridor. This alternative then follows the existing Tacoma Rail Mountain Division route through Rainier, McKenna, and Roy paralleling State Highway 507, then crossing over State Highway 507, and on to Fredrickson. The existing alignment then turns and follows the existing Tacoma Rail Mountain Division route north – northwest to the Freighthouse Square vicinity.

The length of the improved route is approximately 44 miles. The overall route would be single track with a four mile-long segment of double track required somewhere between Fredrickson and State Highway 512 and another four mile-long segment between Rainier and Yelm. The reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Fifteen (15) existing curves, as sharp as six degrees, and totaling about 2.9 miles would need to be realigned to two degrees or less. Forty-six (46) public at-grade crossings would be upgraded with new flashing lights and gates.

This route travels south of Centennial Station in Olympia/Lacey, and would therefore require the relocation of this station, possibly to the towns of Rainier or McKenna. The effects and costs of this station relocation not analyzed in this option.

Included with the improvements would be new track, rebuilt track, centralized traffic control, updated existing grade crossings, and other miscellaneous items.

The estimated cost of this alternative ranges from $205 million to $682 million and is included in the Appendix A.

Greenfield Alternative – Lakewood to Tacoma Tunnel Route

The Greenfield Alternative – Lakewood to Tacoma tunnel route would construct a new alignment through a new tunnel and reconstruct an existing route. This alternative follows the Pt. Defiance bypass route from Nisqually to Lakewood, then leaves the BNSF main near Lakewood, travels northeast on a new alignment through a 39' diameter, four-mile-long tunnel to north of Midland, then turns north and follows the existing Tacoma Rail Mountain Division route north – northwest to the Freighthouse Square vicinity.

The length of the improved route is approximately 20 miles with 4.1 miles of track on a new alignment and 15.9 miles of reconstruction of the existing alignment. The overall route would be single track with a four mile-long segment of double track required through the tunnel. The reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Ten existing curves, as sharp as 6 degrees, and totaling about 1.7 miles would need to be realigned to two degrees or less. Twenty-four (24) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilt track, centralized traffic control, upgraded existing grade crossings, new tunnel, and other miscellaneous items.

This alternative would require right-of-way acquisitions, residential relocations, and commercial relocations.

The estimated cost of this alternative ranges from $2.4 billion to $7.9 billion and is included in the Appendix A.

I-5 Median Route

The I-5 median route would construct a new alignment in the median of I-5 between Tacoma and Nisqually. The route would be approximately 18 miles. The existing median width varies between 13 feet and 300 feet, with the majority of the spaces varying between 20 feet to 40 feet. There is a two mile section in the vicinity of the I-5/41st Division Dr. S. interchange that is approximately 60 feet wide. There is also a 2.5 mile section at the most southern end of the route that varies between 55 feet and 300 feet. An approximate 60 foot median would be required to construct the new alignment at grade. Due to the limited amount of space within the median, this alternative was not analyzed beyond an evaluation of the existing median widths.

Relationship between Point Defiance Bypass Route and Greenfield Alternatives

The Point Defiance bypass route is located inland in Pierce County, and extends roughly 28 miles from the Freighthouse Square vicinity in Tacoma, through Lakewood and to Centennial Station in Olympia/Lacey, where it connects with the BNSF main line (see Figure 1). See Appendix A for a comparison of the Greenfield Alternative routes and the Point Defiance Bypass route. Below is a summary of major differences between the bypass route and Greenfield Alternatives:

1) The bypass route from Freighthouse Square to Centralia Station is approximately 49.8 miles. The Point Defiance bypass route will decrease travel time when compared to the baseline (the baseline is the time it takes for the Amtrak Cascades to travel between Nisqually Junction and the Tacoma station using the current BNSF mainline along the shoreline (the "Shoreline Route")) . The length and travel impact of the Greenfield Alternative routes between Freighthouse Square and Centennial Station are as follows:
    a. Lakewood South Route – approximately 55.1 miles (5.3 miles longer than the bypass route) - decreases travel time when compared to the current route
    b. Spanaway Route – approximately 56.1 miles (6.3 miles longer than the bypass route) - decreases travel time when compared to the current route
    c. Fredrickson Route – approximately 58.6 miles (8.8 miles longer than the bypass route) - increases travel time when compared to the current route (does not meet purpose and need)
    d. Rainier Route – approximately 58.3 miles (8.5 miles longer than the bypass route) - increases travel time when compared to the current route (does not meet purpose and need)
    e. Lakewood to Tacoma Tunnel Route – approximately 49.7 miles (0.1 miles shorter than the bypass route) - decreases travel time when compared to the current route
2) With the exception of the Rainier Route, the Greenfield Alternative creates new alignments and the impacts associated with pioneering those new alignments. The bypass route upgrades an existing line for passenger train use.

