# 3. Phase 2 (High Criticality of Wall Failure)

Wall 36 and Wall 41 are set in Phase 2 due to the high criticality of imminent wall failure. Both Wall 36 and Wall 41 main section of the walls are comprised of a timber pile wall with cable tiebacks. Due to the steep nature of this location workers and equipment can clear during construction both down-station (354.72) and up-station at the Road Access Area (356.13) that can be used as staging storage that outside of foul zone. Wall 36 it is recommended to replace the damaged and decaying timbers. Wall 41 it is recommended to replace with soldier pile wall and lagging wall or steel sheet pile wall in front of the existing wall.

*Optional (2-Marginal Wall) combined project*

Wall 38 is a small timber wall with about 10 feet in exposed timber lagging. The wall's purpose is to retain the ballast material, not to maintain slope stability. With the proximity to wall 36, wall 38 would be a useful wall to repair.

Wall 42 is a small timber wall with about 45 feet of exposed area. The timber piles crushed and deteriorated at the exposed locations and the retaining wall is buried. With the proximity to wall 41, wall 42 would be a useful wall to repair.

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Milepost 354.94 Wall #36

# ALASKA RAILROAD RETAINING WALL INSPECTION FORM

| | | | | | |
|---|---|---|---|---|---|
| Milepost: 354.94<br>Wall Number: 36 | | | Inspectors: Andy Kubic, Eric Thornley | | |
| Date: | July 29, 2021 1:30 PM | | Engineer review required: | Date Forwarded: | |
| Nearest Hwy Intersection: | Parks Highway at Denali Park | | | Nearest RR Crossing: | |
| GPS Coordinates | -148.95979, 63.81798 WGS 1984 | | | | |
| Nearest Siding: | Healy Siding | | | Fiber Optic location: East Side of Tracks | |
| Authorized Track Speed | Passenger: 15 | | Freight: 15 | Overhead Utilities: None | |

**Track & Slope**

| | |
|---|---|
| Wall Condition Rating<br>**Poor** | Rating scale: 5-Excellent, 4-Good, 3-Adequate, 2-Marginal, 1-Poor<br>(see back for rating description) |

| | | | | | |
|---|---|---|---|---|---|
| Line & Surface: | CWR/Ballast | Tangent/Curve: Tangent | | | |
| Tie condition: | Good | | | | |
| Tie type: | Concrete | | | | |
| Distance from end of tie to wall (feet) | South End: | 6.5 | North End: | 6.5 | |
| Distance from end of tie to toe (feet) | South End: | | North End: | | |
| Culverts: | No | | | | |
| Ditchline: | Gravel | | | | |
| Water level: | | | | | |
| Downhill Condition & Vegetation: | Rock Slope | | | | |
| Uphill Condition & Vegetation: | Rock Slope | | | | |

**General Retaining Wall Information (include pictures)**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Soldier Pile** | Type: | | Qty: | | Height: | ’ |
| Condition: | | | | | | |
| **Wall** | Type/Qty: | Timber | Qty: | | Length: | ’ |
| Condition: | Marginal | | | | | |
| **Wales** | Type: | Timber | Qty: | | | |
| Condition: | | | | | | |
| **Tie backs** | Type: | | Qty: | | Length: | |
| Condition: | | | | | | |
| **Anchor Pile** | Type: | | Qty: | | Height: | |
| Condition: | | | | | | |
| Notes: | Poor wall condition rating justification: Material deficiencies, proximity of wall to end of tie, consequences of wall failing. Notes: The purpose of this wall is to retain the ballast material, not for slope stability. Adequate slab rock exists downhill from wall. Monitor as this location is close to centerline of track. Lateral timber members have 50% section loss. | | | | | |

| | | | |
|---|---|---|---|
| Supervisor Review: | | Date: | |
| Engineer Review: | | Date: | |

