Appendix C: Required Technical Appendix (10 pages)

A. Overview

Greenhouse gas (GHG) emissions have been calculated for priority measures included in this proposal. Given the time constraints and limited availability of tools and relevant data, CTUIR has worked hard to build methodologies that are reasonable, as comprehensive as possible, and thorough in our assumptions and calculations. Our priority measures include project components that are designed to improve quantification of GHG emissions reductions possible and to identify and assemble metrics to track carbon emissions reductions specifically. Thus the following calculations are high quality but admittedly preliminary, and we are looking forward to the opportunity to further refine these projections as we implement these projects.

B. Technical Appendix

Priority Measure 1: Kayak Public Transit and Umatilla County Fleet Electrification

Kayak is an award winning free rural public transit service that operates within the CTUIR Ceded lands. Within a 5-year period, it is realistic for Kayak to replace one (1) diesel bus with an electric vehicle (EV) bus. The most realistic route to replace is for the Mission Metro, as it travels locally and can be easily serviced if the EV technology encounters issues. It also would not require a re-negotiation of services provided with other Umatilla, Union, Morrow, or Walla Walla county municipalities served by these routes. The below figures are calculated for the Mission Metro.

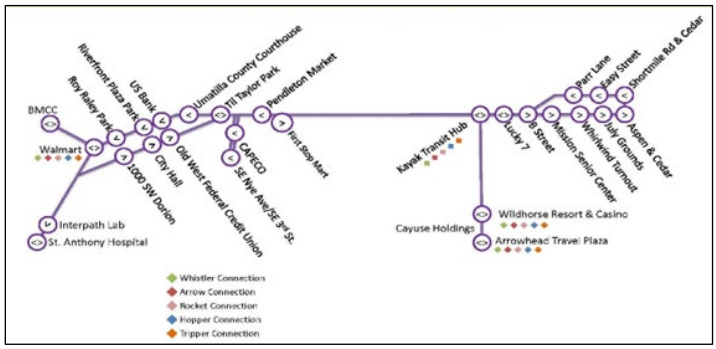


Figure 2: Current route of the Kayak Mission Metro, which serves the Umatilla Indian Reservation, its residential areas, large business entities, and the neighboring community of the City of Pendleton.

Below a detailed description which synthesizes the methodology associated with this Kayak Public Transit Electrification Priority Measure.

<u>Route Distance</u>

Key Assumption: Mission Metro route totals 35 km per route from the Kayak Transit Hub to its furthest destination at St. Anthony's Hospital. Figure 2 shows the full Mission Metro route.

- Route is completed 6 times per weekday from Monday to Friday
- In the span of one year, the Mission Metro travels a total of 50,400 km

<u>Baseline Ridership</u>

Key Assumption: Kayak Public Transit ridership data is taken at point of pick up and tabulated for each route. Data used for this calculation includes ridership from every route for the 2022 year (CTUIR Office of Tribal Planning, 2022).

- In 2023, the Mission Metro totaled 15,880 riders for the year
- These ridership totals are accurate, however they are lower than in previous years, due to impacts from the Covid-19 pandemic.
- Please find the documented ridership data in the Optional Project Narrative Appendix 2 for detailed documentation.

GHG Reductions from Passenger Vehicles Avoided- BASELINE

Key Assumption: In the state of Oregon (OR DMV 2022), approximately half the passenger vehicles on the road are small and medium vehicles, with an average carbon emission of 117 gCO2e per km, and half the vehicles are large vehicles, with an average carbon emission of 192 gCO2e per km (International Energy Agency Mobility Model, May 2020 version). Please find detailed data from the Oregon Dept of Motor Vehicles (DMV) in Appendix 2.

