

Agriculture Technical Work Group

Summary List of Recommended High Priority Mitigation Options

Please note that the option descriptions and straw proposals are initial drafts. They are under development, and will receive further consideration by TWG members in upcoming meetings. Additional draft material for options not ready for CAT review can be viewed at the CAT website (http://www.ecy.wa.gov/climatechange/cat_twg_overview.htm) under the most recent TWG meeting.

#	Mitigation Option Name	Straw Proposal Development Status
AW-1	Manure Digesters/Other Waste Energy Utilization (originally 1.4)	Chad Kruger,
AW-2	In-State Production of Biofuels and Biofuels feedstocks (originally 1.2 and 1.3)	Chad Kruger, Cathy Baker, Tim Crosby, Patrick Mazza, Jim Davis, Wade Alonzo, John Tweedale-tentative (assisting W. Alanzo)
AW-3	Significantly Expand Source Reduction, Reuse, Recycling and Composting (originally 6.1, including 6.4 and 6.5)	Steve Wamback, Sego Jackson
AW-4	Agricultural Carbon Management (combines original options 2.3, 3.1, 3.3, 3.4, 4.1, 5.2)	Chad Kruger, Cathy Baker, Tim Crosby, Jim Davis, Wade Alonzo, Pat Ryan (assisting W. Alanzo)
AW-5	Agricultural Nutrient Management (combines original 3.2, 3.3, and 5.2)	Chad Kruger, Wade Alanzo, Milt Johnston (assisting W. Alanzo)
AW-6	Reductions In On-Farm Energy Use and Improvements in Energy Efficiency (originally 5.1)	Chad Kruger, Patrick Mazza, Keith Goehner
AW-7	Preserve Open Space/Agricultural Land (originally 4.2)	Christi Baumel (Sego Jackson's alternate), Cathy Baker, Tim Crosby, Jim Davis

The following options received significant interest from the TWG but were not considered high priority.

Catalog #	Mitigation Option Name	Comments
1.1	Expanded Use of Woody Biomass Feedstocks for Electricity, Heat and Steam Production	Keep at moderate priority
5.3	Programs to Support Local Farming/Buy Local (focused on post-farmgate good systems)	Keep at moderate priority

AW-1. Manure Digesters/Other Waste Energy Utilization

Straw Proposal Development Status: Developed by TWG; Ready for CAT Review

Based on AW Catalog Option 1.4

Mitigation Option Description

Anaerobic digestion of manure from concentrated animal feeding operations (specifically dairy feedlots) is a critical and commercially available technology for reduction of direct methane emissions and the indirect offset of fossil fuel related energy production. Co-digestion of manure with high solids municipal wastes generates technical and economic benefits for both waste-streams.

Capture and recovery of “biogas” from stored animal manure and municipal wastes directly reduces emissions of methane to the atmosphere. Biogas is a low-BTU form of biologically produced natural gas, and therefore can be used to produce thermal and electrical energy as well as liquid fuel and alternative products.

Mitigation Option Design

- **Goals:**
 - Reduce methane emissions by diversion of open stored animal waste to anaerobic digestion – using waste from approximately 150,000 cows.
 - Reduce methane emissions through co-digestion of high solids municipal wastes with animal manures – using approximately 207,000 tons of high solids municipal wastes (50% of food waste, 20% of yard waste) annually.
 - Substitute bio-gas for non-renewable sources for the production of electricity – from methane from an equivalency of 100,000 cows + equivalent amount of MSW from goal #2.
 - Substitute bio-methane for non-renewable petroleum based vehicle fuels – using methane from an equivalency of 50,000 cows + equivalent amount of MSW from goal #2.
 - Substitute carbon and nutrient based co-products from anaerobic digestion for materials and nutrients derived through fossil fuel combustion and/ or mining and various other products.
- **Timing:**
 - Construction of farm-based digesters for an average of 15,000 cows / year between 2010 and 2020.
 - Production of electricity as primary energy utilization technology through ~2015, with production of compressed / liquefied biomethane taking over as primary energy utilization technology after 2015.