3) With the exception of the Rainier Route, the Greenfield Alternative requires purchasing a significant amount of right of way (between 12-200 acres). Because the bypass route utilizes an existing 100-year-old rail corridor, the general right-of-way already exists.

As the Route Locations map makes clear, many different design variations could be analyzed. The cumulative impacts of pioneering any new alignment through partially undisturbed lands and through heavily developed lands cannot be avoided and will be costly to mitigate (assuming mitigation is feasible). A new route could adversely affect resources protected under Section 4(f) to a much greater magnitude than other reasonable and prudent alternatives.

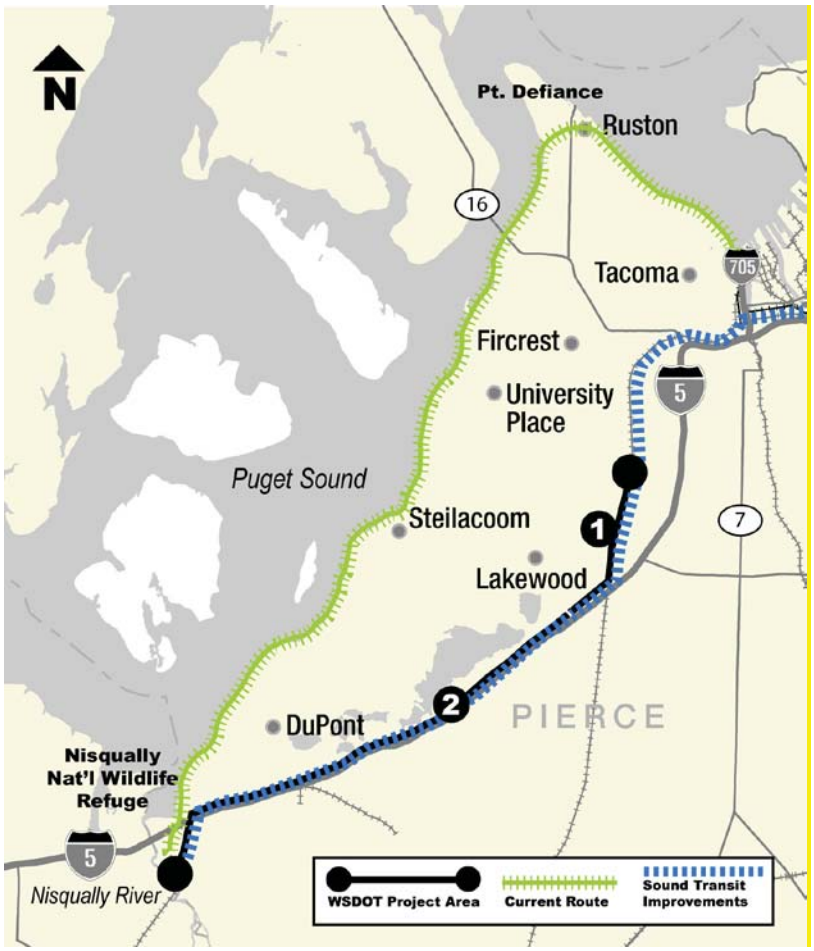

Figure 1

Engineering and Feasibility

The Greenfield Alternative concept was considered for the following reasons: 1) efficiency and 2) frequency.

Efficiency

Three of the six Greenfield Alternative routes (Lakewood South, Spanaway and Lakewood to Tacoma tunnel) analyzed would result in a schedule (travel time) reduction when compared to the baseline, while two of the six Greenfield Alternative routes (the Fredrickson and the Rainier routes) would result in a schedule increase. With the new alignment, re-construction of the existing track, and realignment of the curves associated with the Lakewood South, Spanaway, and Lakewood to Tacoma tunnel routes, the alignment would be able to accommodate 79 mph passenger train speeds.

Frequency

Construction of any of the Greenfield Alternative routes would accommodate two additional daily Amtrak *Cascades* round-trips.