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# ALASKA RAILROAD RETAINING WALL INSPECTION FORM

| Milepost: 354.94<br>Wall Number: 36 | Date: | July 29, 2021 1:30 PM |
|---|---|---|

## Additional Notes/Drawings

Photo of Approach to Wall Start Looking Up Station

Photo of Approach to Wall Start Looking Down Station

| Rating | Condition | Description |
|---|---|---|
| 5 | Excellent | No visible defects, new or near new condition, may still be under warranty if applicable |
| 4 | Good | Good condition, but no longer new, may be slightly defective or deteriorated, but is overall functional |
| 3 | Adequate | Moderately deteriorated or defective; but has not exceeded useful life: Repair within 3 - 5 years |
| 2 | Marginal | Defective or deteriorated in need of replacement; exceeded useful life: Repair within 1 year |
| 1 | Poor | Critically damaged or in need of immediate repair; well past useful life |

ALASKA RAILROAD

# Alaska Railroad Retaining Wall Inspection

**Inspection Date: July 29, 2021 1:30 PM**

**ARRC Mainline Milepost 354.94**
**Wall #36**
**Wall Condition Rating: Poor**

Michael Baker INTERNATIONAL
Michael Baker International
3900 C St. Suite 900
Anchorage, AK 99503
907.273.1600

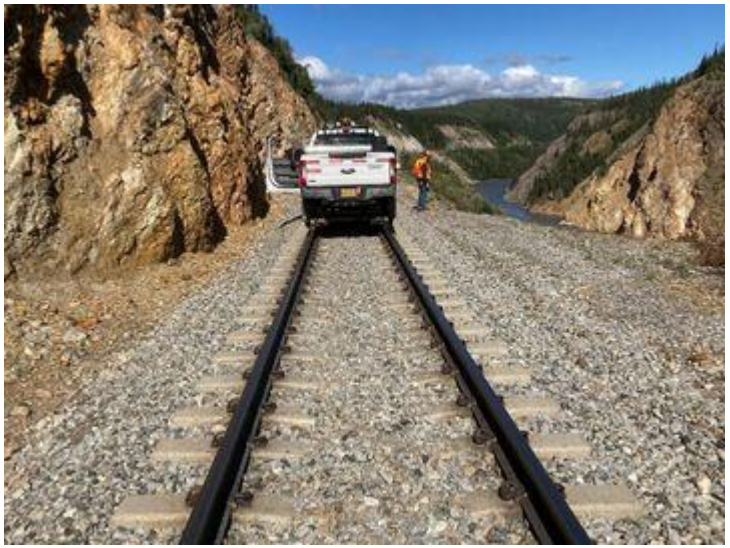

Coordinates: -148.95979, 63.81798 WGS 1984

| Comments: | Photo of Approach to Wall Start Looking Up Station | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 1 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Photo of Approach to Wall Start Looking Down Station | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 2 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 1 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 3 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 2 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 4 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |



| Comments: | Center Point of Wall/Track Centerline 360 Photo 3 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 5 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 4 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 6 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 5 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 7 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 6 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 8 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

| Comments: | Misaligned in damage timbers | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 9 |
| Wall # 36 Wall Condition Rating: Poor | | MP #: | 354.94 |

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## In depth Wall Evaluation

| | |
|---|---|
| **Milepost:** | 354.94 |
| **Wall Number:** | 36 |
| **Wall Condition Rating** | 1-Poor |
| **Inspection Date:** | July 29, 2021 1:30 PM |

### Existing Wall Description

Wall 36, located at Milepost 354.94 in Healy Canyon, 6.8 miles North of Denali National Park Road, and 3.7 miles South of Healy Yard. With no nearby road access, this wall is 1 of 14 walls located in a 1 mile stretch of track (MP 354.30-355.30), narrowly confined on either side by a blasted rock face uphill, and a sliding slope on the exposed downhill. There is a large, mostly flat slope on the right side of the track both down-station (354.72) and up-station at the Road Access Area (356.13) that can be used as staging storage outside the foul zone, where workers and equipment can clear during construction. Wall 38 is in marginal condition; it could be repaired with this project by resolving seepage at ground level and replacing damaged/decaying timbers. The main section of the wall is comprised of a timber pile wall with cable tiebacks. Wall purpose appears to be for ballast material retention.