- Rerouting of high solid municipal wastes to farm-based digesters at an increasing rate of 27,000 tons per year until a total of 207,000 tons per year in 2020 (50% of food waste and 20% of yard waste).
- **Coverage of parties:** Washington State University, Western Washington University, Washington State Department of Agriculture, Washington State Department of Ecology, Washington State Department of Transportation, public and private utilities, Conservation Districts, Municipal Government / Transit Fleets, private sector
- **Other:** Additional co-products generated in the anaerobic digestion process also have the potential to replace other CO₂ emission intense products such as materials and nutrients derived through fossil fuel combustion and/ or mining and various other products. Many of these products remain in the research and development pipeline, but will be commercially viable well before 2020. The potential for crediting reductions in CO₂ intensity is anticipated as significant, but remains to be calculated.

Implementation Mechanisms

[TWG has begun initial discussions]

Related Policies/Programs in Place

[TWG has begun initial discussions]

Types(s) of GHG Reductions

[TWG has begun to provide input: to be discussed at next CAT meeting]

Estimated GHG Savings (in 2020) and Costs per MtCO_{2e}

[TWG has begun to provide input: to be discussed at next CAT meeting]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

[TWG has begun initial discussions]

Feasibility Issues

[TWG has begun initial discussions]

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-2. In-State Production of Biofuels and Biofuels feedstocks

Straw Proposal Development Status: In progress

Based on AW Catalog Options 1.2 and 1.3

Mitigation Option Description

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other: Implementation Mechanisms**

Related Policies/Programs in Place

Types(s) of GHG Reductions

Estimated GHG Savings (in 2020) and Costs per MtCO_{2e}

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-3. Significantly Expand Source Reduction, Reuse, Recycling and Composting

Straw Proposal Development Status: Developed by TWG; Ready for CAT Review

Based on AW Catalog Options 6.1, 6.4, and 6.5

Mitigation Option Description

Expand source reduction, reuse, recycling and composting of household, business, industrial, agricultural, and construction-related waste streams to reduce greenhouse gas emissions. Based on data collected for calendar year 2005, existing recycling efforts reduced greenhouse gas emissions in Washington by almost 3.2 million metric ton CO₂ equivalents. This mitigation option, therefore, builds on existing programs and approaches and proposes to take advantage of newer market and business-based activities.

In addition to traditional recycling programs, a partial list of these approaches includes: source reduction (waste prevention) initiatives; expanding existing and encouraging more reuse, recycling, composting and processing businesses; establishing product stewardship programs; using environmentally preferable procurement practices; encouraging cradle-to-cradle design and manufacturing; facilitating safe byproduct “synergy” strategies; achieving a reduction of toxics in packaging and products to make them safer to manufacture, use and recycle while increasing their value and use in the market place; increasing closed-loop recycling and the percentage of recycled-content in products, and expansion of disposal bans

Mitigation Option Design

- **Goals:**
 - Reduce the total amount of household and business waste by 15% and recycle at least 50% of the waste remaining (see Table 1 for details);
 - Capture for composting¹ over 90 percent of compostable organics (see Table 1 for details).

Table 1. Goals by Household and Business Waste Sources

	Current Recycling Rate	Source Reduction Goal	Recycling Goal	Composting Goal
Aluminum Cans	33%	15%	60%	
Steel Cans	14%	15%	50%	
Glass	26%	15%	50%	
HDPE	20%	15%	50%	
LDPE	91%	15%	91%	
PET	32%	15%	50%	
Corrugated Cardboard	61%	15%	80%	
Newspaper	56%	15%	80%	

¹ or anaerobic digestion processes

Office Paper	44%	15%	60%	
Food Scraps	17%			80%
Yard Trimmings	56%			100%
Mixed Waste Paper (general)	28%	15%	60%	
Mixed Metals	83%	15%	90%	
Mixed Plastics	2%	15%	25%	
Mixed Organics	50%			90%

- **Timing:** Achieve full goal implementation by 2020.
- **Coverage of parties:** All sectors of society in Washington State will be engaged in attaining this mitigation action, as will many levels of state and local government. The private sector will play a critical role by facilitating the transportation of recyclable materials to processors and composters, by providing processing and composting capacity, and through product stewardship actions. The private sector will likely be invited to take the lead in creating new markets for materials, through expanding existing businesses and services, and establishing new enterprises.
- **Other:** The most important of these goals is to significantly “source reduce” to reduce the generation of discarded material. Currently, while recycling rates are increasing, the overall generation of material discarded has increased dramatically as well. The average amount of garbage (including recyclables) produced by each person in the state increased by 5.3 percent from 2004 to 2005 (from an average of 7.5 pounds of waste per person each day in 2004, to an average of 7.9 pounds a day in 2005). In 2005, residents and businesses in Washington generated almost 18 million tons of solid waste.