Geometrics

For this conceptual estimate, the ground was assumed to be fairly flat. Therefore, it was assumed that the embankment and/or excavation required would be minimal. The required footprint for each route was assumed to be 50 feet each side of the track centerline along the entire route.

Structures

The Lakewood South, Spanaway and Fredrickson routes would require a new structure across the Nisqually River Valley. The structure would be approximately 1 mile-long and 50 feet wide.

The Lakewood to Tacoma tunnel route would require a four mile tunnel, approximately 39 feet in diameter. The tunnel would be a two-track tunnel with walkways on each side. Boring a new tunnel of this size underneath a neighborhood presents many risks. Some of the potential risks include the suitability of the soil, the condition of the structures and buildings above the proposed tunnel alignment, acquiring the needed right of way and substantial cost. These are only a small portion of the risks included with this alternative.

Right Of Way

Four of the Greenfield Alternative routes – Lakewood South, Spanaway, Fredrickson, and Lakewood to Tacoma Tunnel require right of way purchases. The acreage required is as follows:

- Lakewood South Route – approximately 118 acres including 15 acres of residential area, Nisqually Indian Reservation land, and Joint Base Lewis McChord (JBLM) property. The new alignment between the Olympia/Lacey Station and Roy is near an impact zone on JBLM.
- Spanaway Route – approximately 217 acres including 88 acres of densely populated residential area, Nisqually Indian Reservation land, and JBLM

property. The new alignment between the Olympia/Lacey Station and Roy is near an impact zone on the JBLM.

- Fredrickson Route – approximately 118 acres including 15 acres of residential area, Nisqually Indian Reservation land, and JBLM property. The new alignment between the Olympia/Lacey Station and Roy is near an impact zone on the JBLM.
- Lakewood to Tacoma Tunnel Route – requires purchasing approximately 12 acres of densely populated residential and commercial property

As part of the Greenfield Alternative, right of way would be needed from select federal agencies including the JBLM and the Nisqually Indian Tribe, requiring substantial time for compliance with applicable statutes and regulations specific to the agency or the tribe. Depending on the agency or tribe, special documentation may be required and the right of way may be acquired as an easement rather than in fee.

Conclusion

The Lakewood South, Spanaway, and the Lakewood to Tacoma Tunnel Routes are attractive because they result in schedule reductions when compared to the baseline.

The Lakewood South and Spanaway Routes have major disadvantages. Each route's cost is high due to the construction of a new alignment, rebuilding existing alignments, a mile-long bridge, and other various items. The disadvantages also include significant federal, state, and private right of way purchases.

The Lakewood to Tacoma Tunnel Route also has major disadvantages. The cost of this route is high due to the construction of an approximate four mile-long tunnel, rebuilding existing alignments, and other miscellaneous items. Without further analysis, it is unknown at this time whether this alternative would even be feasible due to soil conditions and other factors.

The Fredrickson Route and the Rainier Route are not viable options since they both increase travel times; therefore, not meeting the purpose and need.

The I-5 median route is not a viable option due to the limited median width throughout the majority of the route. A limited median would require the rail line to either be elevated on structures, or submerged in a tunnel, both of which result in substantially increased cost and risk. Due to the limited amount of space, this alternative was not analyzed any further than looking at the existing median widths.

Environmental Impacts

This portion of the technical memorandum describes the Greenfield Alternative's likely impacts to the built and natural environmental.

Resources

Air Quality

The Greenfield Alternative is within an area that must meet national air quality standards for ozone and carbon monoxide, and in proximity to an area that must meet standards for particulates.

During construction, dust particles would be released as a result of construction vehicles, equipment and wind erosion over exposed earth surfaces. Fugitive dust releases fine particles in the air, which is linked to respiratory problems, and generally constitutes the largest source of air quality concerns during construction. Most of the dust particles would settle out immediately adjacent to the construction areas while a small fraction would contribute to dust particle levels in the surrounding area. Air quality impacts caused by construction equipment emissions are short term and occur only when construction activities are taking place. Mitigation measures would be implemented to minimize construction emissions and impacts.

Hazardous Materials

Several hazardous material sites are located within 500 feet of all the Greenfield Alternative routes. Additional studies would be necessary to avoid these sites or to determine if any new sites exist. If any sites were located within an expanded right of way, WSDOT would likely be required to remediate the site(s).