- **General equation**
  (((Metro ridership*50%)* Small/Med Vehicle Emissions per km) + ((Metro ridership*50%)*Large Vehicle Emissions per km))*Metro Route Distance = Estimated GHGs avoided in gCO2E

Convert to Metric Tons CO2E
85,871,100 gCO2E / 1000 g per MT = **85,871.1 MT CO2E avoided** from riders choosing Kayak instead of driving

GHG Reductions from Passenger Vehicles Avoided – PROJECTED

Key Assumption: Adding additional buses to each Kayak route will over time increase reliability of these routes and thus, increase ridership. It is assumed that:

- Phase 1 Year 1, no ridership increase will occur. Thus the first year of ridership increase is recorded as 0 and GHG emissions reductions calculated as just MTCO2E avoided from baseline.
- Phase 1 Years 2- 4, ridership will increase by 5% per route. Thus, GHG emissions reductions for these years are calculated for baseline and increased ridership, as well as for EV bus CO2E avoided. These are calculated cumulatively for each year.
- Phase 2, which includes years 5, 2030, and to 2035, ridership will increase by 10%. Thus
- by Phase 3 (2036 to 2050), ridership will increase by 25%.
- Please find the documented GHG reductions spreadsheet in the Optional GHG Reductions Spreadsheets Appendix.

GHG Reductions from Switching from Diesel to EV Bus – BASELINE

Key Assumption: Passenger buses have an average carbon emission of 58.5 gCO2e per km (International Energy Agency Mobility Model, May 2020 version). By switching from a diesel to an electric bus, Kayak is also avoiding carbon emissions that would have otherwise been emitted on this route.

- Mission Metro travels a total of 50,400 kilometers per year
- 50,400 km per year * 58.5 gCO2e per km = 2,948,400 gCO2E

Convert to MTCO2E → 2,948,400 gCO2E / 1000 g per MT = 2,948.4 MTCO2E

GHG Reductions from Switching from Diesel to EV Bus – PROJECTED

Total Cumulative

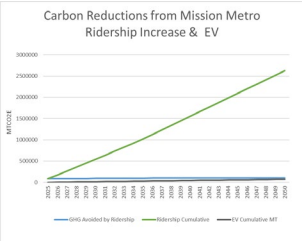
Key Assumption: Passenger buses have an average carbon emission of 58.5 gCO2e per km (International Energy Agency Mobility Model, May 2020 version). By switching from a diesel to an electric bus, Kayak is also avoiding carbon emissions that would have otherwise been emitted on this route, with the same GHG reductions each year, and recorded cumulatively at two benchmarks.

- It is assumed that Project Year 2 (2026) will be the first year an EV bus would be operational. CO2E reductions for Year 1 will be zero.
- Year 2 and beyond: Mission Metro travels a cumulative 50,400 km per year, avoiding 58.5 gCO2e per km = 2,948,400 gCO2E per year.
- This value remains constant between 2025 and 2050 because the length of the route is assumed to remain constant.

Cumulative: 14,742 MTCO2E by 2030; 73,710 MTCO2E by 2050. These values are assumed carbon reductions from replacing a diesel bus with an EV bus.

Total

- GHG Reductions from Passenger Vehicles Avoided BASELINE
  85,871.1 MTCO2E
- GHG Reductions from Passenger Vehicles Avoided PROJECTED
  540,988 MTCO2E by 2030; 2,623,362 MTCO2E by 2050
- GHG Reductions from Switching from Diesel to EV Bus BASELINE
  2948.4 MTCO2E
- GHG Reductions from Switching from Diesel to EV Bus PROJECTED
  14,742 MTCO2E by 2030; 73,710 MTCO2E by 2050



- Priority Measure Total:
  555,730 MTCO2E by 2030
  2,697,072 MTCO2E by 2050

Figure 1: Cumulative and Per Year Carbon Reductions from each of the Priority Measure Elements. The chart shows that increased ridership yields steady carbon reduction benefits, while diesel Kayak bus vehicle replacements with EV produces compounding benefits.

Priority Measure 2: Nixyáawii Watikš Trail Project

Few options exist for commuters to safely travel along major rural thoroughfares without the use of carbonized transportation like personal vehicles. Due to the lack of safe corridors, many who would

otherwise chose to use non-carbonized transport to travel elect to instead use carbonized personal vehicles, resulting in carbon emissions.