The overarching goal is to have continual improvement and progress toward an eventual “no waste” society, thereby dramatically reducing greenhouse gas emissions and attaining one of the cornerstone principles of sustainability. This can be enabled by taking steps toward product stewardship² and the design of products with greenhouse gas emissions, waste prevention, reuse and recycling in mind. This encourages manufacturers to design and manufacture, and for consumers to purchase, products geared towards end-of-life handling methods that conserve, capture, or “recirculate” resources in the most effective and efficient way possible.

The current situation of increasing waste generation implies increasing consumption and production of goods. The greenhouse gas impacts of production are much larger than emissions from disposal facilities. Washington’s greenhouse gas inventory does not fully assign to Washington state the greenhouse gas impacts associated with producing goods that Washington residents and businesses consume. It is in changing the impacts

² **Product stewardship** is a product-centered approach to environmental protection. It calls on those in the product lifecycle—manufacturers, retailers, users, and disposers—to share responsibility for reducing the environmental impacts of products. The greatest responsibility lies with whoever has the most ability to affect the lifecycle environmental impacts of the product. Please see the US EPA’s Product Stewardship site at <http://www.epa.gov/epr/> and the Northwest Product Stewardship Council site at <http://www.productstewardship.net>

associated with the manufacturing of these products that the greatest greenhouse gas reduction potentials are likely to be found.

Implementation Mechanisms

The effectiveness of a reduction/recycling/composting strategy is dependent on giving programs local flavor using local data. The first step in implementing this strategy should be a local waste disposal and recycling characterization audit in each of the state's 39 counties. The baseline data used to prepare this recommendation is nearly fifteen years old (1992 statewide waste audit). Local waste streams may differ significantly from the state average. Waste audits should be implemented using a common scenario with state funding in 2008 and 2009.

Additional crucial early steps:

- Full implementation of Washington's Beyond Waste Plan's current action items.
- Incorporate GHG reduction analysis and strategies in Beyond Waste Plan updates and next phase strategies.
- Fully implement and improve Washington State's Environmentally Preferable Procurement program and policies.

Legislative and budget proposals should be developed for the 2009 Legislature and a report and recommendations provided to the appropriate committees annually thereafter, until the goals are attained.

Specific details are provided below:

1. Local waste audits

- development of statewide system model
- development of statewide funding
- implement audit
- use results to influence local GHG reduction programs

2. Evaluate use of a model and index to measure and monitor GHG reductions

- the EPA's WARM model was used for policy development
- WARM model has some gaps, notably in failing to calculate source reduction potential for yardwaste and foodwaste and it doesn't consider all the materials that are being recycled.
- Investigate applicability or tweaks necessary to account for the actual types and location of disposal facilities in Washington State.³
- Implement and evaluate use of the Washington State Consumer Environmental Index (CEI). CEI tracks changes over time in the environmental emissions and their impacts caused by the production, use and disposal of items purchased each year by Washington's consumers.

³ Given varying distances to transport waste and recyclables, using average distances and population "centroids" (as was used for the estimates in the current run of the WARM model) may not be the most accurate for program implementation