Noise/Vibration

Noise: The Greenfield Alternative routes range in length from approximately 30-44 miles. Noise sensitive receptors within 500 feet of the routes include parks, schools, and homes. All receptor sites located along the proposed routes would be subject to possible noise impacts.

Noise impacts could be reduced by initiating traffic management measures, acquiring land to serve as buffer zones, realigning the rail route, insulating public use or nonprofit institutional structures (not residential or commercial buildings), or constructing noise barriers.

Vibration: The Greenfield Routes pioneer new alignments in some cases, and travel through dense urban areas in others. A *General Vibration Assessment* would be required for the Greenfield routes. If the general assessment determines that there are significant adverse vibration impacts, then a *Detailed Vibration Assessment* would be prepared.

Hydrology/Water Quality

The new alignments of the Fredrickson, Lakewood South, and Spanaway Routes would cross several waterbodies, including the Nisqually River, Muck Creek, and Lacamas Creek. Additionally, the Spanaway Route will cross the North Fork Clover Creek, which is on the Washington State Department of Ecology's 303(d) listed waterbodies for fecal coliform.

The Fredrickson, Lakewood South, and Spanaway Routes would require a new mile-long, 50-foot wide structure to cross the Nisqually River Valley, including the Nisqually River. The quantity of fill material necessary to build the structure is unknown since the details of these routes were not done to the level that they could be quantified. An aerial structure built on footings or pilings would reduce the environmental impacts associated with placing fill material, but would likely cost several times more than a railroad built on embankment.

All six routes are within the Central Pierce County sole source aquifer,[6] the Pierce County critical aquifer recharge area,[7] and are in proximity to wellhead protection areas.[8] WSDOT would need to work with the appropriate entities regarding appropriate protective and mitigation measures. Federal funds may not be expended unless a project is designed to avoid any violation of federal or state drinking water regulations.

It is unknown if the Greenfield Alternative would have a substantial impact on water quality or water resources at this time. Further study would be necessary to determine the extent of these impacts.

Ecosystems

Fish, Wildlife, Vegetation

Property would need to be acquired as right-of-way for the Greenfield Alternative, some of which is developed. Some of this acreage is likely to be wildlife habitat, which would have a direct impact on wildlife.

Route	Total ROW Acres	Residential Acres Sub-Total
Fredrickson	118	15
Lakewood South	118	15
Rainier	0	0
Spanaway	217	88
Tacoma Tunnel	12	12

[6] Designated by the US Environmental Protection Agency
[7] Designated by a city or county under the Growth Management Act
[8] Group A systems (Washington State Department of Health) serving 15 or more residential connections, or 25 or more people per day for 60 days or more per year

The US Fish and Wildlife Service (USFWS) has listed the following species in Pierce County: bull trout (including designated critical habitat), Canada lynx, gray wolf, grizzly bear, marbled murrelet (including designated critical habitat), and northern spotted owl (including designated critical habitat). Additionally, there are eight candidate species, and 26 species of concern. Further study would be necessary to determine the impacts to fish, wildlife, and vegetation.

Endangered Species Act (ESA)

Unavoidable impacts to listed threatened species could occur if the Greenfield Alternative routes are constructed, and a Biological Assessment will be required to determine this alternative's impact on those species and their habitats. The timeframe for formal consultation under Section 7 of the ESA, for larger projects in the Puget Sound area, generally exceeds one year and may take up to two years to complete.

Mitigating for potential impacts to threatened or endangered species' habitat would require the creation or restoration of equivalent habitat near the project. The regulatory requirements and costs of such mitigation would depend on the final alternative alignment and the result of consultation with the regulatory agencies.

Wetlands

The preliminary design information available at the time of this analysis suggests that wetlands may be impacted by the Greenfield Alternative. Further study would be necessary to determine the actual impacts to wetlands. Wetland impacts must be mitigated in accordance with federal, state, and local regulations.

Route	Total Wetlands Impacted	Total Acres Impacted
Fredrickson	19	6.7
Lakewood South	14	5.2
Tacoma Tunnel	3	0.8
Rainier	21	5.9
Spanaway	18	6.6

Wetland impacts would be reduced to the greatest practicable extent by designing and implementing minimization and mitigation measures. However, for unavoidable impacts, the cost to mitigate is highly variable depending on the rating of the impacted wetlands *(Categories I-IV)*, the type of mitigation implemented *(preservation, enhancement, and/or creation)*, and the price of real estate. Construction costs and the cost to subsequently monitor the mitigation site(s) *(up to 10 years or more)* are somewhat more stable, and therefore can be predicted with a higher level of confidence.