#### Wall Component Description

- Timber Pile Walls with Cable Tiebacks
  - Timber piles are typically driven 20-30 feet deep or until refusal and spaced 10-15 feet apart.
  - Timber lagging are the horizontal planks stacked vertically and are the main members to retain soil.
  - Steel cable tiebacks increase lateral carrying capacity to help anchor the wall from overturning/sliding. Tiebacks are anchored into solid rock or use a buried deadman to provide resistance.

### Structure Condition State Justification

Wall 36 is critically damaged or in need of immediate repair, well past useful life. The consequences associated are the proximity of the wall to track. Lateral timber members exhibit section loss, which could result in failure.

#### Layout/Geometry Considerations

Exposed slope appears greater than 1:1. The adjacent area appears to be sliding near an exposed portion of the wall, causing the wall to displace laterally away from the track.

| | |
|---|---|
| Alignment | • Upstation – Tangent<br>• Wall Location- Tangent<br>• Downstation- Tangent |
| Left of Track Looking Upstation | • Upslope – Rocky vertical wall, starts approximately 8+ feet from centerline of track, trees and brush<br>• Ditch – Well defined, rocky |
| Right of Track Looking Upstation | • Existing wall location – Immediate steep slope, slab rock at bottom of wall.<br>• Ditch – N/A<br>• Downslope – Steep/rockslide. |

#### Material Deficiency

- Piles-Timber piles sections exhibit up to 100% section failure and need replacement; steel piles and sheet piles to remain.
- Lagging-At-grade segments exhibit section failure, appear to be non-existent in certain areas, and need replacement.
- Tiebacks-Timber tiebacks with cabling will require further investigation to determine if tiebacks are to remain.

### Recommendation

Excavate and replace damaged and decaying timbers.

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Milepost 355.22 Wall #41

# ALASKA RAILROAD RETAINING WALL INSPECTION FORM

| | | | | | |
|---|---|---|---|---|---|
| Milepost: 355.22<br>Wall Number: 41 | | | Inspectors: Andy Kubic, Eric Thornley | | |
| Date: | July 29, 2021 2:30 PM | | Engineer review required: | Date Forwarded: | |
| Nearest Hwy Intersection: | Parks Highway at Denali Park | | | Nearest RR Crossing: | |
| GPS Coordinates | -148.96633, 63.82082 WGS 1984 | | | | |
| Nearest Siding: | Healy Siding | | | Fiber Optic location: East Side of Tracks | |
| Authorized Track Speed | Passenger: 15 | | Freight: 15 | Overhead Utilities: None | |

**Track & Slope**

| | |
|---|---|
| Wall Condition Rating<br>**Poor** | Rating scale: 5-Excellent, 4-Good, 3-Adequate, 2-Marginal, 1-Poor<br>(see back for rating description) |

| | | | | |
|---|---|---|---|---|
| Line & Surface: | CWR/Ballast | Tangent/Curve: Tangent | | |
| Tie condition: | Good | | | |
| Tie type: | Concrete | | | |
| Distance from end of tie to wall (feet) | South End: | 10 | North End: | 6 |
| Distance from end of tie to toe (feet) | South End: | | North End: | |
| Culverts: | No | | | |
| Ditchline: | Gravel | | | |
| Water level: | | | | |
| Downhill Condition & Vegetation: | Rock Slope | | | |
| Uphill Condition & Vegetation: | Rock Slope | | | |