3. Build on existing source reduction and recycling programs, targeting commodities with the largest GHG reduction potential.
4. Fully implement and update Washington's Beyond Waste Plan. The current 5-year milestones and action items include key initiatives to increase recycling of industrial waste and organic materials, expand green building, reduce toxics and increase the recyclability of products, and more. The next update and related funding priorities should further incorporate GHG emissions analysis and GHG reduction actions.
5. Fully implement and expand Environmentally Preferable Procurement policies and programs by the State and local governments.
6. Encourage manufacturers to provide – and consumers to use – end of life management and upstream design solutions that reduce the green house gas and other environmental impacts of product waste. Develop a framework policy for establishing product stewardship programs.
7. Establish a research and educational institute to address sustainable product design and manufacturing.
8. Ecology, CTED, Health and other appropriate agencies should coordinate reporting to the appropriate committees of the legislature, on an annual basis, progress made in reaching the goals and recommendations for legislation or other actions by the state.
9. Form an on-going technical work group of experts on reduction, reuse, recycling, composting, product stewardship and green business development to advise Ecology, CTED, Health and other appropriate agencies on actions needed to implement this action item and attain the policy goals. This could be accomplished by restructuring the Washington Solid Waste Advisory Committee (SWAC), creating a sub-committee of SWAC, or by creating an entirely new group. The technical work group's recommendations will be considered when reporting progress, next steps and recommendations to the legislature.

Related Policies/Programs in Place

This section identifies (and provides links to) some of the “foundational” policies and programs that are already in place supportive of our proposal.

1. **Washington RCW 70.95** establishes solid waste hierarchy of reduce/reuse/recycle and requires all local governments to have a solid waste management plan.
<http://apps.leg.wa.gov/RCW/default.aspx?cite=70.95>
2. **Washington Department of Ecology Beyond Waste Plan:**
<http://www.ecy.wa.gov/beyondwaste/>
 - Solid Waste Initiative, <http://www.ecy.wa.gov/beyondwaste/SWIssues.html>.
 - Hazardous Waste Initiative, <http://www.ecy.wa.gov/beyondwaste/HazWasteIssues.html>
 - Small Volume Toxics Initiative, <http://www.ecy.wa.gov/beyondwaste/reduceToxics.html>

- Organics Initiative, <http://www.ecy.wa.gov/beyondwaste/increaseOrganics.html>.
 - Industrial Waste Initiative, <http://www.ecy.wa.gov/beyondwaste/reduceWaste.html>.
 - Green Building Initiative, <http://www.ecy.wa.gov/beyondwaste/increaseGB.html>.
 - Measure Progress, <http://www.ecy.wa.gov/beyondwaste/measureProgress.html>
3. **Electronic Product Recycling Program:** Manufacturers required to provide recycling for covered electronics. <http://www.ecy.wa.gov/pubs/wac173900.pdf>.
 4. **Ecology Coordinated Prevention Grants:** Available to local governments to develop and implement their hazardous and solid waste management plans. <http://www.ecy.wa.gov/programs/swfa/grants/cpg.html>.
 5. **Ecology Public Participation Grants:** Public Participation Grants provide funding to citizen groups and not-for-profit public interest organizations to provide public involvement in monitoring the cleanup of contaminated sites and prevent pollution by reducing or eliminating waste at the source. <http://www.ecy.wa.gov/programs/swfa/grants/ppg.html>.
 6. **Washington State Environmentally Preferable Purchasing Policies:** The State of Washington has a broad legislative and policy mandate for environmentally preferable purchasing activities by state agencies. This mandate is articulated in state executive orders, laws and rules. Executive Orders (EOs) are issued by the Governor to direct state agencies and officials in their execution of established laws or policies. The Revised Code of Washington (RCW) is the compilation of all permanent laws now in force in the State of Washington. The Washington Administrative Code (WAC) is the compilation of all rules promulgated by state agencies.

A brief summary of environmentally preferable purchasing executive orders, laws and rules for state agencies is listed below. For more information on specific activities or directives contained within each order, law or rule, follow the link provided.

[Executive Order 02-03 SUSTAINABLE PRACTICES BY STATE AGENCIES](#)

This Executive Order calls for each state agency to establish sustainability objectives and modify their purchasing practices in order to:

- minimize energy and water use
- shift to clean energy for both facilities and vehicles
- shift to non-toxic, recycled and remanufactured materials in purchasing and construction
- expand markets for environmentally preferable products and services
- reduce and eliminate waste

Each agency is required to prepare a biennial Sustainability Plan guided by the above objectives and an annual report on its progress in implementing its Sustainability Plan.

The Office of Financial Management must designate a Sustainability Coordinator to help state agencies meet the goals of the Executive Order.