Assuming all the wetlands identified during this analysis rated as a Category I *(i.e., highest-functioning wetlands)*, the following two cost scenarios[9] were developed:

1. The *lower cost* scenario, which would require a 3:1 creation/restoration ratio[10] per Class I acre impacted and include a 150-foot buffer.
2. The *higher cost* scenario, which would require a 6:1 creation/restoration ratio[10] per Class I acre impacted and include a 300-foot buffer.

Based on the above requirements, the following acreages and associated costs would be needed for each route:

Route	3:1 Ratio	Cost[11,12,13]	6:1 Ratio	Cost[11,12,13]
Fredrickson	20.1 acres	$5.2M	40.2 acres	$10.3M
Lakewood South	15.6 acres	$4.0M	31.2 acres	$8.0M
Tacoma Tunnel	2.4 acres	$0.6M	4.8 acres	$1.2M
Rainier	17.7 acres	$4.5M	35.4 acres	$9.1M
Spanaway	19.8 acres	$5.1M	39.6 acres	$10.2M

These cost scenarios only address the cost of constructing the wetlands; they do not address the costs of locating and purchasing the real estate for these sites or their buffer acreages.

These estimates would be refined only after accurately identifying wetland boundaries and assessing their functions and values. This would be accomplished by delineating and rating each wetland. It is also possible that additional wetlands could be discovered during the fieldwork, which would increase mitigation costs.

Approvals would be required from the following agencies:

- **US Army Corps of Engineers** – Section 404 of the Clean Water Act, which also includes determining the Least Environmentally Damaging Practicable Alternative (LEDPA); Section 10 of the Rivers and Harbors Appropriation Act
- **WA State Department of Ecology** – Section 401 of the Clean Water Act; Coastal Zone Management Consistency Certification
- **WA State Department of Fish and Wildlife** – Hydraulic Project Approval
- **Local jurisdictions** – Shorelines; Floodplain Development; Critical Area Ordinances

Because of the many jurisdictions involved, acquiring the necessary approvals could take a year or longer.

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[9] Based on 2006 guidance, and input from Geoff Gray, SCR Biologist, on September 9, 2010.
[10] Creation/restoration ratios are determined by the US Army Corps of Engineers if a Section 404 Individual Permit is issued.
[11] A total of $256,784/acre. This total was inflated by 15% from the 2006 guidance of $223,290/acre. The cost has been rounded to the nearest $100,000 for the purposes of this analysis.
[12] This total does not include real estate acquisition costs.
[13] This cost does not include the area required for the buffer.

Human Communities

Socioeconomic/Environmental Justice

The Greenfield Alternative could potentially impact private residences, private businesses, Joint Base Lewis-McChord, and the Nisqually Indian Reservation. The 2009 poverty guideline for a family of four is $22,050; within the study area, the median income is above the poverty guideline.

Route	Average Median Income	Minority Population
Fredrickson	$50,374	30%
Lakewood South	$39,875	36%
Tacoma Tunnel	$46,810	40%
Rainier	$51,510	25%
Spanaway	$51,811	33%

Further study is necessary in order to determine whether minority or low-income populations would be disproportionately affected.

Private residences and businesses would be displaced by the Greenfield Alternative. Any individuals or businesses that would be displaced as a result of implementing this alignment would be provided with relocation assistance under the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 USC 4601).

Recreation/Section 4(f) and Section 6(f)[14]

The Greenfield Alternative as currently designed would impact several publicly owned parks, which are Section 4(f) resources. Impacts could include increased noise levels, displacement and/or change in access.

Section 4(f), 49 U.S.C. 303, of the Department of Transportation Act states that the Federal Railroad Administration will not approve the use of land from a significant publicly owned park, recreation area, or wildlife and waterfowl refuge, or a prehistoric/historic site that is on or eligible for the National Register of Historic Places (NRHP), unless the determination is made:

1) There is no feasible and prudent alternative to the use of land from the property
2) The proposed action includes all possible planning to minimize harm to the property resulting from such use

Supporting information demonstrates that there is a feasible and prudent alternative that would avoid these Section 4(f) resources. Because another alternative exists that does

[14] Property purchased with Land and Water Conservation Act funds

not impact Section 4(f) resources, the Greenfield Alternative should be considered and rejected.