Figure 2: From The Nixyáawii Watikš Final Report, project focuses on analyzing the Mission Road corridor from Highway 331 to the reservation's western boundary. The broader Mission area, City of Pendleton, and Riverside community were also examined for context and potential trail connections

<u>Improved Safety for Non Carbonized Commute Results in Reduced Vehicle Traffic</u>

Key Assumption: Construction of a dedicated non-carbonized transportation corridors like walking and biking trails improve commuter safety for non-carbonized travel options, and will improve the utilization of these travel options as a result.

- Realistically for the 5 year period, it was assumed that the Hwy 331 and Mission Road Intersection to Timine Way is the target segment. Following assumptions are built on this initial one.
- Across the model, we assume phases in construction will generate a 2% reduction in passenger vehicle traffic, due to the fact that the road does see non carbonized commuters who already use the area despite its lack of safety. This is described as Phase 1 in our GHG reduction model.
- Across the model, we assume phases already completed will generate a 5% reduction in passenger vehicle traffic, due to the improved safety conditions along these corridors. This is described as Phase 2 in our GHG reduction model.
- Across the model, we assumed that trail segments that have been established for a number of years will generate a 10% reduction in passenger vehicle traffic due to increasing public awareness and acceptance of corridor. This is described as Phase 3 in our GHG reduction model.

<u>Trail Safety and Usability Improvements</u>

Key Assumption: Reductions in GHGs were estimated using passenger vehicle emissions measures for different sized vehicles calculated by the International Energy Agency Mobility Model (May 2020, https://www.iea.org/reports/world-energy-outlook-2020). GHGs are calculated as carbon emissions from "passenger vehicles avoided" for the roadway along the proposed trail. In the state of Oregon, approximately half the passenger vehicles on the road are small and medium vehicles, with an average carbon emission of 117 gCO2e per km, and half the vehicles are large vehicles, with an average carbon emission of 192 gCO2e per km. It is assumed that avoided vehicles will be equally divided into small/medium vehicles and large vehicles avoided.

General equation
((Traffic count* 50%)*Lrg Vehicle gCO2e)+(Traffic count*50%)*Sm Vehicle gCO2e))*Distance of Trail = grams of CO2 equivalent avoided

Estimating Baseline Traffic on Roadways

Key Assumption: Vehicle traffic along Mission Road (9.7 km) and along Highway 331 between Mission Road and Arrowhead Travel Plaza (3.2 km) is estimated from Traffic Impact Assessments (TIA) conducted for developments along these thoroughfares in recent years.

- Traffic volume along Mission Road is estimated from CTUIR Nixyaawii Neighborhood Mixed Use Development TIA (1,377 vehicles in a one day period);
- traffic volume along Highway 331 was estimated from the Wildhorse Resort and Casino Expansion TIA (14,243 average per day) and includes traffic from both weekday and weekend counts.

Implementation of Complete Trail System - GRANT PERIOD

Key Assumption: Implementation of this trail system is limited by internal capacity to administer project funds and activities, and by factors involved in construction such as permitting process, land negotiations, and other factors outside of CTUIR's control. Thus the GHG emissions reductions are based in a phased approach to implementing this Priority Measure. Figure 3 shows an illustration of how this phased approach is used to calculate GHG emissions reductions associated with trail construction.

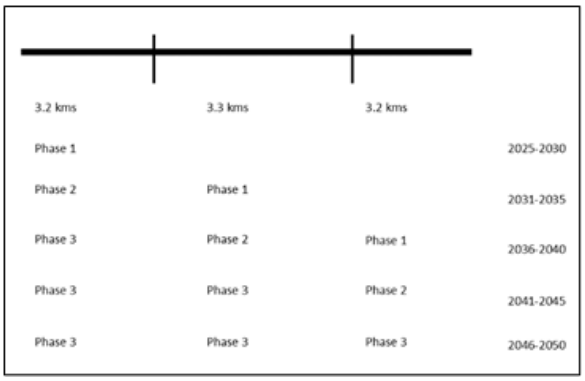


Figure 3: Illustration of phased completion of the Nixyáawii Watikš Trail as it is anticipated within this GHG emissions reductions projection. This assumes the trail system will be completed by 2050, with a phased increase in use by the local community, with a reduction in passenger vehicles associated.