[Executive Order 05-01 ESTABLISHING SUSTAINABILITY AND EFFICIENCY GOALS FOR STATE OPERATIONS](#)

The Executive Order directs state agencies to achieve specific sustainability goals and required actions:

- incorporate green building practices based on Leadership in Energy and Environmental Design (LEED) standards into new building construction and major remodeling projects
- achieve a target of 20% reduction in petroleum use in the operation of state vehicles by 2009
- employ professional vehicle fleet management practices to achieve more fuel efficient and low emission agency fleets
- significantly reduce office paper purchases by 30%, increase the purchase of environmentally preferable paper to at least 50%, recycle all used office paper, and increase the purchase of post-consumer recycled janitorial products
- reduce energy purchases by 10% from FY 2003 to 2009

[Executive Order 04-01 PERSISTENT TOXIC CHEMICALS](#)

The Executive Order directs state agencies to take steps to reduce persistent toxic chemicals in Washington State's environment. Specifically, it directs:

- General Administration (GA) to make available for purchase products that do not contain persistent toxic chemicals. If such products are not available, products with the least amount of persistent toxic chemicals shall be made available.
- Each state agency to adopt measures to reduce purchase of goods that contain persistent toxic chemicals. Agencies are directed to report annually on progress in meeting these measures.
- Department of Ecology to establish through rule specific criteria for use in identifying persistent toxic chemicals.

[Executive Order 07-02 Washington Climate Change Challenge](#)

The Executive Order establishes the goal of reducing greenhouse gas emission in the state of Washington to:

- 1990 levels by 2020 and to 25% below 1990 levels by 2035.

[Chapter 43.19 RCW Department of General Administration](#)

This statute, which is GA's enabling legislation, provides a broad legislative basis for state purchases of recycled content and energy saving products. It also provides the flexibility to allow GA to award state contracts based on environmental considerations. It establishes that factors beyond price, including past performance and life cycle costing, are to be used in determining the "lowest responsible bidder."

[Chapter 43.19A RCW Recycled product procurement](#)

This statute was established to substantially increase the purchase of recycled content products by local and state government agencies. This statute

- established numeric goals for statewide purchase of recycled content paper and compost
- directs GA to develop a strategy for state agencies and GA to increase purchases of plastic products, retread and remanufactured tires, motor vehicles, lubricants, latex paint and lead acid batteries having recycled content.

[Chapter 43.19.539 RCW Purchase of Electronic Products Meeting Environmental Criteria](#)

This statute requires the Department of General Administration to

- establish purchasing and procurement policies that establish a preference for electronic products that meet environmental performance standards relating to the reduction or elimination of hazardous materials.
- ensure that their surplus electronic products, other than those sold individually to private citizens, are managed only by registered transporters and by processors meeting the requirements of RCW [70.95N.250](#).
- ensure that their surplus electronic products are directed to legal secondary materials markets by requiring a chain of custody record that documents to whom the products were initially delivered through to the end use manufacturer.

[Chapter 39.35D RCW High-performance public buildings Green Buildings](#)

State-owned buildings and schools shall adopt recognized standards for high-performance public buildings and allowing flexible methods and choices in how to achieve those standards. Public agencies and school districts shall document costs and savings to monitor this program and ensure that economic, community, and environmental goals are achieved each year.

[Chapter 70.95M RCW Mercury Education Reduction Act Mercury Education Reduction Act](#)

The Mercury Education Reduction Act (MERA) mandates General Administration to give priority and preference to the purchase of equipment, supplies, and other products that contain no mercury-added compounds or components.

[WAC 236-48-096 Bid Award Preference](#)

Washington Administrative Code 236-48-096 establishes a bid award preference for recycled products. When determining the lowest responsive bid, bids for goods certified as recycled are to be given a preference of 10% of the amount of the bid.

7. **Local governments:** Local governments have instituted plans and a wide range of programs and policies to establish reduction, reuse, recycling, and composting activities, to increase procurement of environmentally preferable products, and to ban specific

materials from disposal. Program information is shared through a variety of means including Recycling Coordinator meetings, Solid Waste Policy Forum, and the State Solid Waste Advisory Committee. Product stewardship efforts are coordinated through the Northwest Product Stewardship Council. <http://www.productstewardship.net/>

8. **Businesses:** Many businesses have instituted internal policies to address waste and recycling and some have begun to implement product stewardship programs. Washington has many businesses engaged in the business of reuse, recycling, composting, and processing, including reuse organizations such as Goodwill, and businesses that refurbish electronic equipment and resell building materials. Other businesses incorporate recycled content into their products. Green building activities are coordinated by a variety of business interests including the Built Green program of Master Builders and the Cascadia Green Building Coalition, and others.
9. **Non-Governmental Organizations:** A variety of NGOs have internal policies and work on implementation and coordination of policies and programs. These include Washington Citizens for Resource Conservation, Washington State Recycling Association, Washington Organic Recycling Council, Washington Toxics Coalition, Pollution Prevention Resource Center, and others.