Historic/Cultural

Preliminary research indicates that the Greenfield Alternative could potentially impact the following recorded prehistoric and historic archaeological sites/resources:

- Fredrickson Route: 24 sites
- Lakewood South Route: 25 sites
- Tacoma Tunnel Route: 1 site
- Rainier Route: 19 sites
- Spanaway Route: 25 sites

Some of these sites/resources could be eligible for listing on the NRHP and could trigger a Section 4(f) analysis. Section 4(f) of the Department of Transportation Act requires an analysis to show that there is no prudent and feasible alternative to using such a resource. If there is no prudent and feasible avoidance alternative, then WSDOT must demonstrate that the project includes all possible planning to minimize harm to the Section 4(f) resource. Historic/cultural sites and resources and their potential importance would require extensive study and consultation with agencies with jurisdiction and affected Indian tribes. This consultation could play a major role in developing or modifying this alternative. Excavations for data recovery and historic research would likely be needed for some of these sites/resources.

Section 106 of the National Historic Preservation Act would require any such impact to properties on or eligible for the NRHP to complete a 4(f) Evaluation. This process is discussed in the preceding *Recreation/Section 4(f) and Section 6(f)* sub-section.

Conclusion

Because the Greenfield Alternative would build a new rail alignment, it creates more impacts compared to either improving the Point Defiance Bypass (the proposed action) or the no action alternative. The impacts are as follows:

- Section 4(f) resources such as several publicly owned parks
- Wildlife habitat that supports threatened species
- Private residences, private businesses, a portion of JBLM, and the Nisqually Indian Reservation
- Up to approximately 10.9 acres of wetlands
- Up to 25 cultural/historic resources
- Possible disproportionate adverse effects to minority populations

See Appendix A for a summary of the environmental impacts.

Technical Memo Summary

The Greenfield Alternative includes three routes (Lakewood South Route, Spanaway Route, Lakewood to Tacoma Tunnel Route) that would meet the project purpose and need. Although these routes meet the project's purpose and need, there are many challenges and obstacles including the following:

- Lakewood South Route, Spanaway Route
    - Construction of an approximately one mile-long bridge over the Nisqually River Valley
    - Require upgrading up to 24 at-grade crossings
    - Acquisition of a significant amount of right of way from many different types of owners including residential, commercial, Nisqually Indian Reservation, JBLM, cities, and other federal, state, and private entities
    - The new alignment between the Olympia/Lacey Station and Roy is near the artillery impact zone on JBLM
    - Potential impacts to endangered species
    - Potential significant impacts to socioeconomic resources.
- Lakewood to Tacoma Tunnel Route
    - High cost and associated risks of constructing a four mile-long tunnel
    - Potential impacts to endangered species
    - Potential impacts to socioeconomic resources

Between 0.8 acre (Tacoma tunnel route) and 6.6 acres (Spanaway route) of wetlands may be impacted by the Greenfield Alternative. Assuming that all the wetlands rated as a Category I *(i.e., highest-functioning wetlands)*, the mitigation cost could range from approximately $0.6 million[15] to $10.2 million.[16] Permits from multiple jurisdictions would likely take a year or longer to acquire.

The Greenfield Alternative is within the Central Pierce County sole source aquifer, the Pierce County critical aquifer recharge area, and is in proximity to wellhead protection areas. If a project violates state or federal drinking water regulations, it cannot receive any federal funds.

Staff Recommendation

Staff's recommendation is that the Greenfield Alternative be **eliminated from further consideration**.

WSDOT staff considers this alternative both impractical and unfeasible from a technical, economic, and environmental standpoint, and will describe it as such in the project Environmental Assessment (EA). Because of the Greenfield Alternative's technical and environmental constraints and its high cost, WSDOT does not intend to

[15] The lower cost scenario at a 3:1 creation/restoration ratio
[16] The higher cost scenario at a 6:1 creation/restoration ratio

study this alternative in detail within the project's EA, unless new information becomes available that would change these findings.

The Greenfield Alternative has more potentially significant impacts compared to the bypass alternative. The Point Defiance bypass alternative has fewer potentially significant impacts and better fulfills the project's purpose and need. Project characteristics evaluated under the *Engineering and Feasibility* and *Environmental Impacts* sections of this technical memorandum, make clear the reasons for recommending the elimination of this alternative.