- Phase 0 & 1 (2025-2030) is work that realistically can be completed within the scope of the grant period. This has been estimated to include 2,350 feet of sidewalk construction along Mission Road between the Hwy 331 intersection and the Timine Way Intersection, as well as construction of a roundabout to improve pedestrian and non-motorized commuter safety.
- Connects to existing implementation efforts: 1,318 ft from Parr Lane to bus pull out, and 1,520 ft along Confederated Way to Whirlwind Drive, for a GHG emissions reduction along the whole route within the grant period, totaling 5,188 feet improved during the project period.
- There is also an existing 5280 feet (1 mile) that is commutable between Parr Lane and Mission Road/Hwy 331 intersection that has been included in this transportation distance, which is already commutable and connects the two ends of these construction improvement sites and is included in this GHG emissions reductions total.
- This combines to provide **a total of 10,468 feet (3.2 kilometers) over which Phase 1 of this project will improve commutability.** This total is the reference distance for Phase 1 of this GHG

emissions reduction estimate. This will also be assumed to be in use for project years 4 & 5 as part of the GHG emissions reductions for 2025-2030.

Implementation of Complete Trail System 2025-2030

Key Assumption: Phase 1 of these GHG emissions reductions are improved by compiling reductions possible across the whole completed trail system. It is assumed that by 2040, the trail system from the Riverside neighborhood to the Mission Road/Hwy 331 intersection will be completed, which is aspirational and contingent on sustained funding and administrative capacity to implement. Thus, estimations for GHG emissions reductions from 2025 to 2050 assume the below phased implementation of this trail system:

- Phase 0 - Years 1-3 will not likely result in direct GHG emissions reductions, due to the construction phase of this trail component.
- Phase 1 – Years 4 & 5 are assumed to provide GHG reductions benefits due to close-to-completion presence of increased commuter safety features (sidewalk, traffic calming, and roundabout). Thus these years are assumed to result in a **2% reduction in passenger vehicle traffic for the 3.2 kilometers** projected to be completed during this grant period.
- General Equation
  (P0 traffic reduction per day*3.2 kilometers)*3 years + (P1 traffic reduction per day *3.2 kms)*365 days*2 years
- **GHG Reductions for 2025-2030**
  9,940 MTCO2E

Implementation of Complete Trail System 2031-2050

Key Assumption: Years 2031 to 2035 are assumed to include the implementation of an additional 3.3 kilometers of the trail system being completed, projected to 6.5 kilometers by the end of 2035. Years 2041-2050 are assumed to include the implementation of an additional 3.2 kilometers of the trail system beginning construction, projected to 9.7 kms by the end of 2040 having completed construction. It is anticipated that by 2050 the whole trail system will be completed and under Phase 3 use. This model assumes

- During 2031-2035:
  - A P2 reduction in passenger vehicles along the project area of 3.2 kilometers for 2031-2035 (5 years).
  - A P0 reduction of 0% while under construction (3 years) + a P1 2% reduction in passengers vehicles for 2033-2035 (2 years) along the additional trail system of 3.3 kilometers.
  - General calculation
    (P3 Traffic emissions reductions per day @ 10%)*3.2km*365 days*5 years + (P2 Traffic emissions reductions per day @ 5%)*3.3kms*365 days*2 years
- During 2041-2045:
  - A P3 reduction in passenger vehicles along the completed project area of 6.5 kms of trail previously constructed during 2025-2030 (5 years).
  - A P2 reduction in passenger vehicles along the previously completed project area of 3.2 kms 2042-2045 (5 years)