**General Retaining Wall Information (include pictures)**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Soldier Pile** | Type: | Timber | Qty: | 12 | Height: | ’ |
| Condition: | Poor | | | | | |
| **Wall** | Type/Qty: | Timber | Qty: | | Length: | ’ |
| Condition: | Marginal | | | | | |
| **Wales** | Type: | | Qty: | | | |
| Condition: | | | | | | |
| **Tie backs** | Type: | | Qty: | | Length: | |
| Condition: | | | | | | |
| **Anchor Pile** | Type: | | Qty: | | Height: | |
| Condition: | | | | | | |
| Notes: | Poor wall condition rating justification: Material deficiencies, proximity of wall to end of tie, consequences of wall failing, failure risk due to the wall length and height. Notes: Hollow sounding for entire height of exposed pile with splitting and decay. Up to 100% section loss on top lateral member. First half of wall up to pile seven appears to have been reinforced with new vertical bracing members and are in good condition. The remaining portion of the wall is marginal to adequate. | | | | | |

| | | | |
|---|---|---|---|
| Supervisor Review: | | Date: | |
| Engineer Review: | | Date: | |

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# ALASKA RAILROAD RETAINING WALL INSPECTION FORM

| Milepost: 355.22<br>Wall Number: 41 | Date: | July 29, 2021 2:30 PM |
|---|---|---|

## Additional Notes/Drawings

Photo of Approach to Wall Start Looking Up Station

Photo of Approach to Wall Start Looking Down Station

| Rating | Condition | Description |
|---|---|---|
| 5 | Excellent | No visible defects, new or near new condition, may still be under warranty if applicable |
| 4 | Good | Good condition, but no longer new, may be slightly defective or deteriorated, but is overall functional |
| 3 | Adequate | Moderately deteriorated or defective; but has not exceeded useful life: Repair within 3 - 5 years |
| 2 | Marginal | Defective or deteriorated in need of replacement; exceeded useful life: Repair within 1 year |
| 1 | Poor | Critically damaged or in need of immediate repair; well past useful life |

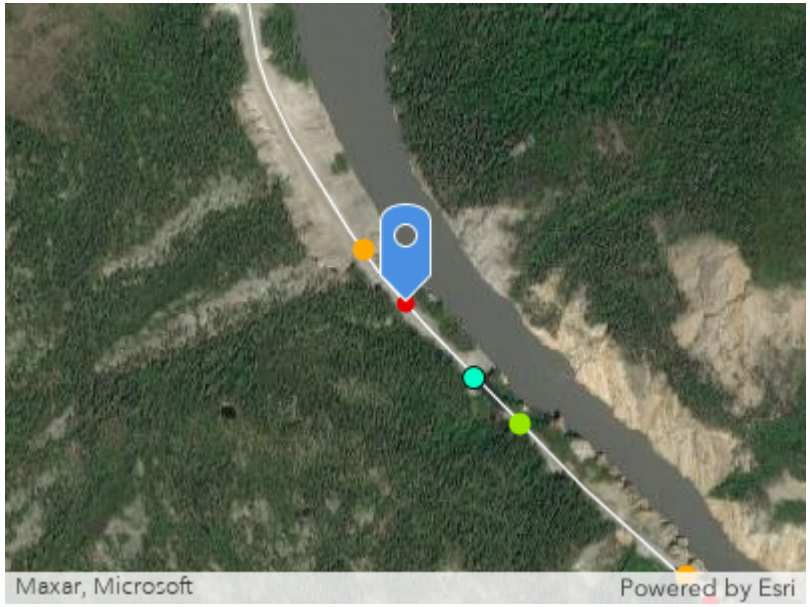
ALASKA RAILROAD

# Alaska Railroad Retaining Wall Inspection

**Inspection Date: July 29, 2021 2:30 PM**

**ARRC Mainline Milepost 355.22**
**Wall #41**
**Wall Condition Rating: Poor**

Michael Baker INTERNATIONAL
Michael Baker International
3900 C St. Suite 900
Anchorage, AK 99503
907.273.1600