Appendix A – Comparison of Greenfield Alternative to Point Defiance Project

Comparison of Greenfield Alternative to Point Defiance Bypass Project

	Fredrickson	Lakewood South	Tacoma Tunnel	Rainier	Spanaway	Pt. Defiance Bypass[1]
Design						
Length of the Route to be Improved	32.5 miles	29 miles	20 miles	44 miles	30 miles	13 miles
Change in route length compared to the water level route	2.8 miles longer	0.7 miles shorter	6.1 miles shorter	2.5 miles longer	0.3 miles longer	6 miles shorter
New/Reconstructed Track	10.5 miles/22 miles	10 miles/10 miles	4.1 miles/28.4 miles	0 miles/44 miles	19 miles/11 miles	2.5 miles/11.5 miles
At-Grade Crossings Upgraded	33	2	24	46	24	10
Construction Cost[10]	$296M - $988M	$238M - $792M	$2.4B - $7.9B	$205M - $682M	$361M - $1.2B	$59.6M
Increase/Decrease Travel Time	Increase	Decrease	Decrease	Increase	Decrease	Decrease
Accommodates 2 Additional Amtrak *Cascades* Daily Trips	Yes	Yes	Yes	Yes	Yes	Yes
Total ROW Required/ Residential ROW	118 acres/15 acres	118 acres/15 acres	12 acres/12 acres	0 acres	217 acres/88 acres	1.3 acres/<1 acre
Potential Environmental Impacts						
Hazardous Materials: Sites Within 500'	Yes	Yes	Yes	Yes	Yes	Yes
ESA[2]: Species Permanently Affected	Yes	Yes	Yes	No	Yes	No
Wetlands: Total Impacted[3]	6.7 acres	5.2 acres	0.8 acre	5.9 acres	6.6 acres	0 acres
Wetlands: Mitigation Ratio[4] (3:1[5]/6:1[6])	20.1 acres/40.2 acres	15.6 acres/31.2 acres	2.4 acres/4.8 acres	17.7 acres/35.4 acres	19.8 acres/39.6 acres	N/A
Wetlands: Mitigation Cost[7,8] (3:1/6:1)	$5.2M/$10.3M	$4.0M/$8.0M	$0.6M/$1.2M	$4.5M/$9.1M	$5.1M/$10.2M	N/A
Socioeconomic/Environmental Justice: % Minority Population	30%	36%	40%	25%	33%	39%
Recreation/Section 4(f)[9] and 6(f): Resources Impacted	Yes	Yes	Yes	Yes	Yes	No
Historic/Cultural: Resources Impacted	24 sites	25 sites	1 site	19 sites	25 sites	0 sites

Note: Since the information was the same for all the routes, no information is being provided in this comparison table for Air Quality *(Attainment Area),* Noise *(Sensitive Receptors)*, Hydrology/Water Quality *(Proximity to Sensitive Surface or Ground Waterbodies)*, or Socioeconomic/Environmental Justice *(2009 Poverty Guidelines* and *Average Median Income)*. See the sub-section for more information.

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[1] *Point Defiance Bypass Project Environmental Summary* (May 2008), and supporting discipline reports; the *Environmental Summary* analyzed only to S. 66th Street in Tacoma, which was the northern extent of the project at that time

[2] The timeframe for formal consultation under Section 7 of the ESA, for larger projects in the Puget Sound area, generally exceeds one year and may take up to two years to complete

[3] Assumes all the wetlands identified during this analysis rated as a Category I *(i.e., highest-functioning wetlands)*

[4] The US Army Corps of Engineers determines creation/restoration ratios if a Section 404 Individual Permit is issued