- General calculation
  (P3 Traffic emissions reductions per day @ 10%)*3.2km*365 days*5 years + (P2 Traffic emissions reductions per day @ 5%)*3.3kms*365 days*5 years + (P1 Traffic emissions reductions per day

- During 2046-2050:
  - All sections of trail are in P3, totaling 9.7 kms (5 years)
  - General Calculation
    (P3 Traffic emissions reductions per day @ 10%)*9.7km*365 days*5 years/1000 g per MT
- **GHG Reductions for 2025-2050**
  947,340 MTCO2E

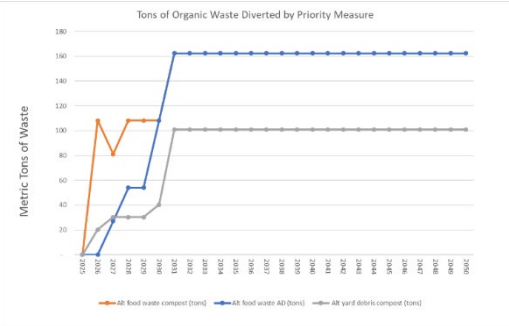
Priority Measure 3: Organic Waste Management

Organic waste includes food and yard waste both residential and commercial producers on the UIR. This waste is currently included in non-organic waste and disposed of in landfills, specifically a large regional landfill located in Arlington, Oregon. Thus this waste travels from the UIR to Arlington, a distance of 129 kilometers (one way), accounting for GHG emissions associated with transportation of this material. Once the organic material is disposed of in this landfill, additional GHG emissions are released from methane resulting from anaerobic decomposition in the landfill. Thus, preventing organic waste from being removed from the UIR as well as preventing uncontrolled anaerobic decomposition will result in GHG emissions reductions that are quantifiable, long lasting, and certain. This priority measure projects the implementation of a UIR organic waste management site that includes both controlled anaerobic digestion (AD) and aerobic composting of food and yard waste for residential and small commercial facilities within the 5 project years and outward to 2050.

Existing Data and Available Calculation Tools

Key Assumption: Food and yard waste data for the UIR specifically unfortunately does not exist currently. To calculate the contribution of UIR's organic waste GHG emissions, data from Umatilla County does exist and is recorded for 2022. The UIR population accounts for 3.6% of Umatilla County (US Census 2020), and thus our model utilizes 3.6% of Umatilla County's organic waste data to calculate these GHG emissions reductions. Estimates for current quantity of food and yard waste currently transported to landfills is calculated from Oregon Dept of Environmental Quality (ODEQ) Waste Impact Calculator (WIC) for Umatilla County, Oregon (open source at https://or-dept-environmental-quality.github.io/wic/)

Phased Implementation and Capacity Expansion



Key Assumption: Capacity will be added slowly over the first 5 years of the project, aided by information from a separate pilot project. project year 1 will result in no food or yard waste diversion, Project year 2 is projected to result in food and yard waste diversion to composting, but capacity for anaerobic digestion will need to still remain zero for this year. This model also assumes a maximum of 25% diversion of organic waste from landfill stream, as it seemed unrealistic that 100% of the UIR would be able to transition to diverting food waste within the given time

period. Figure 4 above shows this phased expansion of organic waste management capacity, as well as this split between aerobic composting, primarily for yard waste, and anaerobic digestion.

GHG Emissions Calculations – Distance Traveled

Key Assumption: Distance traveled by materials hauling is included in the calculations for GHG emission reductions. We also calculate additional reductions from the use of EV technology to collect organic waste and to deliver outputs to recipients.

- Emissions Prevented from Using EV Truck for Organic Waste Service
  - Organic waste collection service would run similar to existing waste collection services provided by TERF. This service collects from residences once per week, and services the farthest community from the collection point, Gibbon Oregon, located 16 kms from TERF. This service typically runs in a looped route from Gibbon back through to closer communities, making for a round trip distance of 32 kilometers.
  - We anticipate acquiring at least 1 EV truck to conduct this service route, thus GHG emission from pick up service are calculated as emissions avoided through use of EV instead of diesel. Diesel trucks are estimated to emit 192 gCO2e per kilometer (International Energy Agency Mobility Model, May 2020, https://www.iea.org/reports/world-energy-outlook-2020).
  - General calculation
    (Emissions avoided per km * Route km) = gCO2e per week * 48 weeks per year over period of interest / 1000 g per MTCO2e = emissions avoided over time period over route
- Emission Prevented from Using EV Truck for Compost/Fertilizer Deliver
  - Emissions from this source are calculated identical to the waste collection emissions avoided, and thus are found in detail above.
  - General calculation
    (Emissions avoided per km * Route km) = gCO2e per week * 48 weeks per year over period of interest / 1000 g per MTCO2e = emissions avoided over time period over route

Total Cumulative GHG Emissions Reductions

- From Landfill Diversion:
  266 MTCO2E by 2030; 2,677 MTCO2E by 2050
- From EV technology:
  1,180 MTCO2 *2 = 2,360 MTCO2 by 2030
  7,078 MTCO2E * 2 = 14,156 MTCO2 by 2050
- **Total:**
  2,626 MTCO2E 2025-2030
  16,833 MTCO2E 2025-2050

Priority Measure 5: Pulp Tree Processing and Innovation

Small diameter trees are harvested as part of routine forest management. Currently these trees are hauled to pulp processing mills, but changes in regional processing option have changed this. Without access to pulp and pellet milling operations, these pulp trees would be burned on the land instead, and release carbon dioxide. By retaining pulp tree processing capacity and expanding this through acquisition

and utilization of small scale biochar burners, CTUIR will be preventing GHG emissions from agricultural activities while maintaining ability to manage resilient forests.

Estimating Forest Carbon

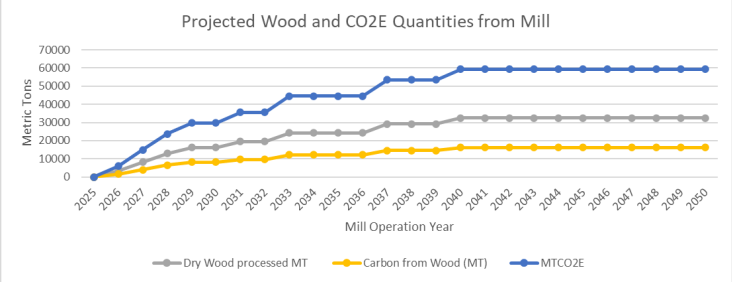
Key Assumption: Calculations were based on the Penn State University "Conversions Commonly Used When Comparing Timber and Carbon Values" methodology, https://extension.psu.edu/conversions-commonly-used-when-comparing-timber-and-carbon-values. Calculations are based on comparing current milling operations "business as usual" processing (carbon saved) and the alternative CO2E that would have otherwise been released if this volume of wood was incinerated in pile burns. The carbon emissions associated with incinerating this volume of wood are considered and calculated as **emissions avoided** through operation of the mill alternatively.

- Model assumes wood processed would have been incinerated otherwise, and volumes of wood processed are avoided from immediate incineration through operation of the mill, continued under CTUIR where it would have otherwise been discontinued.
- Actual mill production values were used to calculate actual volumes of wood processed currently, and estimate MTCO2E associated.
- Values from specific conifer tree species in CTUIR forests were used to estimate green (wet) wood and converted to dry wood and carbon values from Penn State University, https://extension.psu.edu/calculating-the-green-weight-of-wood-species

Estimating Pulp Mill Carbon Reductions Avoided

Key Assumption: Sustaining the operation capacity of the pulp mill under Tribal leadership would enable CTUIR to contribute to GHG emissions reductions as **emissions prevented**.

- Pulp mill current processing volume for dry wood processing is 18,000 English Tons per year (RAF email communication 2024). This quantity of dry wood is assumed to be BASELINE capacity, and is treated in the model as 100% current volume. CTUIR RAF staff estimate processing capacity can double with supported operations to twice this quantity, indicated in the model as 200%, an estimated 36,000 English Tons per year.
- Processing capacity of the mill is anticipated to be interrupted during an ownership transfer to CTUIR's stewardship. Year 1 was estimated to be no capacity due to interruption from transfer of mill operation ownership to CTUIR; Year 2 was anticipated at 20% capacity; Year 3 anticipated at 50% capacity; Year 4 anticipated at 80% capacity; reaching 100% capacity by Year 5, 2030.
- Outside of grant period, milling capacity is anticipated to still increase. From 2031 to 2032, capacity is anticipated to increase to 120% of baseline; 2033 to 2036 is anticipated increase to 150% of baseline capacity; 2037 to 2039 is anticipated to increase to 180% of baseline capacity, and from 2040 to 2050 anticipated to operate at 200% of baseline. Figure 5 shows this phased



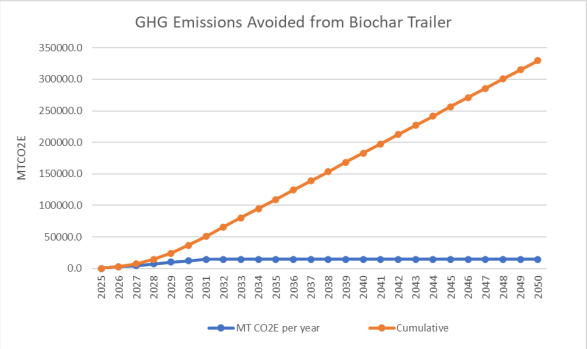
increase in operations capacity for the pulp mill facility under CTUIR ownership. Figure 5: Graphic representation of wood processing quantities from the proposed mill acquisition and its associated carbon emissions prevented, shown per operation year.

- **Total from Pulp Mill Operation**
  74,257 MTCO2E from 2025-2050
  1,107,911 MTCO2E from 2025-2050

Emissions Avoided – Biochar Trailer

Key Assumption: Additional GHG emissions can be avoided by improving CTUIR's ability to process pulp trees in difficult to reach locations, where trees have previously been incinerated due to lack of access for logging trucks to haul trees to milling operations. Acquisition of a small pull-behind biochar trailer would avoid emissions from green wood harvested during operations.

- Processing capacity for this trailer would also increase in phases.
- Figure 6 below shows this phased increase in capacity from the biochar trailer, as well as the cumulative GHG savings anticipated from its operation.
- Green wood is much more damp than dry wood, thus specific conversions for tree species are required. For conifer trees, it is estimated that 27% of this green wood will become dry carbon.
- CTUIR Forest Species Composition is a factor for understanding how carbon from green wood translates into dry carbon and CO2E. CTUIR anticipates a change in the species composition of forest lands as progress is made in forest management for the next 25 years.
    - For 2025-2031, species composition of forest lands being managed is anticipated to be dominated by Douglas fir (45%), Ponderosa pine (40%), Western Larch (5%), and Grand fir (10%).
    - For 2032-2050, species composition of forest lands being managed is anticipated to be dominated by Douglas fir (50%), Ponderosa pine (30%), Grand fir (15%), Western Larch (5%), and Lodgepole pine and Englemann spruce (1% each).
    - These species have different densities of dry wood and can be found in detail in the GHG spreadsheet in Appendix items.
- **Total from Biochar Demonstration Trailer**
  36,609 MTCO2E 2025-2030
  329,823 MTCO2E 2025-2050



Cumulative Total From Pulp Trees

- **Total from Pulp Mill Operation**
  74,257 MTCO2E from 2025-2050
  1,107,911 MTCO2E from 2025-2050

- **Total from Biochar Demonstration Trailer**
  36,609 MTCO2E 2025-2030
  329,823 MTCO2E 2025-2050

- **713,788 MTCO2E 2025-2030**
  5,272,116 MTCO2E 2025-2050