Types(s) of GHG Reductions

[TWG has begun to provide input; to be discussed at next CAT meeting]

Estimated GHG Savings (in 2020) and Costs per MtCO_{2e}

[TWG has begun to provide input; to be discussed at next CAT meeting]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

[Insert text here]

Feasibility Issues

[Insert text here]

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-4. Agricultural Carbon Management

Straw Proposal Development Status: Developed by TWG; Ready for CAT Review

Based on AW Catalog Options 2.3, 3.1, 3.3, 3.4, 4.1, and 5.2

Mitigation Option Description

Vegetation and soils represent a substantial global pool of stored carbon at more than 2,000 gigatons (billion tons) of carbon. Human activities have severely depleted carbon levels in these terrestrial pools releasing that carbon to the atmosphere. For instance, most agriculturally cultivated soils have lost at least 50% of the native carbon to the atmosphere. Changes in management in terrestrial systems can “restore” some of the lost carbon to soils and vegetation.

Agriculture carbon sequestration uses agricultural crops and acreage to store carbon in biomass and soils. Management functions that affect agricultural carbon storage include (1) biomass production / inputs, (2) residue management, and (3) soil disturbance. Increased biomass inputs (either through production, translocation, or residue management strategies) coupled with reduced disturbance will lead to increased soil carbon storage. Low biomass production, residue removal, and/or tillage reduce soil carbon storage. Existing, commercial management tools can affect each of these functions (positively and negatively).

In addition to human management activities, natural features such as precipitation patterns, soils, and temperature also affect the capacity of soils and vegetation to store carbon. The highly variable agro-climatic conditions in Washington State significantly impact the capacity of soils and vegetation to store carbon. Therefore, agricultural carbon management policies need to recognize variability across the landscape.

Mitigation Option Design

- **Goals:**
 - Increase soil carbon storage statewide in agricultural soils by implementation of proven and novel technologies, such as reduced tillage, cover cropping, increased perennial cropping, rotational grazing, managed grasslands, and alternatives to agricultural burning.
 - Increase diversion of organic residuals and wastes from all sources (including municipal wastes) for land application on agricultural soils.
 - Increase vegetative standing biomass in agriculture by 80,000 acres per year through the use of high biomass producing woody crops and perennial grasses sequestering.
 - Expand use of agricultural crops and residuals for bioproducts that sequester carbon (e.g. fiberboard from straw).

- **Timing:**

Soil carbon sequestration timing:

- Increase use of no-till / direct-seed farming practices in the dryland (high and intermediate rainfall zones) region of the state by an average of 100,000 acres / year between 2010 and 2020 for a total of at least 1 million acres (total no-till acres will be ~ 25% of dryland acres).
- Increase use of high-residue farming (ie. cover crops, no-till, etc.) practices in the irrigated region of the state by 30,000 acres / year between 2010 and 2020 for a total of at least 300,000 acres (25% of irrigated acres).
- Increase use of improved management on pasture / grassland / rangeland / Conservation Reserve Program lands throughout the state by an average of 300,000 acres / year between 2010 and 2020 for a total of at least 3 million acres (~35% of rangeland / pasture / grassland) by 2020.
- Increase use of high-biomass perennial crops (hybrid poplar, switchgrass, etc.) to increase soil carbon storage by an average of 20,000 acres / year beginning in 2016, for a total of 80,000 acres by 2020. This practice initiates later due to the need to have commercially viable cellulosic energy conversion technologies / markets in place.
- Consideration must be given for the maintenance (or offset) of existing soil carbon pools, such as orchards, riparian areas, and Conservation Reserve Program / Set-aside lands – most of which are affected by either markets or additional [state and federal] government programs.