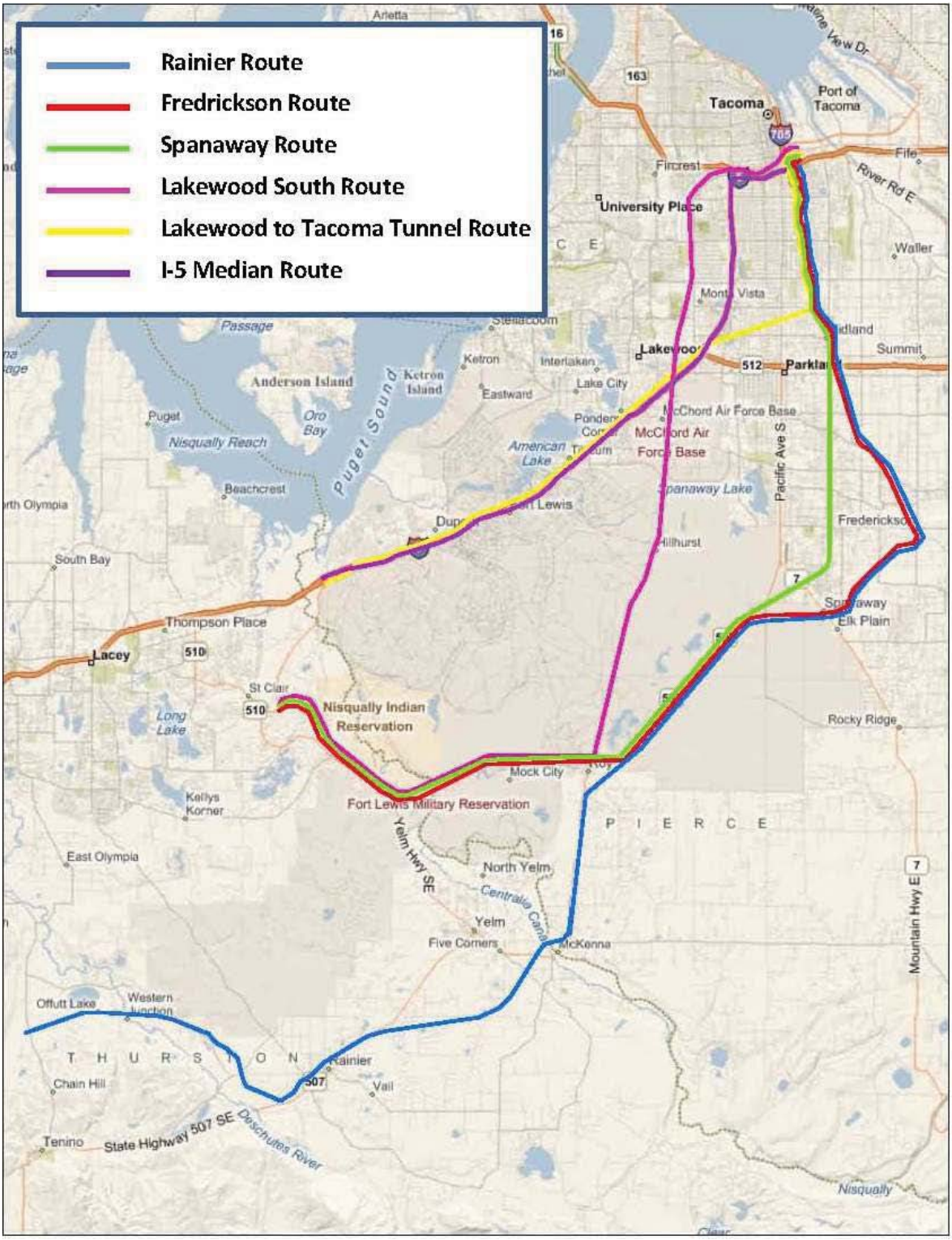
[5] The lower cost scenario, which would require a 3:1 creation/restoration ratio per Class I acre impacted and include a 150-foot buffer.

[6] The higher cost scenario, which would require a 6:1 creation/restoration ratio per Class I acre impacted and include a 300-foot buffer

[7] A total of $256,784/acre based on 2006 guidance, and input from Geoff Gray, SCR Biologist, on September 9, 2010; this total was inflated by 15% from the 2006 guidance of $223,290/acre and has been rounded to the nearest $100,000 for the purposes of this analysis

[8] This cost does not include real estate acquisition costs or the area required for the buffer

[9] FRA will not approve the use of a Section 4(f) resource unless a determination is made that 1) there is no feasible and prudent alternative to the use of land from the property; and 2) the proposed action includes all possible planning to minimize harm to the property resulting from such use; supporting information demonstrates that there is a feasible and prudent alternative that would avoid these Section 4(f) resources

[10] Per the "Cost Estimating Manual for WSDOT Projects", an estimate range of -40% to 100% was used for a 1% to 15% project maturity (% of design completed)

Appendix B – Route Locations