Coordinates: -148.96633, 63.82082 WGS 1984

| Comments: | Photo of Approach to Wall Start Looking Up Station | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 1 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Photo of Approach to Wall Start Looking Down Station | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 2 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 1 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 3 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 2 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 4 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 3 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 5 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 4 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 6 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 5 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 7 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Center Point of Wall/Track Centerline 360 Photo 6 | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 8 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Hollow sounding for entire height of exposed pile with splitting and decay | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 9 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| Comments: | Lateral member decay | Date: | 7/29/2021 |
|---|---|---|---|
| | | Photo: | 10 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

| | | | |
|---|---|---|---|
| Comments: | Up to hundred percent of section loss top horizontal member | Date: | 7/29/2021 |
| | | Photo: | 11 |
| Wall # 41 Wall Condition Rating: Poor | | MP #: | 355.22 |

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**In depth Wall Evaluation**

| | |
|---|---|
| **Milepost:** | 355.22 |
| **Wall Number:** | 41 |
| **Wall Condition Rating** | 1-Poor |
| **Inspection Date:** | July 29, 2021 2:30 PM |

## Existing Wall Description

Wall 41, located at Milepost 355.22 in Healy Canyon, 7.3 miles North of Denali National Park Road, and 3.2 miles South of Healy Yard. With no nearby road access, this wall is 1 of 14 walls located in a 1 mile stretch of track (MP 354.30-355.30), narrowly confined on either side by a blasted rock face uphill, and a sliding slope on the exposed downhill. There is a large, mostly flat slope on the right side of the track both down-station (354.72) and up-station at the Road Access Area (356.13) that can be used as staging storage outside the foul zone, where workers and equipment can clear during construction. Wall 42 is in marginal condition; it could be repaired with this project by replacing with steel sheet pile wall to replace rotten timber piling wall. The main section of the wall is comprised of a timber pile wall with cable tiebacks.

### Wall Component Description

- Timber Pile Walls with Cable Tiebacks
  - Timber piles are typically driven 20-30 feet deep or until refusal and spaced 10-15 feet apart.
  - Timber lagging are the horizontal planks stacked vertically and are the main members to retain soil.
  - Steel cable tiebacks increase lateral carrying capacity to help anchor the wall from overturning/sliding. Tiebacks are anchored into solid rock or use a buried deadman to provide resistance.

## Structure Condition State Justification

Wall 41 is critically damaged or in need of immediate repair, well past useful life. This is due to overall wall condition and the consequences associated with wall proximity to track and wall failure.

### Layout/Geometry Considerations

Area surrounding the wall appears to be sliding with indications of loose/failing tiebacks causing the wall to rotate. The track is in close proximity to the wall, and could be in jeopardy if the slope failure continues.

| | |
|---|---|
| Alignment | • Upstation – Slight Right-Hand Curve<br>• Wall Location- Tangent<br>• Downstation- Tangent |
| Left of Track Looking Upstation | • Upslope – Steep sloped rock wall with some debris, trees, and brush<br>• Ditch – Well defined, rocky, minor debris buildup |
| Right of Track Looking Upstation | • Existing wall location – Immediate steep rock slope with gravel and minor brush<br>• Ditch – N/A<br>• Upslope – Rocky slope wall with minor brush |

### Material Deficiency

- Piles-Exposed timber piles exhibit up to 100% section failure and are in need replacement.
- Lagging-Above grade segments are missing or exhibit up to 100% section failure and need replacement. Unable to inspect below grade segments due to apparent excavated fill from the opposite side of the track placed on the exterior toe of the wall. Further investigation is required to determine if below grade lagging is structurally sound and adequately retaining the fill supporting the track.
- Tiebacks-Unable to inspect tieback anchors. Further investigation is required to determine if steel cable tiebacks are to remain, but the current state of the wall indicates that these cables are not functioning as designed and could be the cause of the wall rotation.

## Recommendation

Replace with soldier pile wall and lagging wall or steel sheet pile wall in front of the existing wall. May need tiebacks.

**MP: 354.95 Wall#38**

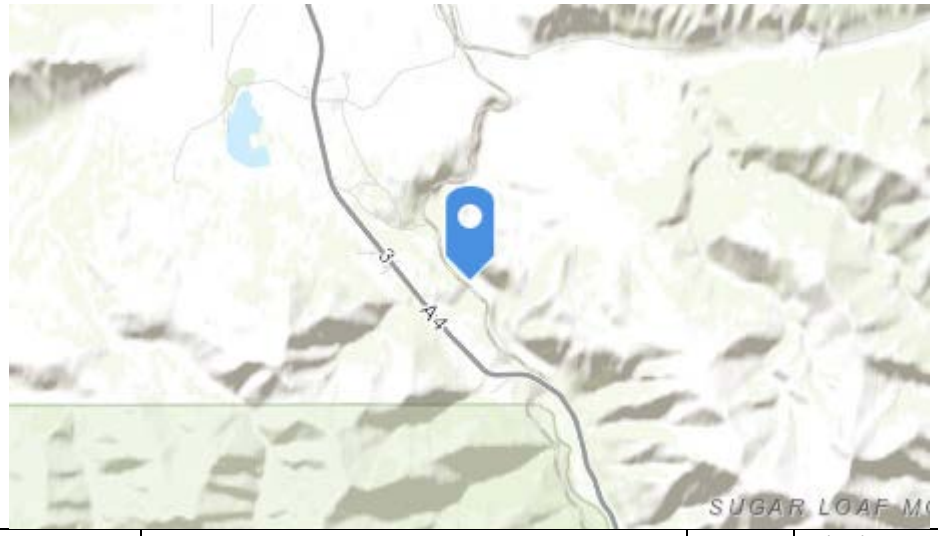
ALASKA RAILROAD

Alaska Railroad Retaining Wall Inspection-

Inspection Date: 7/28/2021

Wall #38

**MP: 354.95**
**Wall Condition Rating: Adequate**




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Comments: | | Date: | 7/28/2021 | Comments: | Wall Location | Date: | 7/28/2021 |
| | | Photo: | 1 | | | Photo: | 2 |
| Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 | Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Comments: | Photo of Approach to Wall Start Looking Up station | Date: | 7/28/2021 | Comments: | Photo of Approach to Wall End Looking Down Station | Date: | 7/28/2021 |
| | | Photo: | 3 | | | Photo: | 4 |
| Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 | Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 |

| | | | |
|---|---|---|---|
| Comments: | Center Point of Wall from Track Centerline | Date: | 7/28/2021 |
| | | Photo: | 5 |
| Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 |

| | | | |
|---|---|---|---|
| Comments: | Center Point of Wall from Track Centerline | Date: | 7/28/2021 |
| | | Photo: | 6 |
| Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 |

| | | | |
|---|---|---|---|
| Comments: | Center Point of Wall from Track Centerline | Date: | 7/28/2021 |
| | | Photo: | 7 |
| Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 |

| | | | |
|---|---|---|---|
| Comments: | Center Point of Wall from Track Centerline | Date: | 7/28/2021 |
| | | Photo: | 8 |
| Wall #38 Wall Condition Rating: Adequate | | MP #: | 354.95 |

| | | | |
|---|---|---|---|
| Comments: | Center Point of Wall from Track Centerline | Date: | 7/28/2021 |
| | | Photo: | 9 |
| Wall #38 | Wall Condition Rating: Adequate | MP #: | 354.95 |

| | | | |
|---|---|---|---|
| Comments: | Center Point of Wall from Track Centerline | Date: | 7/28/2021 |
| | | Photo: | 10 |
| Wall #38 | Wall Condition Rating: Adequate | MP #: | 354.95 |