Land Application of organic residuals:

- Re-direct the equivalent of an additional 0.8 million dry tons of raw organic residuals (equivalent to 1/3 of waste paper in Washington State) for land application to agriculture by 2020. These organic residuals could come in the form of raw, composted, anaerobically digested, or thermochemically converted materials.

Standing Biomass:

- Increase use of high-biomass perennial crops (hybrid poplar, switchgrass, etc.) to increase above-ground, vegetative carbon storage by an average of 20,000 acres / year beginning in 2016, for a total of 80,000 acres by 2020. This practice initiates later due to the need to have commercially viable cellulosic energy conversion technologies / markets in place. Credit for the above ground carbon storage of perennial crops may need to be transferred if the biomass is converted to energy or materials.
- Consideration must be given for the maintenance (or offset) of existing vegetative carbon pools, such as orchards, riparian areas, and Conservation Reserve Program / set-aside lands.

Use of biomass for bioproducts:

- Collection of crop residues / biomass crops from ~80,000 acres of high-yielding, irrigated land (approximately 30% of current irrigated wheat production) beginning ~2016 for sequestration in long-term materials storage (ie. straw board, etc.). Note: Removal of crop residue will eliminate or reduce soil carbon sequestration – and therefore cannot be double credited and should be constrained

to high-yielding farmland. Furthermore, removal of crop residues (and standing biomass) has implications for nutrient management.

- **Coverage of parties:** Washington State University, Conservation Districts, USDA Natural Resource Conservation Service, Washington State Department of Agriculture, Washington State Department of Ecology, private sector
- **Other:** There is additional potential to increase carbon sequestration through agriculture practices beyond what is explicitly stated in the goals above. However, there is not enough information currently available to fully develop policies in these areas: replace CO₂ emitting practices with CO₂ neutral practices in agriculture (e.g. generation of CO₂ in greenhouses; crop drying); optimize carbon-cropping for the state's diverse bioregional specifications that reduction GHG emissions, sequester carbon, and allows a cash crop for farmer (e.g. food, fuel, or carbon crop); increase conversion of dryland acreage to irrigated acreage (this will increase carbon sequestration but will rely upon more water that may not be available due to existing water rights and potential reduction in hydro power, snowpack, and rainfall); organic cropping systems (additional research is needed to compare location-specific organic and conventional cropping systems for carbon sequestration using life cycle assessment techniques that include, but are not limited to, tractor/farm vehicle hours, fuel usage, source of any nutrient and pesticides, hauling of nutrients and pesticides and respective application rates, and energy use from processing/conversion of crops for next stage use).

Implementation Mechanisms

[TWG has begun initial discussions]

Related Policies/Programs in Place

[TWG has begun initial discussions]

Types(s) of GHG Reductions

[TWG has begun to provide input: to be discussed at next CAT meeting]

Estimated GHG Savings (in 2020) and Costs per MtCO_{2e}

[TWG has begun to provide input: to be discussed at next CAT meeting]

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[TWG has begun initial discussions]

Additional Benefits and Costs

[TWG has begun initial discussions]

Feasibility Issues

[TWG has begun initial discussions]

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-5. Agricultural Nutrient Management

Straw Proposal Development Status: Not yet developed by the TWG

Based on AW Catalog Options 3.2, 3.3, and 5.2

Mitigation Option Description

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other: Implementation Mechanisms**

Related Policies/Programs in Place

Types(s) of GHG Reductions

Estimated GHG Savings (in 2020) and Costs per MtCO_{2e}

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-6. Reductions In On-Farm Energy Use and Improvements in Energy Efficiency

Straw Proposal Development Status: Not yet developed by the TWG

Based on AW Catalog Options 5.1

Mitigation Option Description

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other: Implementation Mechanisms**

Related Policies/Programs in Place

Types(s) of GHG Reductions

Estimated GHG Savings (in 2020) and Costs per MtCO_{2e}

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-7. Preserve Open Space/Agricultural Land

Straw Proposal Development Status: In progress

Based on AW Catalog Options 4.2

Mitigation Option Description

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other: Implementation Mechanisms**

Related Policies/Programs in Place

Types(s) of GHG Reductions

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- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

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Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD