



BART Sustainability Action Plan

Full Report



December 2017

Table of Contents

EXECUTIVE SUMMARY

1 INTRODUCTION	4
<i>Taking Action</i>	
<i>Policy Vision and Goals</i>	
<i>Timeline of Sustainability Efforts</i>	
2 GOVERNANCE	9
<i>Resources</i>	
<i>Leadership</i>	
<i>Mission</i>	
<i>Partnerships</i>	
<i>Integration</i>	
<i>Inspiration</i>	
<i>Visibility</i>	
<i>Implementation</i>	
3 ACTIONS : OVERVIEW	18
<i>Sustainability Categories</i>	
<i>Action Identification</i>	
<i>Action Prioritization</i>	
<i>List of Priority Actions</i>	

ACTIONS

4 RESOURCE CONSERVATION – Energy and GHG Emissions	21
<i>Opportunities for conservation and renewable energy</i>	
5 RESOURCE CONSERVATION – Water	37
<i>Efforts to reduce use of water resources</i>	
6 EMISSIONS AND POLLUTION CONTROL	46
<i>Activities related to solid waste management, wastewater, stormwater, and other sources of pollution</i>	
7 MATERIALS AND CONSTRUCTION OPERATIONS OPTIMIZATION	57
<i>Environmental performance in material selection, construction, and fabrication of transit system physical components</i>	
8 EXTREME WEATHER ADAPTATION AND RESILIENCE	64
<i>Efforts to address impacts from extreme weather events and natural disasters</i>	
9 SMART LAND USE AND LIVABLE NEIGHBORHOODS	70
<i>Opportunities to work with local and regional partners on policies and programs that support place-making, increase mobility, and promote development near transit</i>	
10 PATRON EXPERIENCE	77
<i>Measures that support a positive patron experience</i>	



Chapter 1 Introduction | Taking Action

Sustainability at BART is both **what BART does**, and **how BART does it**. BART is essential to the mobility, economy, and livability of the Bay Area, for riders and non-riders alike. BART plays a central role in meeting the region’s sustainability goals by providing a reliable transit option that significantly reduces the region’s greenhouse gas emissions. In addition, BART is committed to integrating sustainability into its daily operations and future transit investments.

What BART Does: Approximately 430,000 passengers exit BART turnstiles each weekday. During peak periods, at 24 trains per hour per direction, BART transports more people from the East Bay to San Francisco than the Bay Bridge does. In California, about 40% of greenhouse gas (GHG) emissions are produced by transportation, and of those, about 70% are produced by personal driving.¹ Current estimates show that BART displaces over 360,000 metric tons of carbon dioxide per year and the system eliminates around 2.6 times the emissions it produces through its own service.² These contributions make BART indispensable to the important task of creating a more sustainable Bay Area. Data gathered by the Bay Area Council in 2013 indicated that when BART is not running, congestion produces an additional 16 million pounds of carbon dioxide equivalent each day.³

Average number of weekday trips system-wide	430,000 trips
Average passenger trip length	15 miles
Gallons of gas saved on average by avoiding driving (round trip)	1.4 gallons
GHG emissions avoided in one average round trip	27 lbs CO₂e⁴
Average GHG emissions avoided by BART riders per weekday ⁵	2.7 million lbs CO₂e
Total GHG emissions displaced by BART riders in 2015	350,000 MTCO₂e⁶

¹ California Greenhouse Gas Inventory 2016 Edition California Air Resources Board, https://www.arb.ca.gov/cc/inventory/pubs/reports/2000_2014/ghg_inventory_trends_00-14_20160617.pdf

² GHG Displacement Inventory Fiscal Year 2016, N. Wong.

³ Bay Area Council. BART Strike Having Costly Environmental Impact on Bay Area. 2013.





⁴ lbs CO₂e = Pounds of Carbon Dioxide equivalent. CO₂e is an equivalence to measure all greenhouse gases and their global warming potential in terms of carbon dioxide’s warming potential.

⁵ BART Green Fact Sheet revised 6/1/2017. https://www.bart.gov/sites/default/files/docs/2017%20Green%20Factsheet%20_Final.pdf.

⁶ MTCO₂e stands for metric tons of CO₂e.

By reducing the need to drive, BART makes possible dense, mixed land-use patterns, contributing to places where people can rely less on cars for their daily needs. The compact, walkable communities made possible by BART support healthy lifestyles, making it convenient for residents and workers to walk or bicycle frequently. BART also reduces transportation costs for its riders, equitably serves all populations, and strengthens the economy.⁷ A well-functioning BART system is essential to the health of the region — connecting workers with businesses, residents with recreational activities, and relieving regional traffic congestion.

How BART Does It: As BART prepares to modernize the system, sustainability helps define how BART does its work. BART has been a signatory of the American Public Transportation Association (APTA) Sustainability Commitment since 2010. The APTA Commitment sets out four core principles listed in the table below.

APTA Sustainability Commitment Principles	BART Achievement
1. Make sustainability a part of your organization’s strategic objectives.	
2. Identify a sustainability champion coupled with the human and/or financial resources and mandates.	
3. Establish an employee outreach program to engage staff.	
4. Undertake a sustainability inventory of your organization.	

Consistent with APTA’s program, this Sustainability Action Plan (Plan) identifies, evaluates and prioritizes the most important actions BART can take to advance sustainability through 2025 and implement the revised 2017 Sustainability Policy. This Plan was initiated in 2015 and finalized in 2017; data from 2015 is used to establish the Business As Usual (BAU) baseline⁸ from which the outcome of the actions will be compared and measured against in 2025. This Plan summarizes much of the existing sustainability work BART does and highlights the best approaches to leverage sustainability in the future planning, design, construction, operations and on-going maintenance of the system. At this time, BART’s Sustainability Program is especially focused on transitioning to clean energy while also achieving a return-on-investment in energy, managing long-term labor costs related to system maintenance, and introducing greater system resilience.

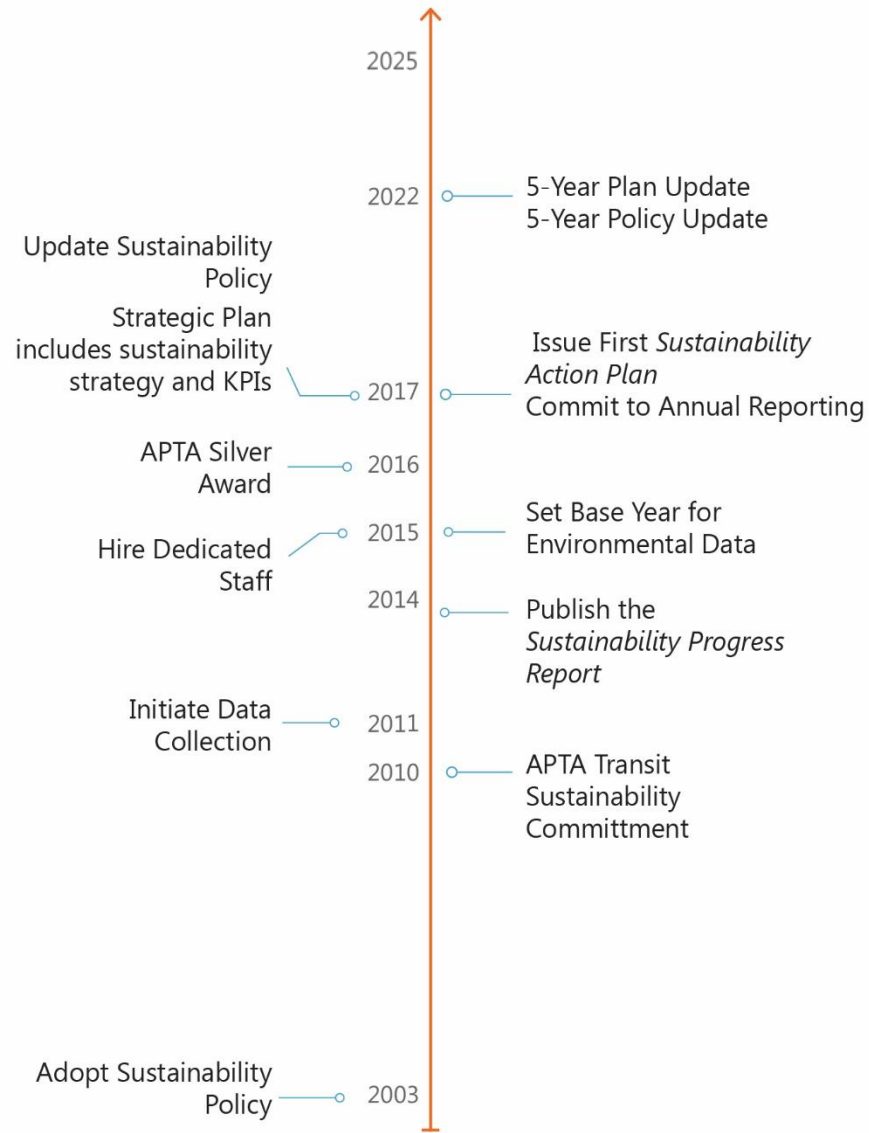
⁷ Role of BART in the Region report, October 2016 (found at www.bart.gov/about/reports).

⁸ For more information on the Business As Usual baseline, see page 19.



BART staff volunteering at the City of Oakland's Annual Earth Day Clean-up

Timeline of Sustainability Efforts



BART SUSTAINABILITY POLICY (Adopted 2017)

VISION

The San Francisco Bay Area Rapid Transit District (BART) is committed to advancing regional sustainability by providing safe, affordable, equitable, and environmentally-friendly transit to move people to jobs, recreation, and services. BART incorporates cost-effective sustainability through fulfillment of the following goals:

GOALS

1. Advance smart land use, livable neighborhoods, and sustainable access to transit by implementing:

- The District's Station Access policy.
- The District's Transit-Oriented Development policy.

2. Choose sustainable materials, construction methods, and operations practices by:

- Adopting standards, designing projects, and purchasing products and services to minimize ongoing maintenance and reduce waste.
- Considering net embodied energy, incorporating efficient construction, deconstruction, and recycling practices, and including local businesses.

3. Use energy, water, and other resources efficiently by:

- Achieving 100% renewable electricity supply through on- and off-site sources.
- Reducing energy use, water use, and consumption of other resources at all BART facilities and in non-revenue vehicles through resource-efficient equipment, systems, and practices.
- Designing new facilities to be resource efficient.

4. Reduce harmful emissions and waste generation by:

- Powering non-electric facilities and vehicles with sources generating the lowest feasible greenhouse gas emissions and criteria air pollutants.
- Reducing, reusing, and recycling materials including hazardous and non-hazardous materials.
- Managing wastewater and stormwater comprehensively, including strategies to reuse water safely.

5. Respond to risks from extreme weather, earthquakes, and other potential disruptions by:

- Assessing and addressing resilience in projects and operations to ensure BART is prepared for disturbances most likely to happen in the future, including impacts from climate change.
- Implementing hazard mitigation strategies that contribute to community safety.

6. Improve patron and employee health and experience by:

- Choosing the safest possible materials and design strategies for trains, facilities, and systems.
- Controlling noise to improve rider experience and reduce impacts on nearby residents and businesses.
- Providing clean and comfortable stations and trains that are easy to navigate while functioning smoothly.
- Implementing programs for BART employees to decrease their environmental impact.

7. Serve as a leader in sustainability for transit agencies and the communities that BART serves by reducing BART's environmental footprint and encouraging other organizations and institutions to act similarly.

Chapter 2 | Sustainability Governance and Implementation

Sustainability provides a common thread to many of BART's strategic directives. The District has taken active strides to formalize and reinforce its program. The following chapter describes how BART will integrate sustainability as a standard practice including leadership roles, accountability and reward systems, as well as opportunities for staff engagement. It also identifies the work BART will do to implement this Plan and update it regularly.

Eight steps BART is taking to integrate sustainability throughout the District include:

- 1 RESOURCES** - Dedicate sustainability staff, commit adequate funding
- 2 LEADERSHIP** - Involve the BART Board and top level management
- 3 MISSION** - Define mission, vision and core values
- 4 PARTNERSHIPS** - Use cross-cutting teams for action implementation and oversight
- 5 INSPIRATION** - Inform, engage and motivate employees
- 6 INTEGRATION** - Coordinate with existing decision making tools; i.e. performance measures and budget prioritization
- 7 VISIBILITY** - Gain public recognition and support for District sustainability initiatives
- 8 IMPLEMENTATION** - Ongoing reporting on progress, regular updates, incorporating actions into annual workplans and budgets

1 - RESOURCES – Dedicate sustainability staff and commit adequate funding

In 2015-2016 the District established the Sustainability Group and began to develop internal protocols for sustainability implementation. The table following describes the overarching responsibilities of the Sustainability Group. Funding sustainability initiatives requires a broader array of cross-department agreements. BART is working to develop funding tools including identifying new sources with external grants or partnerships as well as areas for internal cooperation and procedures integrated into BART's existing funding streams. BART is also developing methods to understand the comprehensive costs and savings of a project when evaluating funding.

Sustainability Group Manager

- Oversees Sustainability Action Plan implementation
 - Leads Executive Committee
 - Supports resource allocation and clarifies staff roles
 - Identifies obstacles and develops strategies to overcome them
 - Guides policy decisions related to Sustainability
 - Communicates with the public about BART sustainability activities
-

Sustainability Group Staff

Four staff including a Sustainability Project Manager, Energy Division Manager, Energy Analyst, and Environmental Engineer. Staff will:

- Manage BART's energy portfolio and transition to clean energy
- Implement sustainability projects and support other groups in incorporating sustainable features into projects
- Conduct training in sustainability
- Coordinate with relevant internal departments
- Develop funding initiatives as feasible
- Collect and track data related to established Targets and Goals
- Contribute to new procedures and standards to achieve sustainability goals

2 - LEADERSHIP – Involve the BART Board and top-level management

In 2017 BART’s Board adopted an updated Sustainability Policy directing the District to implement this Sustainability Action Plan. The sustainability leadership team will ensure that policies and objectives are established and compatible with the District’s strategic direction. Leaders help integrate sustainability into business practices, ensure adequate resources, and promote a culture of continuous improvement.

Position	Sustainability Focus Area
General Manager, Board of Directors	Holds Departments accountable for meeting Sustainability Action Plan Targets
Executive, Planning Development and Construction (Committee Sponsor)	Sponsors the interdepartmental Sustainability Executive Committee (more fully described in Partnerships, later in the chapter) to review and implement Sustainability Actions
Department Leads	<ul style="list-style-type: none">• Implement sustainability actions in areas of their control• Take responsibility and initiative to identify areas of improvement• Coordinate with Sustainability Executive Committee
Sustainability Group Manager	Highlights sustainability initiatives at “All Hands” or “Monthly Managers” meetings, particularly those with positive impacts on revenue and efficiencies

3 - MISSION – Define mission and core values

BART’s overarching Vision is to support a sustainable and prosperous Bay Area by connecting communities with seamless mobility. BART’s Mission is to provide safe, reliable, clean, quality transit service for riders. This mission is identified in the 2015 Strategic Plan Framework, which also identifies Environment, Equity, Economy, Experience, and Financial Stability as key goals, as shown in Figure 1.

Actions that focus on the Environment and support these goals are primarily described in this Plan. Sustainability is also reflected in the Strategic Plan Framework’s Economy and Equity goals. BART’s approach to equity includes hiring a diverse workforce, the equitable delivery of transit service, universal access, and compliance with Title VI requirements. BART’s approach to economic sustainability includes supporting the Bay Area’s growing economy with transit connections that save time and money. Financial stability includes optimizing system performance, peak hour fleet availability, fleet reliability, system reinvestment and balancing the transition to clean energy with low and stable operating costs. The Sustainability Action Plan aims to bring these related efforts together. Thus, the Economy and Equity goals are referenced and supported in this Plan.

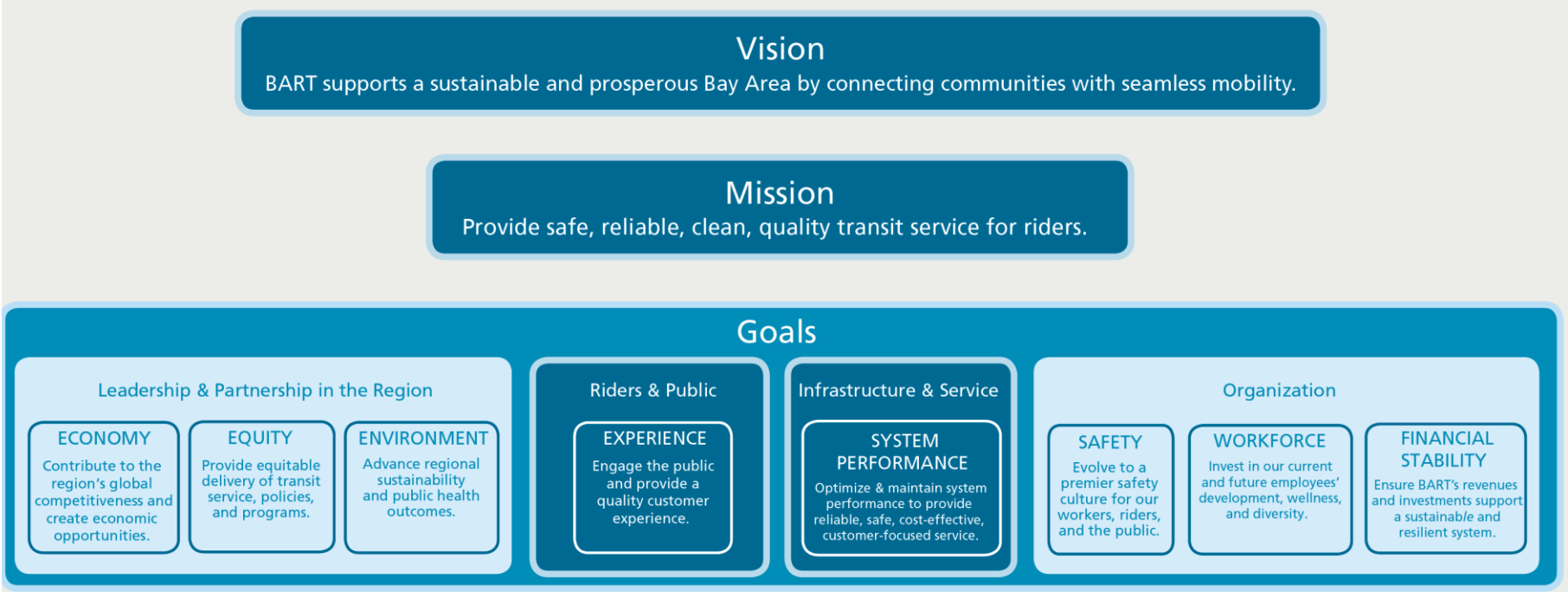


Figure 1 – Strategic Plan Framework Goals (2015).

4 - PARTNERSHIPS – Use cross-cutting teams for implementation and oversight

A Sustainability Executive Committee was established in 2016. This committee is comprised of Executive-level Assistant General Managers with authority to approve and direct sustainability action implementation. Led by the Sustainability Group Manager, the Committee also presents a substantial opportunity for cross-department engagement. Committee members will be asked to provide implementation support for this Plan by assigning staff to participate in associated projects, identifying ways sustainability can be incorporated into their own and others' workplans, and communicating about sustainability to their staff.

5 - INTEGRATION – Incorporate sustainability into existing decision-making tools and procedures

Sustainability criteria will be incorporated into BART's existing decision-making tools e.g. workplans, performance evaluations, budget prioritization, and procurement processes. Opportunities to support internal funding and decision-making processes include:

- *Workplans* – Use the four-year workplan process to coordinate implementation of priority sustainability projects and work directly with departments with identified dependencies.
- *Budget requests* – Incorporate sustainability priorities into project funding requests; i.e. resource conservation and cost savings.
- *Performance evaluations* – BART uses an employee performance evaluation that includes both environmental management and environmental justice criteria. Sustainability staff will work with Human Resources to further define how employees throughout the District can help achieve sustainability goals and raise awareness.
- *Executive decision-making documents* – Include a summary of impact to equity and environment along with fiscal stability.
- *New procurement procedures* – BART is exploring the implementation of a sustainability project checklist: policies for third-party certifications, Total Cost of Ownership⁹ decision-making tools, and a Green Purchasing Policy.

Sustainability priorities will also be directly incorporated into major initiatives:

- *Big 3 Priorities* (Fleet of the Future, Train Control System and Hayward Maintenance Complex). These three capital projects will apply sustainable approaches to energy and resource conservation while expanding system capacity.
- *System Renewal* (Measure RR) – Identify opportunities for integrating sustainable and green materials into station design as well as innovative technology upgrades for renewable energy and energy storage.

⁹ Total Cost of Ownership (TCO) is a financial estimate intended to determine the cost of a purchase across a product's or system's entire lifecycle. The overall TCO includes direct and indirect costs such as purchasing, deploying, using, and retiring/recycling of a product or system.

- *Asset Management Framework* – Include sustainability as a criterion by which assets should be evaluated and prioritized.

6 - INSPIRATION – Inform, engage and motivate employees

BART is a complex organization, made up of administrative, planning, design, operational, engineering, and maintenance staff. Those in Operations (including Transportation and System Service, Rolling Stock and Shops, and Maintenance and Engineering) and the Police Department total more than 3,000 of the 3,600 BART employee population. These groups represent the largest opportunity to spread the sustainability message. **BART will ensure that every employee can participate in its sustainability objectives.** Beyond the discrete actions included in this Plan, achieving ambitious sustainability targets requires a shift in cultural expectations.

The District is also working to address change at the individual level by:

- Recruiting staff champions who influence activities through informal networks and engaging them to broaden sustainability efforts
- Exploring formal channels for cross-department engagement, e.g. listening platform for employee sustainability input, the BART intranet, or crowd-sourced idea platforms
- Organizing brown bag lunch learning sessions
- Recognizing employees who have taken initiative on sustainability
- Promoting internal campaigns, posters and other communication techniques

The District has pledged to train all employees on sustainability. Sustainability training may also be integrated into existing training programs such as:

- Safety training and accident prevention
- New employee orientation
- Training key groups that will implement sustainability

SUSTAINABILITY AT OTHER TRANSIT AGENCIES

MetroLinx in Ontario, Canada developed an Ideas at Work online crowd-sourcing platform for its employees. The idea for the platform was initially generated via an employee survey to ensure insights from operations staff were being heard and to introduce innovation. The platform is now being refined to move the ideas from the front line up the pipeline.

- Mentorship programs
- Employee wellness programs
- Related process and program delivery efforts
- Project Manager training

7 - VISIBILITY – Gain public recognition and support for agency sustainability initiatives

BART is already a national leader in sustainability, achieving Silver recognition from the American Public Transportation Association (APTA) in 2016. BART is now on the path to the highest levels of recognition.

The top levels of BART leadership will include BART’s focus on sustainability in public presentations and make clear BART’s significant role in achieving our shared, regional sustainability goals.

BART will develop a website featuring its sustainability strategy. The website will frame information and include updates on quickly moving efforts and accomplishments. It will provide links to the Sustainability Action Plan, Sustainability Policy, related documents, and key target reporting. BART will report on its sustainability accomplishments annually and publish the results on its website.

SUSTAINABILITY AT OTHER TRANSIT AGENCIES

Washington Metropolitan Area Transit Authority (WMATA) in Washington D.C. holds an annual awards reception to acknowledge staff who introduce projects with cost savings and sustainable business practices.

InterCity Transit in Olympia, WA relies on incentive programs to demonstrate the high value the Authority places on innovation. Employee recognition programs for sustainability include the opportunity to earn merit-based vouchers that can be cashed in once a year. Video displays run stories on the employee successes.

At InterCity Transit, the General Manager signs an individual letter of thanks to each person. Coworkers and managers support each other in innovation and excellent customer service.

8 - IMPLEMENTATION – Provide ongoing progress updates, incorporating actions into annual workplans and budgets

Establishing targets and assembling appropriate data to monitor performance provides teams with the capacity to conduct comparisons and gives decision-makers (and other team members) relevant information to adjust approaches. This Plan commits BART to new environmental targets and proposes strategies to track the related performance. This Plan includes the following implementation activities:

- Plan Targets will be assessed for progress annually towards 2025 goals
- Plan action status will be reported annually
- All annual reporting will be presented to the Sustainability Executive Committee
- New actions will be identified and prioritization will be updated as actions are completed
- Annually, the Sustainability Group will work with other teams to support inclusion of Plan actions into annual work plans and budgets
- Every five years, the Sustainability Action Plan and Sustainability Policy will be reviewed and updated as needed

As feasible, annual sustainability reporting will coincide with Strategic Plan reporting. Staff will report on progress meeting identified targets and actions using a template for Sustainability Reporting.

New BART train during testing, 2016



Chapter 3 | ACTIONS

This chapter provides a framework to understand BART's sustainability targets, actions and progress towards implementing each action. Sustainability at BART is organized into the seven categories shown in the image on the right. These seven sustainability categories are organized based on the goals in the 2017 Board-adopted Sustainability Policy and they span across multiple departments' responsibilities. The following pages briefly outline how this Plan was built and how certain Actions are identified and marked for Priority implementation.

The remaining chapters in this Plan are devoted to an in-depth focus on each of the seven sustainability categories. Each chapter includes relevant targets, a category overview, current achievements and initiatives, and a detailed Actions Table of future work. The Action Tables call out discrete Actions that represent significant opportunities spanning:

- System planning and design,
- Maintenance,
- Operations,
- New construction, and
- Long-term capacity building (e.g. future staffing, pipeline for future sustainability opportunities)

Each Action is associated with at least one Department that is responsible for leading the implementation of a listed Action. As sustainability is inherently cross-functional, key collaborator Departments that are crucial to achieving each Action are also listed in the Action Tables.

The Sustainability Group will be primarily focused on actions that support Environmental Performance, and Operations and System Resilience. In many cases, BART's Sustainability Group provides a coordinating role and will assist in resourcing the technical expertise found in the Engineering or Operations Departments.

SUSTAINABILITY CATEGORIES



While each action is listed under a single category, many offer co-benefits. For example, energy efficient lighting retrofits (*Resource Conservation – Energy and Greenhouse Gas Reduction Action 7*) not only supports reducing energy use but also improves patron experience by fostering a safe and secure environment at BART stations. Actions with strong co-benefits and that meet multiple Departments’ objectives are key to the sustainability message for inter-department collaboration.

ACTION IDENTIFICATION

Actions in this Plan come from BART initiatives that are either proposed or underway, as well as best practices from other transit agencies. Many departments and stakeholders were consulted to establish Actions that are realistic and align to BART’s Goals (refer back to Strategic Plan Framework) and Sustainability Policy.

TARGETS

Each of the seven Sustainability Categories includes metrics to monitor program outcomes, support continuous program improvement, and conduct performance tracking in coordination with the BART Strategic Plan Framework. These measures may also be used as a communications tool for internal and external stakeholders and in on-going coordination between departments. Targets have been developed according to the following:

- Committed Goal – Based on commitment to Actions that met multiple BART objectives (see Criteria table on the next page); implementation is constrained by potential funding limitations.
- Aspirational Goal – Assumes implementation of all Actions outlined in this Plan and fewer budget constraints.
- Time Horizon – 2015-2025.

For quantitative environmental targets, e.g. water and energy reduction, BART assessed how much a given action might reduce a proposed metric’s projected 2025 Business as Usual (BAU) value. BART’s 2025 BAU values were calculated using assumed growth factors from BART’s Climate Action Plan Target Calibration Model (CAPTAC)¹⁰.

ACTION TABLES

The following chapters summarize each sustainability categories’ set of Actions and give a detailed description of associated sub-actions. Two-thirds of the identified Actions are already underway. Action Status is ranked as shown below, rating the relative progress BART is making on

¹⁰ For GHG and Energy reduction targets, the CAPTAC 2013 commitment and aspiration values were not used because they include energy efficiency factors that (a) do not reflect a BAU scenario, and (b) would double count the energy and GHG savings of many of the actions quantified. It is assumed that changes in metrics follow a linear path from 2020 to 2035.








action implementation. The BART group and/or division(s) responsible for implementing the actions are identified in each chapter’s Action Table as well, with the primary owner of the action listed first in bold and additional stakeholders listed after.

Action Tables also include a marker of priority. High priority actions are defined as those that have earned a total of 11 points or higher out of a possible 17 points. They were prioritized using the following measures:

Criteria	Score	Description
Impact	0-5	Assumed level of impact to the relevant sustainability metric.
Supports BART Major Priorities	0-3	Relationship/support for BART’s “Big Three” priorities (Train Control System; Hayward Maintenance Center Complex; Fleet of the Future). Connection to Measure RR funding.
Feasibility	0-3	Availability of internal technical resources, staff capacity and political will.
Funding	0-3	Relative availability of new external funding, partnerships or grants, or existing internal funding sources.
Visibility	0-3	Relative importance to Board, Public and Employees.

Measure RR is a \$3.5 billion general obligation bond that will help fund rebuilding and upgrading BART’s aging infrastructure. The funds will be spent on specific infrastructure and stations and will address safety, reliability and capacity. The Actions that will be funded and at least partially implemented by BART’s Measure RR campaign are identified by the RR logo.

Action Status Ranking and Level of Completion

Priority	
Complete 75%-100%	
Partially Complete 50%-75%	
Underway 25-50%	
Limited Activity 0-25%	
No Activity	
Measure RR	

Refer to the Action Status markers shown above when reviewing the Action Tables in each of the following chapters.



2025 TARGETS

Committed | Aspirational

Reduce Total District Energy Use per Vehicle Revenue Mile (VRM) vs. 2025 Business as Usual Scenario

4% | 6%

Reduce Total Greenhouse Gas (GHG) Emissions per Vehicle Revenue Mile (VRM) vs. 2025 Business as Usual Scenario

85% | 89%

Note: BART targets are normalizing by Vehicle Revenue Mile (VRM) to control for higher than average numbers of passengers per car in the achievement of its targets.

GOAL: Use Energy Efficiently and Minimize Related Emissions.

The transportation sector accounts for 36% of the climate change emissions in the Bay Area with single occupancy automobile travel accounting for a majority of those greenhouse gas (GHG) emissions.¹¹ By providing over 430,000 passengers trips each weekday and nearly 129 million trips annually, BART has significant positive influence on the GHG emissions of Northern California's transportation sector. The composition of BART's power portfolio impacts the GHG footprint of every resident who relies upon BART for their mobility. BART's efforts to supply its traction power with low carbon and carbon-free energy are also contributing to achieving statewide GHG targets – seeking to return emissions to 1990 levels by 2020 (Assembly Bill 32 (AB32) – the Global Warming Solutions Act). BART also supports a shift from driving alone to transit, which is part of the Bay Area's commitment to reducing carbon emissions.

¹¹ 2016 CARB California GHG Emission Inventory.

BART ENERGY USE SUMMARY

Electricity

BART is one of the largest consumers of electric power in Northern California, using about 400,000 megawatt hours (MWh) of electricity annually. This is similar in scale to the City of Alameda’s annual consumption.

96% of the energy consumed at BART is in the form of electricity. After labor, electricity is the District’s second largest operating expense, costing the agency around \$40 million a year. As shown in Figure 2, BART’s single largest source of energy demand is its *traction power* (for train propulsion), consuming nearly 80% of purchased electrical power and 75% of total District energy overall. Electricity is also used for lighting, communication systems, control systems, fare systems, elevators and escalators, train washing and maintenance activities.

Fuel

4% of BART energy is consumed as fuels (acetylene, propane, gasoline, diesel and natural gas). These are used to power BART’s non-revenue vehicles and equipment, and provide heat.

Energy and Greenhouse Gas (GHG) Emissions

Energy used by BART is directly related to its Greenhouse Gas (GHG) emissions. APTA divides the impact of transit on GHG emissions into three categories: operational emissions (burning fuel, purchased electricity), emissions from capital projects, and displaced emissions (land use effects, patrons using transit). This chapter addresses operational and capital emissions produced by transit. The major elements are inventoried such as tailpipe emissions from transit vehicles, electricity used for rail, and maintenance yards and stations operations. BART does not quantify emissions from capital projects at this time.

BART also inventories the third category, emissions displaced by people choosing to take transit. The net impact of these GHG emissions is detailed in Chapter 9 Smart Land Use and Livable Neighborhoods.

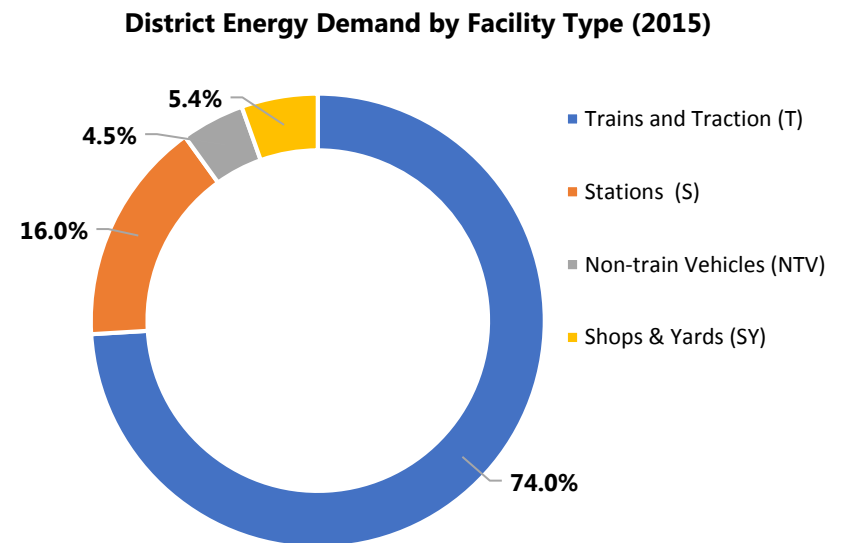


Figure 2 – District Energy Use by Facility Type Climate Action Plan Target Calibration Model (CAPTAC) 2015.

BART has established a series of Resource Conservation – Energy (RCE) actions to help meet adopted targets for the District’s energy and GHG emissions reductions. For the purposes of target setting, each of the fourteen actions (as listed below) have been assessed for potential impact to BART’s 2025 Business As Usual (BAU) scenario.¹² Actions were classified by two tiers of implementation: “commitment” and “aspirational”. Committed actions form the basis of the lower end of the target range and aspirational actions (possible with dedication of additional resources) provide the upper end. In some cases, an action was assumed to have both a lower (committed) level of implementation and a higher (aspirational) level of implementation. Eight of the fourteen actions were quantified. Those not quantified may achieve energy and GHG reductions but do not *directly* lead to those reductions or there is not enough data to quantify the impact. Combined, these fourteen actions have the potential to reduce the District’s 2025 energy use per Vehicle Revenue Miles (VRM) by 6%, and traction power GHG emissions per VRM by up to 87%.

Details on each action are found in the *RCE Action Table* at the end of this chapter.

ACTION	TITLE
RCE 1	Increase Capacity to Support Regional GHG Goals
RCE 2	Adopt a Strategic Energy Plan
RCE 3	Make Renewable Energy Purchases
RCE 4	Invest in On-Site Energy Generation
RCE 5	Investigate Investment in Renewable Diesel
RCE 6	Conduct Station Energy Consumption Analysis
RCE 7	Invest in District Lighting Retrofits
RCE 8	Onboard New Energy Efficient Train Cars
RCE 9	Reduce Electricity Losses from Traction Power
RCE 10	Explore Opportunities for Energy Storage
RCE 11	Green Non-Revenue Fleet
RCE 12	Reduce Employee Trips in Non-Revenue Vehicles
RCE 13	Support Energy Efficiency Operations in Offices
RCE 14	Implement EV Charging Policy

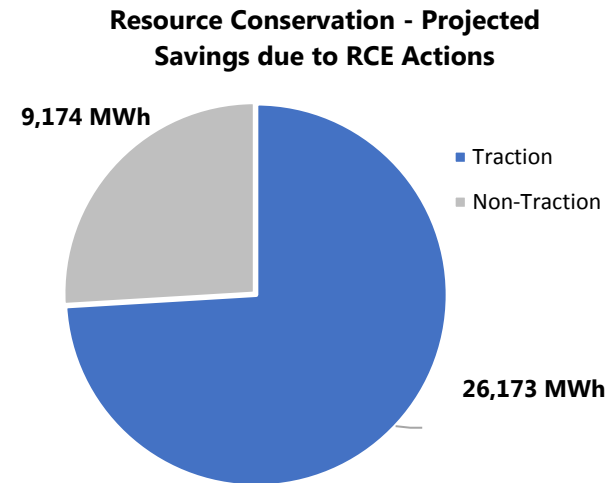


Figure 3 - Most of BART’s energy savings result from changes to traction power. Traction energy accounts for 74% of the 6% aspirational reductions relative to the 2025 BAU.

¹² 2025 BAU values are calculated using assumed growth factors from BART’s Climate Action Plan Target Calibration Model (CAPTAC).

TARGETS

Total District Energy Use per Vehicle Revenue Mile By 2025

The Bay Area has been responding to climate change for nearly a decade, beginning with the 2006 passage of California’s Assembly Bill 32 (AB32), the Global Warming Solutions Act. This bill set a statewide reduction target of 1990 emission levels by 2020 and required adoption of reduction measures by 2011. Subsequent Executive Orders require GHG reductions of 80% by 2050. As part of this process, BART developed a thorough inventory of all sources of its GHG emissions. The Climate Action Plan Target Calibration Model (CAPTAC) baseline information was most recently updated in 2015. Emissions data is summarized below:

BART Greenhouse Gas Emissions Inventory (2015)

BART Supply	% Total GHG Emissions
Trains and Traction Power	75.4%
Stations	16.3%
Non-Train Vehicles	3.4%
Offices	N/A
Shops and Yards	5.0%

BART Greenhouse Gas Emissions Sources (2015)

Emissions Source	% Total GHG Emissions
Electricity (indirect Purchased)	96.0%
Gasoline	2.4%
Diesel	1.0%
Natural Gas	0.7%
Propane/ Acetylene	N/A

To project BART’s future energy use, a Business As Usual scenario (BAU) is calculated. 2025 BAU values are calculated using assumed growth factors from BART’s CAPTAC model. The CAPTAC model assumes metrics increase or decrease linearly from 2020 to 2035, with the 2025 figure representing a point in the linear projection. The BAU incorporates all funded projects as of 2015 as well as operation and service changes BART will implement by 2025. As Figure 4 illustrates, the BAU Total Energy Use per Vehicle Revenue Mile (VRM) in 2025 is similar to the existing Total Energy Use per VRM. The major changes reflected in the BAU include the new fleet, traction power efficiency, the new computer based train control system, station energy efficiency upgrades, non-revenue vehicle efficiency improvements, and operational efficiencies based on the new trains and control system.

Like today, BART’s projected 2025 energy use is primarily associated with the electricity used to run its traction power (estimated at 79% in 2015 and 83% in 2025). Figure 4 shows that BART achieves the most impact in energy from the new trains; over 4% of energy reductions result from BART’s commitment to purchase new, more efficient trains (RCE 8). The aspirational target becomes possible with additional

investments in lighting retrofits (RCE 7) and wayside energy storage capacity (RCE 10) as well as greening the non-revenue vehicle fleet (RCE 11).

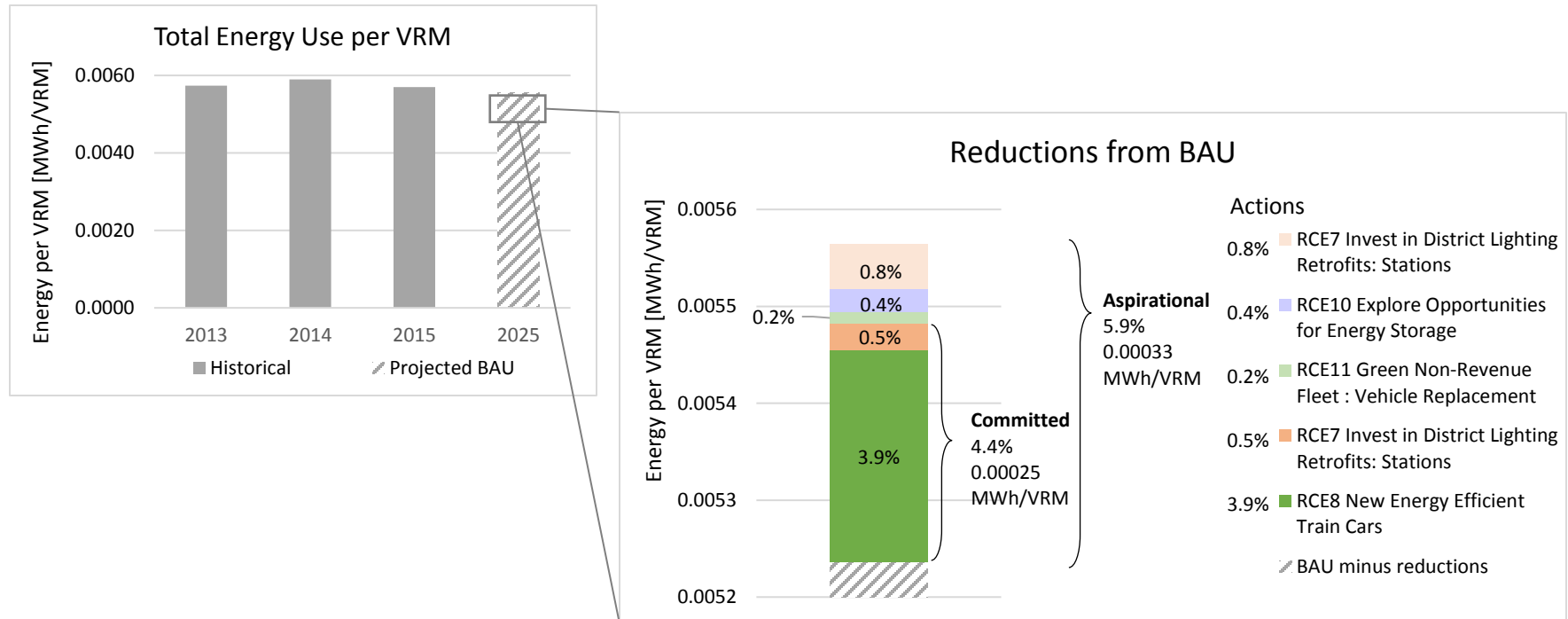


Figure 4 – Left: Historical and projected traction power District Energy Use per Vehicle Revenue Mile (VRM). Right: Potential impact of committed and aspirational actions on the projected 2025 BAU scenario. Note: Actions repeat where there are both committed and aspirational impacts from the same activity.

Reduce GHG Emissions per BART Vehicle Revenue Mile

The State of California allows BART to purchase wholesale power. California State Senate Bill 502 (SB502), adopted in 2015, also expands the District's energy procurement options.¹³ The ability to negotiate directly with suppliers reduces BART's electricity costs and makes measuring and monitoring GHG emissions associated with its operations straightforward. BART's current energy contracts are relatively short-term, many of which began in 2017. Ongoing renegotiation of these contracts represent the beginning of an effort to aggressively target 100% zero-carbon and renewable sources to power the system.

With this major shift in energy procurement strategy, BART aims to reduce up to 87% of its GHG emissions from the 2025 BAU scenario. Of the fourteen Resource Conservation actions, projected GHG reductions are strongly dominated by renewable energy purchases.

BART's 2025 GHG emissions per VRM can be significantly reduced primarily through the commitment to purchase 100% low-carbon, zero-carbon and renewable electricity (RCE 3),¹⁴ which could reduce GHG emissions per VRM by 80.4%. As shown in Figure 5, additional GHG emission reductions result from the purchase of new, more efficient trains (RCE 8). The non-traction power GHG emissions result from conserving fuel use as well as on-site solar PV (RCE 4), district lighting retrofits (RCE 7) and greening of the non-revenue vehicle fleet (RCE 11).

Beyond the committed actions, adding the aspirational use of renewable diesel in eBART (RCE 5) and the potential for new energy storage options (RCE 10) would reduce GHG emissions by an additional 3.2%. Combined, these actions could boost BART to an aspirational target of 89.0% reduction in GHG emissions by 2025.

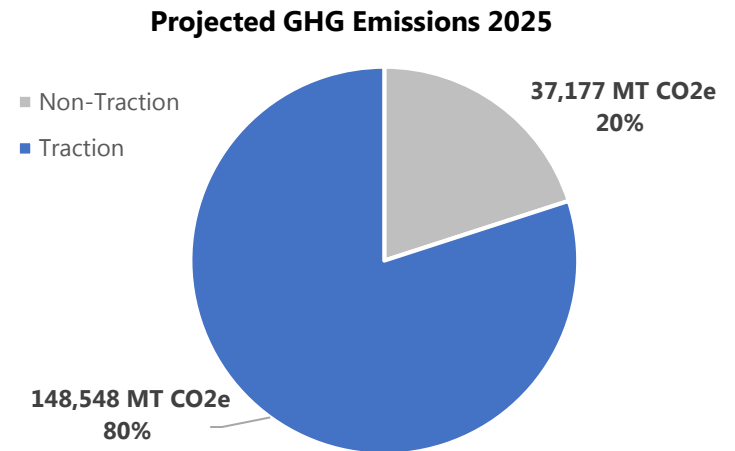


Figure 5 - Projected 2025 GHG emissions breakdown by traction and non-traction GHG emissions. Traction includes GHG emissions from train and traction electricity consumption plus eBART diesel, while non-traction GHG is composed of GHG emissions associated with the rest of BART's energy consumption (facilities, etc.).

¹³ PUC 701.8 (b)(3) and (g).

¹⁴ A maximum of 100 lbs CO2e per MWh was assumed in calculating potential reductions, as this is BART's committed average carbon intensity for 2017 through 2024.



Chapter 4 ACTIONS | Resource Conservation – Energy & GHG Emissions

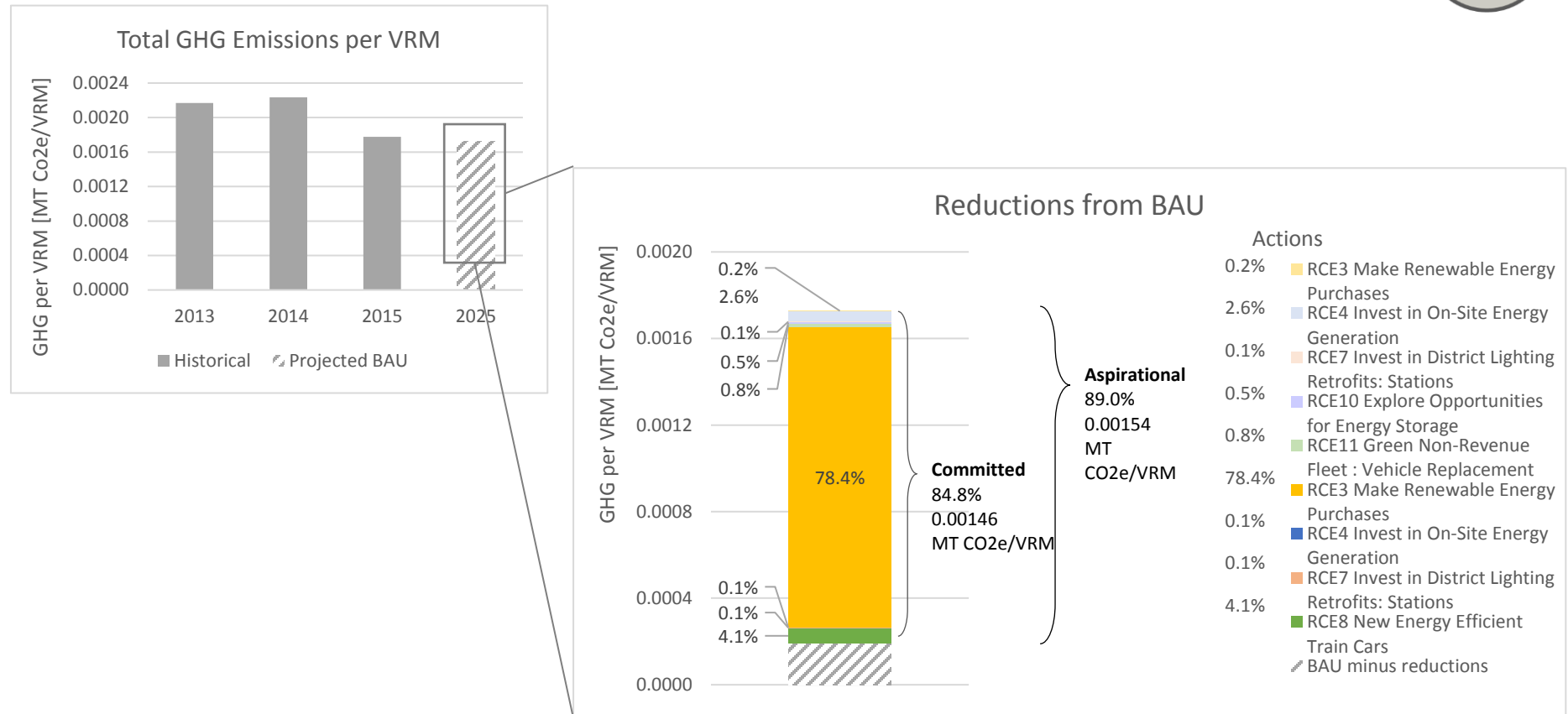


Figure 6 – District GHG Emissions per VRM historical (left) and projected 2025 BAU scenario reductions (right). Note: actions repeat where there are both committed and aspirational impacts from the same activity.



Current Achievements and Initiatives

ON-SITE RENEWABLES

The District is exploring the use of on-site solar systems to power trains, stations and other facilities. The recently opened Warm Springs Station has a 512 kilowatt (kW) on-site solar system that helps power the station and the electric vehicle (EV) chargers. It produces enough energy to power the equivalent of approximately 100 homes. In addition, BART has installed on-site solar systems on the rooftops of its Richmond and Hayward maintenance yards and over its pedestrian promenade and busway at the Union City Station. Solar projects are under construction at the new Antioch Station and the existing Lafayette Station. These projects are each 1 megawatt (MW) in size and will be operational in 2018. These local, clean power sources are part of BART's effort to provide renewable energy to support operations. BART will continue to evaluate

appropriate locations for future on-site renewables, taking into consideration the potential energy production and potential alternative uses including transit-oriented development.

[For Next Steps See RCE 4](#)

INVESTING IN ELECTRIC VEHICLE CHARGING

In support of the Bay Area deployment of plug-in electric vehicles (EV), BART initiated a pilot project at the Warm Springs Station. In the first phase, BART built EV parking spaces and associated charging capacity for 42 vehicles. This demonstration project will be monitored to guide development of BART's future EV Charging Policy and influence future charging station investments over the next 10 years. The EV Charging Policy will also consider providing

employee charging at yards/shops. This resource would provide co-benefits to employee mobility and make use of existing on-site solar investments.

[For Next Step See RCE 14](#)

EFFICIENT FACILITIES

When BART-owned projects are newly constructed or renovated, the BART Facilities Standards (BFS) sets building efficiency standards and guidelines for design.

The BFS addresses:

- *Configuration and Building Placement* – natural ventilation, daylighting, solar access, etc.
- *Envelope* – insulation and windows.
- *Mechanical Systems* – HVAC, commissioning, appliances.
- *Lighting* – efficient fixtures, smart controls, daylighting.
- *Integrated Building Systems* – metering, verification, advanced controls.

[For Next Steps See RCE 6](#)

DISTRICT LIGHTING RETROFITS

BART is advancing its use of energy efficient lighting in coordination with the Station Modernization program. The BFS incorporates efficient LED lighting and fixture specifications, smart controls and daylighting.

BART has conducted several high-level assessments of the potential for District-wide lighting retrofits.¹⁵ A 2016 study¹⁶ evaluated the lighting conditions based on fixture current condition, age and energy efficiency in stations and associated parking facilities. BART is planning to expand the study to shops, tunnels and yards.

The Station Modernization program is implementing lighting upgrades at Powell, 19th Street and El Cerrito Del Norte Stations. BART is focusing on lighting replacement in first priority locations, which includes LED lights and centralized smart lighting controls to maximize energy efficiency and patron safety. System-wide, lighting retrofits have the potential to save more energy in the short-term than any other action evaluated. Lighting retrofits are expected to generate a return on investment for BART.

[For Next Steps See RCE 7](#)

¹⁵ Energy Solutions Memo, BART Lighting Strategy – Initial Findings v.2, March 31, 2015.

¹⁶ Arup North America, BART Stations' Lighting Status Summary report, November 16, 2016.

NEW ENERGY EFFICIENT TRAIN CARS

BART is expanding its train car fleet with 166 new cars starting service in 2018. New cars will alleviate crowding and improve rider comfort during peak periods. The cars may also reduce greenhouse gas (GHG) emissions by enabling more people to use transit rather than drive.

The new cars have been designed to be at least 7% more efficient than those currently in service, largely due to improvements to the regenerative braking capture system.¹⁷ New more efficient train cars are estimated to reduce BART's 2025 energy use by 4% and reduce 2025 GHG traction emissions by 5%. These estimates are based on approximations of the proportion of new vehicles to existing cars in the 2020 and 2030 fleets and their associated energy savings. Additional sustainable features include:

- Lightweight design,
- Natural heat and light reflection properties of aluminum,
- A white roof to help lessen the load on the interior cooling system, keeping passengers comfortable while decreasing energy consumption,
- Energy savings operations modes,
- Sensors to automatically detect available sunlight and adjust LED brightness accordingly.

For Next Steps See RCE 8

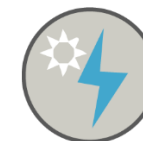
¹⁷ <http://www.bart.gov/about/projects/cars/sustainability>

ENERGY STORAGE CAPACITY

As BART continues its investment in on-site solar PV, the District is seeking to understand the best options for station energy storage for use during hours of peak demand. In addition to solar power generation, BART is interested in expanding its capture of the braking energy from vehicles stopping and slowing. While some of this energy is currently reused by nearby trains, additional energy storage allows for energy for later use.




BART is analyzing a variety of energy storage and capture options and will continue to evaluate the most promising technical solutions. Whatever technology is selected will complement upgrades to electrical systems funded by Measure RR.

For Next Step See RCE 10

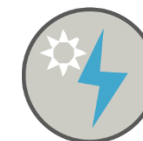








ACTION TABLE

The following section lists recommended actions to achieve BART **Resource Conservation – Energy and Greenhouse Gas Emissions** Goals.










ACTION – Resource Conservation – Energy and Greenhouse Gas Emissions		STATUS/ PRIORITY	RESPONSIBILITY
 <p>RCE 1 Increase Capacity to Support Regional GHG Goals</p>	<p>Enable expanded service for additional riders by increasing the ridership capacity of the BART system. Expanding service provides more opportunities for Bay Area residents and visitors to take low-GHG trips through the region and supports regional efforts to set the stage for such trips through land use and transportation policies and investments. Much of this action is reflected in the BAU activities to expand the fleet and modernize train operations.</p>		<p>All</p>
	<p>In addition, this action includes a number of smaller projects that build upon the BAU scenario and if implemented will further increase efficiency and capacity. These projects include vertical circulation (elevator and escalator) upgrades, fare gate replacements, and a pilot project to test platform screen doors to allow additional passengers to safely use the platform.</p>		
<p>RCE 2 Adopt a Strategic Energy Plan</p>	<p>2.1 Develop a plan to achieve low carbon energy procurement targets (and other identified energy performance goals). The focus of the plan will be on defining procedures to implement the Wholesale Electricity Portfolio Policy.</p>		<p>Sustainability (Energy Division) Budgets Financial Planning</p>
	<p>2.2 Develop a Wholesale Electricity Portfolio Policy.</p>		<p>Sustainability</p>
	<p>2.3 Develop procedures to track and report out on energy indicators and set performance goals. Implement Asset Management software to track District energy use.</p>		<p>Sustainability IT Accounts Payable</p>

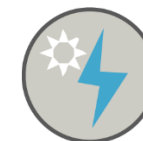
Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program



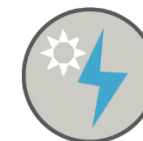
ACTION – Resource Conservation – Energy and Greenhouse Gas Emissions		STATUS/ PRIORITY	RESPONSIBILITY
RCE 3 Make Renewable Energy Purchases	Continue to invest in wholesale low-carbon, zero-carbon and renewable electricity purchases to meet the Performance Metrics in the Wholesale Electricity Portfolio Policy (RCE 2.2).	 	Sustainability Procurement
RCE 4 Invest in On-site Energy Generation	4.1 Move forward with additional appropriate locations for on-site solar photovoltaic (PV) power generation.	 	Sustainability Procurement Legal SE/CM Stations Planning RE+PD
	4.2 Further explore the trade-offs between solar power generation and BART's Transit-Oriented Development and housing policies; maximize the potential for PV applications where feasible.		Sustainability RE+PD Stations Planning
	4.3 Continue to seek outside funding sources to support PV installations and associated energy storage.		Sustainability Grants
RCE 5 Investigate Investment in Renewable Diesel	eBART, which will run diesel trains, is expected to begin service in 2018. BART also operates non-revenue heavy machinery using diesel and uses diesel in its non-revenue fleet. Determine eligibility for eBART's use of renewable diesel and explore the feasibility of including a percentage of biofuels or renewables into the fuel mix for non-revenue service fleet. (See also RCE 11).		Sustainability eBART/BART to OAK Operations Planning
RCE 6 Conduct Station Energy Consumption Analysis	An energy monitoring study will assess electricity consumed by each equipment category in stations by investigating six representative stations. This study will help prioritize decision-making for efficient replacement of station components such as lighting, escalators, fare gates, and ventilation systems.		Sustainability M&E (Engineering: Electrical Engineering)






ACTION – Resource Conservation – Energy and Greenhouse Gas Emissions		STATUS/ PRIORITY	RESPONSIBILITY
 <p>RCE 7 Invest in District Lighting Retrofits</p> <p>Co-benefits to:</p>  <p>Patron Experience</p>	<p>7.1 Prioritize stations for energy efficient lighting retrofits with attention to return on investment, capital needs planning, and maintenance. Expand prioritization to include other types of facilities such as parking lots, garages, shops, towers, and yards. The Sustainability Work Plan commits to Implement Energy Efficiency lighting strategy at 3 to 4 stations for Fiscal Years 2018 through 2020.</p>	 	<p>Sustainability ODA SE/CM M&E (Engineering: Electrical Engineering)</p>
	<p>7.2 Determine next steps for lighting upgrades and develop robust lighting design guidance to ensure lighting is considered as a part of comprehensive station design. Guidance should also foster a sense of safety and security while allowing for energy savings.</p>		<p>Sustainability ODA CPSE/CM M&E (Engineering: Electrical Engineering)</p>
<p>RCE 8 Onboard New Energy Efficient Train Cars</p> <p>Co-benefits to:</p>  <p>Patron Experience</p>	<p>Continue to fund the new train car procurement, and after the fleet is in operation, conduct testing to confirm energy efficiency gains.</p>	 	<p>RS+S (New Car Procurement)</p>
 <p>RCE 9 Reduce electricity losses from Traction Power</p>	<p>Traction power accounts for 79% of BART’s electricity use, so even a small reduction in losses offers significant opportunities to conserve energy, particularly during upcoming track renewal and system control upgrades. The Measure RR work will provide opportunities to replace traction power systems with current-technology materials that will reduce the losses. The Sustainability Team will continue to work with BART staff to explore and apply potential improvements to achieve efficiencies.</p>		<p>M&E (Engineering: Traction Power) Sustainability</p>




ACTION – Resource Conservation – Energy and Greenhouse Gas Emissions		STATUS/ PRIORITY	RESPONSIBILITY
<p>RCE 10 Explore Opportunities for Energy Storage</p>	<p>Regenerative energy capture has the potential to reduce electricity purchases for BART traction power energy.</p> <p>10.1 Continue to seek funding options to support investment in energy storage technologies in coordination with Measure RR projects and new vehicle procurement.</p>		<p>Sustainability Grants M&E (Engineering: Traction Power)</p>
	<p>10.2 Conduct an engineering-level study of feasible options to demonstrate long-term, system-wide implementation of energy storage.</p>		<p>Sustainability RS+S (Revenue Vehicle Maintenance Engineering) M&E (Engineering: Traction Power)</p>
<p>RCE 11 Green Non-Revenue Fleet</p> <p>Co-benefits to:</p> <p>Smart Land Use and Livable Neighborhoods</p>	<p>While the GHG emissions of the non-revenue vehicle fleet will decrease via more stringent fuel economy standards, opportunities may be further developed to reduce operational emissions and phase in the purchase of cleaner alternative fuels, more efficient vehicles and new technologies.</p> <p>11.1 As gasoline vehicles are retired from the fleet, replace with hybrid vehicles on a continuing basis. Pickup trucks and sedans that have less than five years of useful life left may be retired and replaced early. The incremental investment in a hybrid vehicle is paid back in fuel savings for those vehicle types in approximately five years.</p>		<p>Sustainability M&E (ROW Maintenance: NRV) RS+S</p>
	<p>11.2 Right-size heavy equipment vehicles to be the appropriate scale for the activity.</p>		<p>Sustainability M&E (ROW Maintenance: NRV)</p>
	<p>11.3 Implement operational strategies such as anti-idling and other fuel saving driving techniques.</p>		<p>Sustainability M&E (ROW Maintenance: NRV)</p>



ACTION – Resource Conservation – Energy and Greenhouse Gas Emissions		STATUS/ PRIORITY	RESPONSIBILITY
<p>RCE 12 Reduce Employee Trips in Non-Revenue Vehicles</p>  <p>Co-benefits to: Smart Land Use and Livable Neighborhoods; Resource Conservation Energy</p>	<p>Reduce fuel and emissions by introducing new strategies for car-sharing and transit choice for BART employee work-related travel.</p> <p>Pilot employee-based mobility strategies; explore cost/benefit in relationship to reduction of BART’s non-revenue service (employee pool) vehicles.</p>		<p>Sustainability M+E (ROW Maintenance: NRV) Human Resources Transportation All</p>
<p>RCE 13 Support Energy Efficiency Operations in Offices</p>	<p>BART currently rents office space in the LEED certified Kaiser Building at 300 Lakeside Drive in downtown Oakland (this building is not included in the Corporate GHG Inventory). BART’s lease expires in 2021, offering negotiating opportunities and the ability to consider long-term space needs and sustainability requirements. When considering future office needs, the District should take into consideration the energy efficiency of the options. In addition, BART assumed ownership and management responsibilities of the MTC Building in 2017. Any future improvements to the building should consider energy efficiency as a goal.</p> <p>In the near-term, assess the feasibility of reducing BART’s organization-wide energy use via employee training such as avoiding continuous operation of electronics and other office equipment when not in use.</p>		<p>Sustainability RE+PD</p>



ACTION – Resource Conservation – Energy and Greenhouse Gas Emissions		STATUS/ PRIORITY	RESPONSIBILITY
RCE 14 Implement EV Charging Policy	14.1 Pursue funding opportunities for implementing EV charging for BART patrons and employees.		Sustainability M&E (ROW Maintenance: NRV) Customer Access
	14.2 Pilot EV charging at the new Warm Springs Station. Develop a pilot project that includes the installation of EV charging stations and a process for assessing how the EV charging is used.		
	14.3 Following the Warm Springs pilot, develop a policy, implementation strategy, and metrics for appropriate expansion of EV charging at additional stations.		
	14.4 Install EV charging stations at BART shops and yards to enable the purchase/lease of EVs as part of BART’s non-revenue fleet.		
	14.5 Install EV charging stations at shops and yards (and other locations with high employee parking) to allow BART employees who cannot take BART to work because of their duty location to charge their vehicle.		



2025 TARGETS

Committed | Aspirational

Reduce District Potable Water Use vs. 2025 BAU scenario
(General use, irrigation and fire)

6% | 17%

Total Gallons per Vehicle Revenue Mile (VRM)

GOAL: Optimize District use of potable and non-potable water resources.

Between 2010 and 2016, the State of California faced a severe drought, prompting the governor to call for a 20% voluntary reduction in water use across the State in 2014 and a 25% reduction in urban areas in 2015. Due to this multi-year drought, the State Water Board adopted emergency water conservation regulations in July of 2014 targeting outdoor urban water use. In November 2009, California passed Senate Bill 7-7 (SB7-7) requiring the state to achieve a 20% reduction in urban per capita water use by December 31, 2020.

BART WATER USE SUMMARY

BART’s 2015 District water use was nearly 42 million gallons, of which 80% was for general purposes, 19% was for irrigation, and <1% for fire. Water use will continue to rise as BART adds more infrastructure. On average, the general station water usage is roughly 630,000 gallons per year per station. However, this number varies greatly: in 2015, water use was as little as 59,000 gallons at the very urban 16th Street Mission Station to over 1.8 million gallons at Dublin/Pleasanton Station due to variations in irrigation needs and bathrooms’ usage/closures.¹⁸

BART began working to reduce water use in 2013. Between 2013 and 2015 BART reduced its water use by 17 million gallons or nearly 30%.

TARGET

Reduce District Potable Water Use

Seven water conservation actions (summarized in Figure 9) will help BART achieve its water conservation targets. These actions build on findings and staff estimates of costs initiated in 2013. Five of these actions, RCW 1 to RCW 5, were quantified. The final two actions that are not quantified would have indirect impacts on water savings; therefore, their impact is assumed to be <1% or 0%. The District is committed to Action RCW 1 Regularly Audit Water Use and Correct Issues, which is estimated to reduce the Districts water usage by 6%. The remaining actions are Aspirational and have the potential to reduce water usage by another 11%. Cumulatively, the actions have the potential to reduce BART’s water usage by 17%.

Figure 9 also shows historical and projected water use. The call-out box on the right estimates the impact of committed and aspirational actions on the projected 2025 BAU scenario. Over one third of reductions result from the improvements that could be realized via water audits and retrofits (RCW 1). An additional 11% in reductions could be achieved through the aspirational actions including renovating irrigation infrastructure (RCW 2), upgrading station water fixtures (RCW 3), and replacing yard water distribution systems (RCW 4). A modicum of

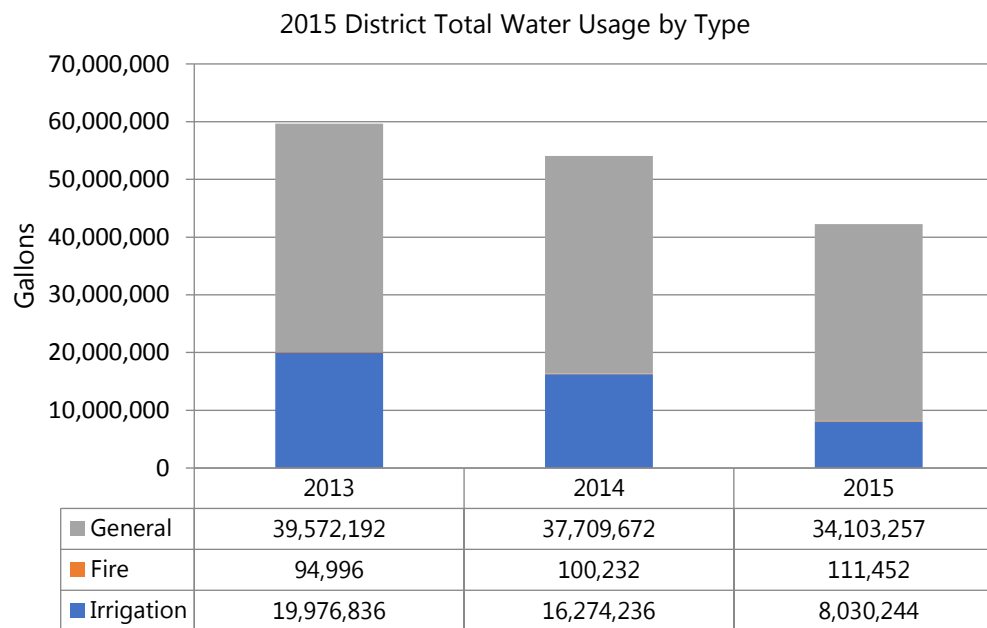


Figure 8 – BART District water use estimates.

¹⁸ 2016 BART Water Recorder, N. Wong.

additional savings may come from engaging staff to achieve water conservation (RCW 6). Details on each action are found in the *RCW Action Table* at the end of this chapter.

ACTION	TITLE
RCW 1	Regularly Audit Water Use and Correct Issues
RCW 2	Address Irrigation Usage and Infrastructure
RCW 3	Upgrade Water Fixtures
RCW 4	Replace Water Systems in Shops and Yards
RCW 5	Investigate Train Car Washing
RCW 6	Engage Operations Staff for Water Conservation
RCW 7	Participate in Water District Conservation Programs

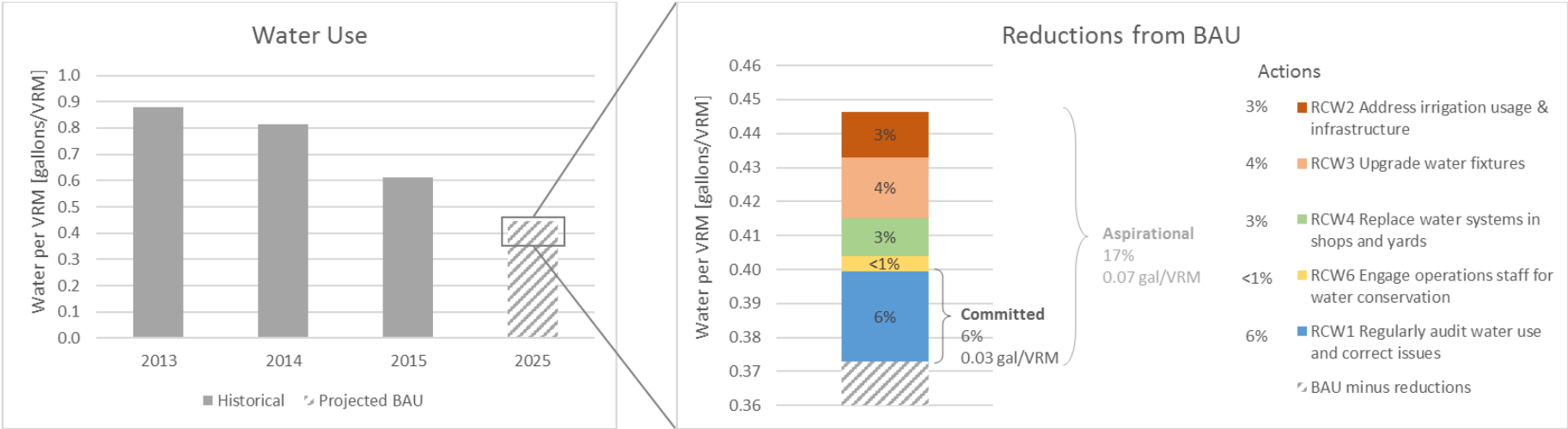


Figure 9 – Left: Historical and projected water use by VRM. Right: Potential impact of committed and aspirational actions on the projected 2025 BAU scenario.



Current Achievements and Initiatives

MONITORING AND TRACKING OUR WATER

BART is working to centralize how it tracks water consumption to obtain a complete understanding of its usage trends and opportunities across the District. BART purchases its water from sixteen different suppliers which account for over two hundred different accounts. This involves digitizing invoices and developing procedures for information systems. Systematic monitoring procedures are already paying dividends. Staff investigated the stations with the highest water usage. Except for Lake Merritt Station, all the high water use stations have seen their water use decline by 30% or more from 2013-2015. This decrease in water use is due primarily to changes in irrigation procedures. BART is now working to assess its performance against a 2015 baseline, identify

outliers, and target responses. Regularly monitoring station water usage and correcting any anomalies is estimated to have a savings of 6%. This estimate was made by identifying the existing higher-than-average water consuming stations and estimating that through monitoring and improvements the stations' usage can be brought down to the average consumption level.

[For Next Steps See RCW 10](#)

IRRIGATION IMPROVEMENTS

A 2014 survey explored the condition and function of irrigation systems across all stations and compiled information on component age and condition. The survey found that while 37 stations use

irrigation, the quality of the irrigation systems is inconsistent, infrastructure can be up to 40 years old, and much of the infrastructure is in need of replacement. Systems in poor condition require an estimated 80 hours per year of maintenance time.

BART can improve irrigation and landscaping at its stations for approximately \$200,000 per station, on average. Cost savings from reduced water usage and maintenance work would then save an estimated \$10,000 per year at each station. While temporary measures have been taken to cap systems in poor repair until funding is available for repairs and upgrades, these projects can be conducted on a station-by-station basis, as time and funding permits, and in conjunction with other projects. Older systems should be upgraded with labor saving features such as remote access to controllers and water saving features such as sub-surface irrigation, rain harvesting, and recycled water. Irrigation upgrades should be conducted in coordination with water saving landscape features; planting palettes and irrigation should only be used during an establishment period while the plants grow and take root.

In the shorter term, in response to the drought, BART implemented a series of irrigation actions between 2013 and 2014. Data suggests these actions:

- Saved BART over 5 million gallons of water a year.
- Reduced overall irrigation schedule by approximately 2/3.
- Reduced irrigation within 48 hours of a rain event.

[For Next Steps See RCW 2](#)

¹⁹ BART Facilities Standards (BFS) 32 90 00.

WATER WISE LANDSCAPING

Tied to irrigation improvements is an opportunity to incrementally change out existing plantings for climate-appropriate, water-saving varieties. In support of this initiative, BFS landscaping and planting standards and approved plant lists have been reoriented to preference native, water efficient, low maintenance and hardy plant selections.¹⁹

The landscape improvements unveiled in summer of 2016 at Richmond Station showcase the positive effects of complementary goals of water conservation, climate appropriate landscape, stormwater detention and filtration, beautification, and community place-making.

UPGRADING FIXTURES

Beyond landscaping, in-station water use is largely determined by the availability of a public bathroom. The public bathrooms were closed in the underground stations after September 11, 2001 due to homeland security issues.

In 2014, the Facilities and Building Maintenance Department surveyed the water fixtures in BART's station bathrooms. The stations contain 147 toilets, 34 urinals and 189 faucets. From this information, BART staff created a ridership-based model to estimate typical water usage at a station with open restroom facilities. The model suggests that the use of the stations water fixtures is approximately 5.5 million gallons annually. The baseline model allows Facilities and Building Maintenance to audit water use and prepares them to identify and address outliers.

Upgrading water fixtures in stations is the largest untapped opportunity to reduce BART’s water use system-wide. Upgrading water fixtures requires relatively little upfront investment and generates a net return on investment after about two years.

BART has also initiated several pilot projects in coordination with its water audits. In 2014, Buildings and Grounds piloted automatic dual-flush flush-o-meter upgrades for toilets. Bay Fair Station has piloted new fixtures.

[For Next Steps See RCW 3](#)

TRAIN CAR WASHING

BART washes its train cars as part of the maintenance process, as unwashed train cars will experience increased corrosion and pitting of the aluminum exteriors. The BART Facilities Standard (BFS) specifies standards for train washing conservation and to recycle water within the car wash to minimize water use and the quantity of wastewater produced.

Each of BART’s yards with washing facilities—Concord, Hayward, Daly City, and Richmond—has implemented the capture and reuse of car-washing water. Between 2004 and 2009, in response to drought conditions, BART installed water treatment systems into the vehicle wash operations. Each system is designed to capture and reuse 90% of the water (or approximately 1,040 gallons for a 10-car train) from each wash. BART introduced an optimization of the train car wash schedule in 2009 which significantly reduced the number of required washes while maintaining the same level of cleanliness.

²⁰ BART Sustainability Progress Report 2014, p. 34.




A 2010 study estimated that water recycling at BART train-washing facilities saves on the order of approximately 1.6 million gallons of clean water each year, which corresponds to about 4% of BART’s total annual water use.²⁰

[For Next Steps See RCW 5](#)






ACTION TABLES

The following section includes a series of recommended actions to achieve BART **Resource Conservation – Water** Goals.

ACTIONS – Resource Conservation – Water		STATUS / PRIORITY	RESPONSIBILITY
RCW 1 Regularly Audit Water Use and Correct Issues	1.1 Allocate resources to pilot water use data tracking in Asset Management software. Create baseline assumptions by station type (e.g. square footage, landscaping treatment type, other) to generate representative water consumption targets for different types of stations.	 	Sustainability CIO M&E (Facilities Maintenance)
	1.2 Continue to conduct leak detection and fixes at the high-water use stations in order of consumption volume.		M&E (Facilities Maintenance) Sustainability
	1.3 Investigate the potential to receive electronic data from Water Suppliers to support a more efficient work flow.		Sustainability CIO
RCW 2 Address Irrigation Usage and Infrastructure	<p>Irrigation infrastructure in poor repair results in both reduced water savings and labor costs.</p> <p>2.1 Prioritize irrigation upgrades in coordination with (RCW 1 Water Audit), targeting higher usage stations. Coordinate irrigation upgrades with on-going maintenance improvements and the station modernization program.</p>		Sustainability M&E (Engineering: Civil Engineering) M&E (Facilities Maintenance)

Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program



ACTIONS – Resource Conservation – Water		STATUS / PRIORITY	RESPONSIBILITY
Co-benefits to:  Emissions and Pollution Control; Patron Experience	2.2 Analyze pilot installation of remote access controllers at Warm Springs Station and apply lessons to other BART stations. Require new protocols to install similar controllers.		M&E (Facilities Maintenance: Grounds) Sustainability M&E (Engineering: Civil Engineering)
	2.3 Update the irrigation maintenance manual to ensure that irrigation watering frequency and volume is reduced after plants are established (BFS 32 84 00).		M&E (Facilities Maintenance: Grounds) Sustainability
RCW 3 Upgrade Water Fixtures	Upgrading water fixtures requires relatively little upfront investment, and generates a net return on investment after about two years. 3.1 In coordination with (RCW 1 Water Audit), develop a plan to prioritize the installation of water saving fixtures by station and/or fixture type. Install, as feasible.	 	M&E (Facilities Maintenance: Facilities/Building) Stations Planning Sustainability
	3.2 Audit existing fixtures in stations and ensure that control settings are designed for the specific application.		Sustainability M&E (Facilities Maintenance)
	3.3 If pilot testing for low flow fixtures is found to be positive, move forward to outfit stations with low flow toilets. Update the associated <i>BFS Designated Matching Products</i> list.		M&E (Facilities Maintenance: Facilities, Buildings) Sustainability



ACTIONS – Resource Conservation – Water		STATUS / PRIORITY	RESPONSIBILITY
RCW 4 Replace Water Systems in Shops and Yards	BART’s five yards and shops utilized 25% of District water in CY2015. Water pipe systems in these yards are at higher risk of leaks due to corrosion. Audit the Yards and Shops to identify leaks. Consider upgrades such as sectionalizing pipes with isolation valves. These upgrades will reduce leaks and allow simpler repair when leaks occur.		M&E (Facilities Maintenance) RS+S
RCW 5 Investigate Train Car Washing	Determine the most water-efficient cycle/schedule that still meets the District’s asset management needs. Reassess the wash cycle in conjunction with implementation of the new fleet in 2018 considering the new car requirements. In conjunction with the green purchasing policy, determine if there are greener alternatives to any of the chemicals used in the car wash process.		Operations Planning M&E Sustainability
RCW 6 Engage Operations Staff for Water Conservation	Educate and engage relevant staff on ideas for water conservation in the workplace. Quick changes identified by staff include: <ul style="list-style-type: none"> • Operations: improvements to cleaners, manual scrubbers, power washing. • Leaky hydrants: ensure that they are turned off. 		Sustainability
RCW 7 Participate in Water District Conservation Programs	BART partners with 16 different water suppliers. Water Districts offer rebates, incentives, and technical assistance. Take advantage of partnering opportunities for improved water efficiencies in BART operations, explore recycled water service and rebates, and explore the Water Smart Business Certification. Work with agencies to develop a more efficient exchange of information to influence the above.		Sustainability



6 ACTIONS | Emissions and Pollution Control

2025 TARGETS*

Reduce Total District Solid Waste (Total Tons by Vehicle Revenue Mile)

Increase Landfill Diversion Rate

**Solid Waste targets will be adopted in the future.*

GOAL: Reduce District waste generation and stormwater emissions.

BART's solid waste is disposed and directed to either landfills or recycling facilities. Waste is generated at administrative buildings, in passenger facilities and the shops and yards.

BART is proactively working to reduce its emissions and pollutant discharge – in some instances, beyond current regulatory requirements. BART's solid waste strategies respond to California State Assembly Bill 341 (2011), which sets a 75% goal to divert solid waste away from the landfill by 2020.

BART WASTE BASELINE SUMMARY

Solid Waste

BART is working to improve data collection and will adopt future targets for waste and landfill diversion. Figure 10 shows a working estimate for BART's solid waste disposal (system-wide). Diverted components include mixed recycled materials, metal and compost. The current BART diversion rate is estimated around 12.5%. At the administrative buildings, waste is generated by the employee and consists of office-related waste, typically paper. Waste generated at the passenger stations is generated from patrons and consists of a mix of products.

Stormwater

BART facilities have impervious surfaces that result in stormwater runoff. Stormwater can contain pollutants from the atmosphere, leaked from roadways and vehicles or trash that is blown into storm drains. The stormwater impacts of BART's construction and operations are regulated through the Industrial Stormwater Permit, the Municipal Stormwater Sewer Permit (MS4), and a Construction Storm Water Permit.

Hazardous waste generated primarily from maintenance activities at shops and yards and includes waste oil, soiled rags, spilled fuel, batteries, solvents and broken bulbs.

2015 District Solid Waste Summary

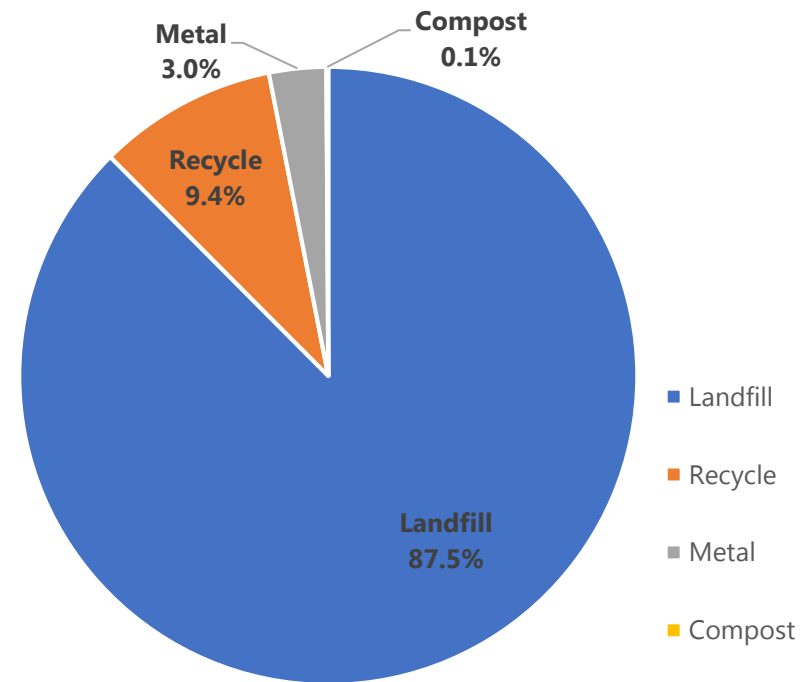


Figure 10 – 2015 working estimate of BART Solid Waste Inventory, with a total of 8,550 Tons. Recycled materials include paper, glass, cardboard, plastics and other assorted materials. Metals are separated from the recyclable category to indicate materials collected from BART's maintenance shops.



Current Achievements and Initiatives

SINGLE STREAM RECYCLING IN STATIONS

In 2015, BART began to explore the implementation of single-stream recycling in stations. Single-stream recycling is a system in which all types of recyclables (paper, plastics, metals, glass, etc.) are placed in the same receptacle and then separated at the recycling facility.

BART piloted three different types of trash and recycling receptacles at 16th Street, Fruitvale and Concord Stations. BART then performed a follow up study to audit the amount of waste collected and the diversion rates achieved using the receptacles. The study informed the selection of new receptacles and draft guidelines for their placement and identified several accompanying next steps to create

a successful program including a marketing and education campaign.

[For Next Steps See EP 1 and EP 2](#)

OFFICE WASTE

BART staff is working to reduce office waste. In 2015, the Procurement Department established a District-wide recycling program for used inkjet cartridges and toner cartridges. BART maintains a standard practice of purchasing paper with a 30% post-consumer content or greater. In 2013, 2,224 cases of paper were purchased avoiding over 3 million pages of new paper created. In 2016, BART worked with the managers of their administrative

building to implement composting and recycling throughout the office in an effort to support Oakland's Zero Waste Initiative.

[For Next Steps See EP 5 and EP 6](#)

RECYCLING IN FACILITIES – SHOPS AND YARDS

BART conducted an audit of the Oakland Facilities waste in 2012. The facility at the time had a 0% landfill diversion rate. The Stop Waste audit found that only 45% of Oakland shop and yard waste was actually trash (for landfill) while 35% was recyclable and 20% was compostable. A series of actions were identified, and recycling at the Oakland shops began in 2013. By 2015, the Oakland Shops diversion rate was estimated at 11%.

The Stop Waste audit suggested posting signs indicating what to place in each container, training employees on disposal practices, communicating with system services staff about the collection system, monitoring contamination in recycling bins, requesting compactor weight reports to monitor collection frequency, and providing employees with updated information each year. Upon full implementation of these actions, there is a high potential to

further increase recycling and save on waste disposal costs. Furthermore, building upon Oakland's experience, BART's other shops and yards have the potential to begin or increase recycling and save on waste pickup costs.

Another opportunity in shops and yards is to save costs on rag disposal. Currently, most shops dispose of rags that come into contact with hazardous waste. This disposal is costly, with BART paying \$67,000 for disposal of rags annually and an additional \$1,500 in annual disposal taxes. To eliminate these costs and the associated waste, the Oakland shop began using a hazardous waste laundry service for its 8.3 tons of rag waste per year at a cost of \$3,900 annually.

One of the most promising waste diversion opportunities is to expand the rag laundry service already in place in Oakland to non-Oakland shops. Cumulatively, these Shops generate an estimated 46.6 tons of rag waste per year. Scaling up the cost of Oakland's rag laundry service proportionally, and offsetting current disposal costs and taxes, BART would save approximately \$47,000 each year.

[For Next Steps see EP 3, EP 4, and EP 7](#)

CLEAN STORMWATER

BART Facilities Standards (BFS) have been updated in response to the California State Water Resources Control Board Municipal Separate Storm Sewer System (MS4), and are aimed at lessening and mitigating storm water runoff.

Specifically, the 2014 BFS update allows project managers to introduce areas for bioretention in projects with paved areas as feasible. These treatments help remove pollutants from storm water via natural processes such as filtration, infiltration, and sedimentation. Natural drainage pilot projects have been implemented, or are underway at the Oakland Maintenance Facility, Warm Springs, Union City, and Richmond Stations.



[For Next Steps See EP 8](#)

URBAN HEAT ISLAND EFFECT

The Urban Heat Island Effect is a phenomenon where the air and surface temperatures are higher in a localized area than in adjacent areas. This temperature difference is due to a number of factors, including a reduction in the amount of shade, an increase in the amount of heat-absorbing surfaces and the accumulation of waste heat from cars and energy consumption. BART is exploring how appropriate landscape coverage can reduce the heat island effect at its facilities. Plants also contribute to cooling the air through the evaporation of water from their leaves.

[For Next Steps See EP 10](#)

WATER DIVERSION AT SHOPS AND YARDS



BART is working to fully comply with changes to the California Industrial Storm Water Permit at its yards and shops. This requires installation of metal filtration equipment or storm water diversion to prevent pollution. BART is currently preparing to install bioretention areas at the Oakland Shops. In addition, the new Hayward Maintenance Center, currently under design, will pilot the use of a rainwater catchment system to replace municipal water used at the Train Car Wash facility and supply some of the non-potable water needs at the future Maintenance shop.

[For Next Steps See EP 8 and EP 9](#)








ACTION TABLES

The following section includes a series of recommended actions to achieve BART **Emissions and Pollution Control** Goals.

ACTIONS – Emissions and Pollution Control		STATUS/ PRIORITY	RESPONSIBILITY
<p>EP 1 Support Solid Waste Reduction</p> <p>Co-benefits to:</p>  <p>Patron Experience</p>	<p>Each of BART's 16 waste management vendors has different policies regarding their trash and recycling service. Service agreements specify the container size, frequency of pick-up, and numbers of containers.</p> <p>1.1 Review the results of the station recycling pilot project in association with the District waste audit (2017). Develop targets for BART's in-station recycling and landfill diversion rate. Provide resources for more robust monitoring of BART waste data.</p>		<p>Sustainability Transportation</p>
	<p>1.2 Perform a comprehensive waste hauler contract and service agreement audit. Renegotiate waste hauling and recycling contracts to achieve efficiencies and ensure vendors are meeting needs.</p>		<p>Transportation (Operations Support and Review) Sustainability</p>
	<p>1.3 Conduct a public education and marketing campaign for BART customers to support a District in-station recycling roll-out.</p>		<p>Sustainability Marketing and Research Transportation</p>
	<p>1.4 Hire more system service workers to provide service to and support implementing recycling in BART stations.</p>		<p>Transportation</p>

Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program








ACTIONS – Emissions and Pollution Control		STATUS/ PRIORITY	RESPONSIBILITY
<p>EP 2 Pilot Station Dumpster Enclosures Co-benefits to:</p>  <p>Patron Experience</p>	<p>The design and installation of secure trash enclosures at BART stations reduces contamination levels, improves security, and minimizes scavenging and overflow. Dumpster enclosures are necessary to ensure recycling at stations is comprehensive and successful.</p> <p>Implement a pilot project for dumpster enclosures at Lafayette, Concord, and Fremont Stations. Ensure that plans for future enclosures are coordinated with ongoing station modernization program.</p>		<p>Stations Planning Sustainability ODA Transportation</p>
<p>EP 3 Pilot Facility-based Sustainability Program at Shop(s)/Yard(s)</p>	<p>3.1 Evaluate the opportunities at BART’s shop(s)/yards(s) to pilot a facility-based Sustainability Plan. The Plan would focus on one or more resources and introduce performance tracking and monitoring, document environmental compliance, and identify new or innovative ways to conserve resources.</p> <p>3.2 Based on the pilot, allocate funds and resources to develop a strategic Sustainability Program for BART’s shops/yards. Resources would include additional staff RS&S staff as needed to implement the Plan, particularly the monitoring and reporting system.</p>		<p>Rolling Stocks & Shops (RS+S) Sustainability System Safety</p>
<p>EP 4 Improve Recycling at All District Shops and Yards</p>	<p>4.1 Experience at the Oakland Shop suggests that BART’s shops and yards have the potential to divert 10-45% of landfilled waste to recycling and/or composting. Engage the Oakland Shops and other departmental leads to explore changes since the 2012 Stop Waste audit, review results obtained, and consider the potential to further increase diversion. Transfer lessons learned at the Oakland Shops to an operations manual and an implementation plan for all other shops and yards.</p>	 	<p>RS+S Sustainability System Safety</p>








ACTIONS – Emissions and Pollution Control		STATUS/ PRIORITY	RESPONSIBILITY
EP 5 Incorporate Composting in Employee Worksites	5.1 The City of Oakland recently passed a Zero Waste Ordinance. Work with building management to develop a comprehensive recycling and composting program throughout the BART administration offices.		Sustainability RE+PD
	5.2 Implement recycling and composting, as required by local ordinances, into the staff rooms at all BART shops and yards.		
	5.3 Investigate the potential to include composting at BART stations in the future, as required.		
EP 6 Improve Office Recycling and Reuse	6.1 Initiate an inter-District "green team" to identify and advance easy to implement waste reduction strategies such as paperless purchase orders. Develop a plan for those more difficult improvements, such as file sharing to reduce paper waste.		Sustainability Procurement
	6.2 Develop a paperless policy to encourage employees to go paperless. Consider a pilot project to have the Board of Directors go digital. Review the union contracts to identify any out of date wasteful strategies that are performed because they are embedded in the Union contracts. Develop a list of wasteful actions to be addressed during the next union negotiation.		Sustainability Employee Relations (Labor Management)
	6.3 Reduce the number of items sent to landfill by creating a searchable database of materials available for salvage and reuse and allow for both internal and external donations of unused goods. Update District policy for <i>Disposition of Surplus Personal Property</i> .		Sustainability Legal



ACTIONS – Emissions and Pollution Control		STATUS/ PRIORITY	RESPONSIBILITY
EP 7 Reduce District Hazardous Waste Co-benefits to:  Materials and Construction Operations Optimization	7.1 BART follows environmental regulations for disposal or mitigation of hazardous materials. Encourage specification of non-hazardous materials in capital projects to avoid future disposal issues; further coordinate with inventory management procedures; and collaborate with departments to seek/implement adequate non-hazardous alternatives.		System Safety RS+S Sustainability
	7.2 In conjunction with EP 4, expand the Oakland and Rag Laundry Service to reuse and launder oily rags to the BART vehicle shops and document progress. This action will also help to reduce Hazardous Waste. Remove budgetary barriers to implementation.		
 EP 8 Minimize and Clean Storm Water Runoff Co-benefits to:  Resourcing Conservation Water	The State Water Resources Control Board issued the <i>California State Board's Inland Surface Waters Plan</i> and <i>Ocean Plan Trash Amendments</i> in 2015. These documents require trash capture technology at all transit stations within eight years to keep pollutants and trash from coming into contact with waterways. ²¹ BART is aware of this requirement and is developing appropriate standards and protocols in the BFS.		M&E (Engineering: Civil Engineering) Sustainability
	8.1 Secure appropriate resources to construct trash interceptors/storm drain diversion structures as required and treat drainage for all parking lots, plazas and stations.		

²¹ http://www.waterboards.ca.gov/water_issues/programs/trash_control/documentation.shtml



ACTIONS – Emissions and Pollution Control		STATUS/ PRIORITY	RESPONSIBILITY
	<p>8.3 Pilot the capture of rainwater and storage for landscaping or cleaning use.</p>		<p>ESP/HMC Sustainability</p>
	<p>8.4 Complete BFS Updates: Develop standard drawings for bio-filtration facilities and include as standard in the BFS. Complete updates to Civil BFS drainage sections to reflect Best Practices for low-impact stormwater mitigations. Include guidance for site-planning techniques that can use landscaping and bio-filtration facilities as a design feature.</p>		<p>M&E (Engineering: Civil Engineering) Sustainability</p>
<p>EP 9 Clean & Reuse Water</p> <p>Co-benefits to</p>  <p>Resource Conservation Water</p>	<p>9.1 BART holds permits to dispose of accumulated water at its facilities. This water eventually flows into the Bay. BART may instead be able to reclaim and reuse this water for irrigation, train washing, or other purposes to limit the impact of flushing dirty water. Explore and implement the reuse of sump pump water.</p>	 	<p>Sustainability M&E (Engineering: Civil Engineering) M&E (Facilities Maintenance)</p>
	<p>9.2 Explore and implement greywater recovery systems at the shops and yards.</p>		<p>RS+S Sustainability</p>
	<p>9.3 Explore and implement stormwater capture.</p>		<p>ESP/HMC Sustainability</p>
<p>EP 10 Invest in Tree Planting</p> <p>Co-benefits to</p>  <p>Resource Conservation Energy</p>	<p>10.1 Direct resources to prioritize increasing tree coverage, including in plazas and parking lots. Coordinate new trees planting with any complementary efforts to redevelop or redesign BART property with housing, active uses, and/or power generation.</p>		<p>Stations Planning Sustainability ODA M&E (Engineering)</p>
	<p>10.2 Include requirements in the BFS as feasible for trees in parking lots and other impervious surfaces.</p>		



ACTIONS – Emissions and Pollution Control

STATUS/
PRIORITY

RESPONSIBILITY

EP 11
Replace Gas Powered
Tools with Electric

11.1 Gas powered tools are less regulated than automobiles and expel ozone-contributing pollutants that contribute to ozone depletion and an unhealthy work environment. Hand tools that are fueled by electric power reduce the emissions of harmful gases and particulate matter during use.

Co-benefits to



Resource
Conservation Energy

11.2 As tools need to be replaced, develop a policy of purchasing electric (battery) versions. Prioritize landscaping tools such as leaf blowers, lawn mowers, and gas-powered tools used in the Transbay Tube.

11.3 BART's high rail gang trucks should be outfitted to include areas to charge batteries and outlets to plug in electric powered tools such as rail saws, rail drills and grinders.



M&E (Maintenance Support)
Sustainability



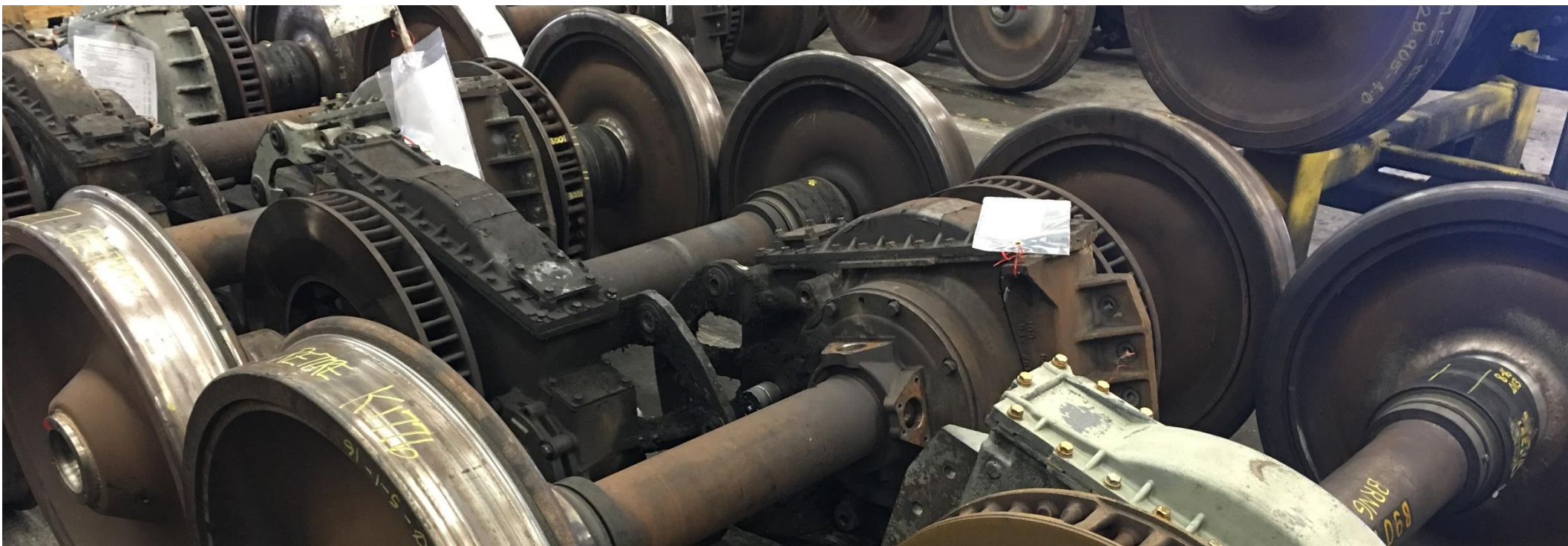
2025 TARGET

100%

BART Project Delivery staff will be trained in BART Facilities Standards (BFS) Sustainability Controls

GOAL: Choose sustainable materials, construction practices and approaches to operations.

Sustainability measures can help evaluate materials beyond the conventional measures of cost, schedule and design quality. This category addresses how BART will integrate sustainability into material selection, capital project construction procedures, and sustainable project delivery as well as programs that promote sustainable operations.



Current Achievements and Initiatives

BART FACILITIES STANDARDS UPDATES

The BART Facilities Standards (BFS) provides guidance and minimum standards for the design and construction of all BART facilities and infrastructure and has closely followed Leadership in Energy and Environmental Design (LEED) standards since 2004. The BFS is the District's primary directive for continually improving the environmental performance of capital projects and ongoing retrofits.

BFS R3.0.1 (2014) integrated best practices from the American Public Transit Association (APTA) Sustainability Guidelines (2011) and incorporates both Title 24 and the California Green Building Code. With sustainable practices and requirements included in the

BFS, BART's task is to ensure that standards and requirements are enforced and that teams are not only educated but also supportive of sustainability goals.

BART's specifications for construction practices are located in the BFS by section. These sections regulate the management and construction methods used by BART contractors. BART standards encourage project teams to reduce waste, minimize pollution and improve how contractors track sustainability requirements.

BFS 01 81 13 (General Requirements: Sustainability Requirements) includes requirements for Waste Management Plans and Storm Water Pollution Prevention Plans as well as Material requirements



and Management requirements. This section outlines targets for construction waste, e.g. diversion of 70% of construction waste from landfills, 100% of steel and concrete, minimum of 50% of remaining demolition waste.

BFS 01 81 13 (General Requirements: Sustainability Requirements) also introduces, for the first-time, contractor tracking of sustainable materials. Requirements in this section include:

- Reporting of Product Sustainability – information is required on a total of 26 priority items including heat island effect, exterior light pollution and water consumption performance;
- Requirements for post-consumer recycled content;
- Recommended approach for salvaged or reused material in construction projects;
- Preference for regional materials (manufacturing location);
- Preference for rapidly renewable materials;
- Unacceptable packaging materials list;
- Low VOC content materials / adhesives;
- Approval method for alternative products.

This section also requires contractors to hold pre-construction project meetings introducing sustainability as an agenda item. The purpose of this agenda item is to develop an understanding of the project's sustainability requirements and coordinate the contractor's management of these requirements.

The BFS standards address project *material selection*:

BFS 01 74 14 (Cleaning) Use of green cleaners for janitorial purposes.

BFS 09 91 00 (Finishes) Specifications for paint and sealants to promote indoor air quality.

BFS 03 05 15 (Concrete) Requirements for the use of Fly Ash in Portland Cement.

[For Next Steps See MC 1](#)

SUSTAINABLE CONTRACTUAL TOOLS

Public agencies such as BART rely on a competitive bid process to secure services. BART is analyzing the best methods to integrate sustainability at various phases of capital project delivery: from Conceptual Design to Preliminary Engineering, Final Design and Project Delivery.




BART is also exploring how to achieve a higher level of environmental responsibility and more sustainable outcomes in its procurement strategies through contracting techniques such as Design/Bid/Build, Design Build, and Design Build Operate Maintain.

[For Next Steps See MC 2 and MC 3](#)







ACTION TABLES

The following section includes recommended actions to achieve BART **Material Selection and Construction Operations Optimization** Goals.

ACTIONS – Material Selection and Construction Operations Optimization	STATUS/ PRIORITY	RESPONSIBILITY	
 <p>MC 1 Select Green Materials and Products</p> <p>Co-benefits to:</p>  <p>Resource Conservation Energy; Emissions and Pollution Control</p>	<p>The District may benefit from new operational procedures or a comprehensive green purchasing policy.</p> <p>1.1 Develop a green purchasing policy that helps BART prioritize lifecycle considerations of major products and materials, and makes long-term performance of components, systems and materials a priority. The policy should:</p> <ul style="list-style-type: none"> • Outline a specific process for researching the feasibility of green product replacements including pilot projects or trial-runs of the replacement, and involving the end-user as a stakeholder in the process and decision-making. • Coordinate with Total Cost of Ownership guidance to capture the full lifecycle cost of a product. • Make explicit the trade-off between products that are more expensive upfront, with their associated sustainability benefits, such as public health or reduced energy use. • Formalize how premiums are calculated or offset through efficiency gains, cost savings, and/or lowered risks during the product/project lifecycle. • Optimize life-cycle scoring (identify a standard or a specific benefit – e.g. health benefit) for major materials, including global warming potential, while maintaining durability and quality. • Require Environmental Product Declarations (EPDs) for construction materials to improve disclosure of materials information and incentivize the selection of better environmental performing products. 		<p>Sustainability Procurement RS+S Transportation M&E</p>

Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program



ACTIONS – Material Selection and Construction Operations Optimization		STATUS/ PRIORITY	RESPONSIBILITY
	<ul style="list-style-type: none"> Define responsibility and accountability – how will this policy be enacted; e.g. a steering committee. Explore local resources such as Alameda County and/or San Francisco to piggy back on sustainable procurements to receive price reductions. 		
	<p>1.2 Provide District (or department-specific) procurement guidelines that include green materials and features and strengthen related BFS sections on material selection as feasible. Outline a specific process for researching the feasibility of green product replacements, including pilot projects or trial-runs of the replacement, and involve the end-user as a stakeholder in the process and decision-making.</p>		
 <p>MC 2 Update BFS for Construction Activities</p>	<p>2.1 Require Environmental Product Declarations (EPDs) for construction materials, including steel products and concrete mix designs, to improve disclosure of materials information and incentivize selection of better environmental performing products.</p>	 	<p>Sustainability ODA M&E SE/CM</p>
	<p>2.2 Develop online tools (such as a website) to provide contractors the means to self-report their sustainable practices during project delivery. At Substantial Completion, Contractors should produce a close-out report, documenting final levels of each of their sustainability objectives.</p>		
	<p>2.3 Engage Construction industry on best practices in sustainable construction with BART Project Managers and Design Community.</p>		
<p>MC 3 Improve BFS Sustainability Guidance, Criteria and Standards</p>	<p>3.1 The Sustainability Guidelines are a repository for policy guidance on minimum requirements and opportunities to exceed these requirements.</p>		<p>Sustainability ODA M&E</p>



ACTIONS – Material Selection and Construction Operations Optimization

STATUS/
PRIORITY

RESPONSIBILITY



Co-benefits to:



Emissions and Pollution Control; Resource Conservation Energy

- Update to the Guidelines is suggested to: a) differentiate between project type (infrastructure, facilities, stations); b) clarify project phase (e.g. planning, design, construction, O&M); c) link back to relevant BART Policy; and d) ensure that relevant guidance is easily accessed at the appropriate phase.
- Provide policy guidance, including project size threshold, for the use of third party sustainability certifications, cost premiums, and expected outcomes.
- Utilize performance-based specifications for sustainability outcomes.
- Emphasize the use of instrumentation and data collection for measuring sustainability performance.

3.2 Continue to make updates to BFS Construction Standard Specifications:

- Include and update standards to incorporate sustainability best practices as feasible into specifications for construction contracts.
- Develop requirements for Best Practices in construction fleets, such as anti-idling and construction equipment.
- Communicate compliance as a risk reduction measure for required Environmental Review.

MC 4
Incorporate Sustainability into Operations and Maintenance Procedures

Co-benefits to:







Emissions and Pollution Control; Resource Conservation Energy

Identify operations and maintenance procedures that are complementary to the BFS updates resulting from MC 3.



Sustainability
Transportation | RS+S



ACTIONS – Material Selection and Construction Operations Optimization		STATUS/ PRIORITY	RESPONSIBILITY
<p>MC 5 Explore Sustainable Contractual Tools (Capital Projects)</p>	<p>Explore contracting tools to best leverage sustainability including:</p> <ul style="list-style-type: none"> • Incentive programs to move beyond the established baseline. • Weighted performance targets in RFP and bid documents allowing sustainability scores to contribute to overall assessment of best value. • Internal mechanisms and tools to track and encourage sustainable initiatives not currently incorporated into project standards and documentation (such as solar or other renewable energy, and green roofs). • Commit resources to further study. 		<p>Sustainability Procurement Legal</p>
<p>MC 6 Develop Sustainability Design Guidance</p> <p>Co-benefits to:</p> <div style="display: flex; justify-content: space-around;">   </div> <p>Emissions and Pollution Control; Smart Land Use and Livable Neighborhoods</p>	<p>eBART will be completed in 2018 and the eBART maintenance facility will be LEED-ready; Hayward Maintenance Center is also pursuing LEED certification.</p> <p>6.1 Develop a mechanism to guide sustainability considerations during the project development stages, set sustainable goals/targets for the project, and allocate any necessary financial resources.</p>	 	<p>Sustainability ODA M&E (Engineering) Legal</p>
	<p>6.2 Include language in new General Engineering contracts to request Engineers and Designers with experience with green building and LEED certification.</p>		<p>Sustainability ODA M&E (Engineering) Legal</p>
	<p>6.3 Provide policy guidance, including project size threshold, for the use of third party sustainability certifications, cost premiums, and expected outcomes. Consider piloting a publicly available tool that is more focused on infrastructure projects, such as INVEST or ENVISION on a short-term project.</p>		<p>Sustainability M&E (Engineering) ODA</p>



2025 TARGET

100%

High Priority Actions in the BART Local Hazard Mitigation Plan Actions are underway or complete

GOAL: Resilient response to extreme weather, earthquakes, and other potential natural disasters or shocks.

Planning for future natural disasters and the impacts of climate change requires collaborating across jurisdictions, geographies, sectors, and time frames to address complex, cross-cutting issues.

BART is taking proactive steps to assess risks to its infrastructure and operations. BART applies adaptation strategies to its major activities including land use and planning, design and construction, operations and maintenance, and participates in collaborative, regional efforts to identify hazards.

Planning for extreme weather includes assessing, analyzing, and mapping vulnerable areas. Staff monitor, identify and prioritize strategies to reduce risks from natural and anthropogenic sources. Additionally, BART fosters strategic partnerships to mitigate hazards and collaborate on regional resilience planning, as well as identify opportunities to improve standards and procedures.



Current Achievements and Initiatives

ADAPTING TO RISING TIDE

According to current projections, San Francisco Bay water levels will rise 16 inches by mid-century and 55 inches by the end of the century due to climate change.²² In response to this critical infrastructure threat, the San Francisco Bay Conservation and Development Commission (BCDC) and National Oceanic and Atmospheric Administration Office for Coastal Management (NOAA OCM) have gathered local, regional, state, and federal agencies and organizations as well as non-profit and private associations to conduct collaborative planning along the San Francisco Bay Area shorelines. The Adapting to Rising Tides (ART) Sub-regional Project is identifying how current and future flooding and storm surges will

affect communities, infrastructure, ecosystems, and economies, and has developed detailed risk profiles for approximately 30 transportation assets including road, rail, and transit.

As a part of this work, BART is prioritizing adaptation strategies for its highest at-risk infrastructure. The District published a 2014 “Bay Area Transportation Climate Resilience” plan which lays out adaptation strategies for assets in three focus areas: San Francisco – Oakland Bay Bridge Peninsula – ‘Bay Bridge Touchdown Focus Area’; Oakland Coliseum Area – ‘Coliseum Focus Area’; State Route

²² BART, Caltrans, BCDC, Climate Change and Extreme Weather Adaptation Options for Transportation Assets in the Bay Area: Pilot Project Technical Report (2014).

92 Corridor – ‘Hayward Focus Area.’ BART has since refined the most feasible and practical adaptation options.²³

[For Next Steps See EWA 1](#)

CONDUCT HAZARD MITIGATION PLANNING

There are nine hazards that impact the Bay Area: five related to earthquakes (faulting, shaking, earthquake induced landslides, liquefaction, and tsunamis) and four related to weather and climate change (flooding, landslides, wildfires, and droughts). Local hazard mitigation planning conducted by the Association of Bay Area Governments (ABAG) assesses public assets in relationship to these hazards.

Beginning in 2016, BART is responsible for its own Local Hazard Mitigation Plan (LHMP).²⁴ The Emergency Preparedness Task Force Committee (EPTFC) serves as a steering committee to the District’s Emergency Preparedness Program and for the LHMP update process. BART staff solicited comments from Alameda, Contra Costa, San Francisco, and San Mateo Counties as well as various local cities.

The Local Hazard Mitigation Plan addresses short- to long-term actions for emergency preparedness including water distribution systems, storm drain systems, flooding and water intrusion, power resilience, fire hazard removal, and public communication.

²³ Ibid.

²³ BART Local Hazard Mitigation Plan, February 2016.

[For Next Steps See EWA 2](#)

RESILIENT INFRASTRUCTURE DESIGN

The construction of new infrastructure and adapting existing infrastructure provides opportunities to rethink how to better harmonize with dynamic, natural processes. As BART adapts infrastructure to storms and floods, it is also evaluating how to achieve multiple, synergistic benefits from these investments.

The *Climate Change and Extreme Weather Adaptation Options for Transportation Assets in the Bay Area Pilot* proposes a conceptual design for the Damon Slough Living Levee (in the Oakland Coliseum Focus Area). The project is an example of infrastructure that proactively meets environmental compliance, contributes to habitat restoration, and supports community design aspirations. Instead of creating a wall against the shoreline, it creates a more natural transition between the water and upland areas. The living levee’s multiple benefits protect at-risk infrastructure, produce marsh and riparian habitat for improved water quality, and expand the floodplain to accommodate high water flows.

Other BART concepts for resilient infrastructure with multiple benefits include the use of low-impact development techniques at station locations to decentralize the response to stormwater detention and retention, minimize heat island effect, and improve wildlife habitat.

For Next Steps See EWA 1 and EWA 3

TRAIN CONTROL ADAPTATION PLANNING

Modernizing BART's 40+ year old train control system is an important factor in regional resilience and offers opportunity for sustainability.

Currently, more than half of BART's infrastructure-related delays are due to the train control system, causing BART riders to face more than 400 hours of delay each year. A modernized train control system will enable BART to meet projected Transbay demand of over 30,000 passengers per hour in the peak, compared to today's approximately 21,000 passengers.²⁵ Shifting to this newer technology instead of rehabbing the old system offers many advantages including less equipment, lower maintenance, and lower energy consumption.

The new train control system will also bring more throughput and increase train capacity, removing travelers from the road, thereby contributing to reducing the Bay Area's GHG emissions.






For Next Steps See EWA 4

²⁵ <http://m.bart.gov/about/projects/traincontrol>







ACTION TABLES

The following section includes a series of recommended actions to achieve **Extreme Weather Adaptation and Resilience** Goals.

ACTIONS – Extreme Weather Adaptation and Resilience		STATUS/ PRIORITY	RESPONSIBILITY
<p>EWA 1 Coordinate with Regional Agencies in Climate Adaptation Planning and Implementation</p> <p>Cobenefit to:</p>  <p>Patron Experience</p>	<p>1.1 Develop and socialize a planning process requirement that considers future climate change impacts as a standard part of project design. Create the process in coordination with long-range planning, asset management, capital projects and Capital Needs Inventory. Review Caltrans, Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) guidance as a template for this process.</p>	 	<p>Office of District Architect Sustainability Strategic Planning</p>
	<p>1.2 Actively seek grants, matching funds and partnering opportunities to support implementation of adaptation strategies. Identify and promote strategies that have multiple benefits.</p>		<p>Office of District Architect Grants Sustainability Strategic Planning</p>
	<p>1.3 Modify as necessary design standards in the BFS to ensure resilient infrastructure designs, especially flood-prone infrastructure. Support and pilot resilient infrastructure design to protect critical assets.</p>		<p>Office of District Architect Sustainability M&E (Engineering)</p>
<p>EWA 2 Conduct Hazard Mitigation Planning</p>	<p>2.1 Incorporate the Local Hazard Mitigation Plan LHMP (2016) considerations into capital improvement plans and budget through project-specific mechanisms. Ensure that the projects and mitigation strategies identified as existing or having relatively high priorities in the LHMP are implemented.</p>	 	<p>Office of District Architect System Safety Strategic Planning Sustainability</p>
	<p>2.2 Update the LHMP every five years.</p>		<p>Office of District Architect System Safety</p>

Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program



ACTIONS – Extreme Weather Adaptation and Resilience		STATUS/ PRIORITY	RESPONSIBILITY
 <p>EWA 3 Expand the Water Intrusion Program to respond to Sea Level Rise and Extreme Weather Events</p>	<p>The existing BART Water Intrusion Program addresses water leaks caused by infrastructure degradation, structural fatigue, environmental impacts, materials performance, and high rates of usage in actual operating conditions. This program should be expanded to prepare for additional water intrusion associated with sea level rise and extreme weather.</p> <p>3.1 Upgrade systems that track water inundation issues within the District.</p>		<p>Office of District Architect Sustainability Operations Planning</p>
	<p>3.2 Expand the existing BART Water Intrusion Program to focus on identifying assets vulnerable to water inundation and develop a program to systematically prioritize and mitigate the risk.</p>		<p>Office of District Architect Operations Planning Sustainability</p>
	<p>3.3 Partner with the local watershed jurisdictions, e.g. Alameda Flood Control District, to conduct a watershed analysis of runoff and drainage systems to predict areas of insufficient capacity in the storm drain and natural creek system.</p>		<p>Office of District Architect Sustainability</p>
	<p>3.4 Partner with the pertinent jurisdictions on protecting the east and west portals of the Transbay Tube and surrounding area.</p>		<p>Office of District Architect</p>
	<p>3.5 Study options to waterproof venting structures and entrances for underground stations.</p>		<p>Office of District Architect M&E (Engineering)</p>
 <p>EWA 4 Integrate Resiliency into Train Control Modernization</p>	<p>Implement the Train Control Modernization Program to replace the current train control system. The new Communication-Based Train Control (CBTC) system is a fiber optic system that will significantly reduce train headways, permitting increased system capacity. In conjunction with the new trains, the CBTC will enable the trains to be more energy efficient and provide flexibility for recovery after a delay. The fiber optic system will provide resilience towards any water inundation related to extreme weather events.</p>		<p>Capital Program Systems (PD&C) Sustainability</p>



2025 TARGETS

Access²⁶

BART’s Access Policy is working to shift passengers to greener modes

<u>Access Policy Mode Share</u>	<u>Targets</u>
Active (Walking and Bicycling)	52%
Shared Mobility	32%
Drive & Park	16%

Reduce GHG emissions associated with passenger access to the station by 24% -a reduction of 0.54 to 0.41 kg CO2e per average weekday home-based station access trip

Transit-Oriented Development²⁷

BART’s TOD policy seeks to catalyze TOD on and near BART-owned properties

- Increase Residential Units to 7,000 units (35% of which are Affordable) from 2,400 units
- Increase Office/Commercial SF to 1,000,000 SF from 209,000 SF²⁸

GOAL: Promote smart land use, livable neighborhoods and sustainable access.

The 2013 Plan Bay Area anticipates 2.1 million additional Bay Area residents by 2040 and prioritizes housing growth in transit accessible locations. BART’s TOD and Access Policies support Plan Bay Area by establishing a series of performance targets, including intensification of housing and commercial uses within ½ mile of BART stations.

Regional land use patterns have a major impact on BART’s carbon intensity. In turn, the BART system has significant potential to shape efficient land use by facilitating compact development. California Senate Bill 375 (SB 375) requires the California State Air Resources Board to review each municipal planning organization’s Sustainable Communities Strategy to determine compliance with GHG reduction targets. Based on 2005 emissions, the nine-county Bay Area was assigned reductions of 7% per capita by 2020 and 15% per capita by 2035.

²⁶ BART Station Access Policy Adopted Performance Measures 12/1/2016.

²⁷ BART TOD policy program Adopted Performance Measures 12/1/2016.

²⁸ SF stands for Square Feet.



BART's projected daily ridership is expected to increase from around 400,000 daily trips today, to nearly 500,000 by 2025, and over 600,000 by 2040 due to land use actions described in Plan Bay Area 2013.

To respond to and manage transportation demand, BART works with regional agencies on land use issues. BART also partners with cities on Transit-Oriented Development (TOD) projects, and supports access improvements to its stations. These actions help secure regional sustainability goals including supporting more compact urban environments that lead to less greenhouse gas intensive travel, contributing to safer commutes and healthier communities, reducing vehicle miles traveled in private vehicles, and improving non-motorized access to BART stations.

This sustainability category is primarily implemented by the BART Access Policy and BART TOD Policy. Departments leading these sustainability strategies include Customer Access, Real Estate and Property Development, Station Planning, and Strategic Planning.



Current Achievements and Initiatives

IMPROVE STATION CHARACTER AND COMMUNITY FIT

BART operates 46 stations in a variety of settings, from busy urban underground stations in San Francisco and Oakland to elevated multimodal stations in Contra Costa and Alameda Counties. As part of its complete and sustainable communities strategy, BART is a pro-active participant with its municipal partners working to improve the unique relationship between each city and its station(s). This means that BART, in addition to supporting improvements within the station footprint, has dedicated programs and funding streams to contribute to adjacent community spaces and local access improvements. These programs contribute to sustainability by encouraging new transit riders, supporting changing patron needs, and increasing the usability of station locations.

For Next Steps See SLU 1

CONTINUE TO LEAD THE REGION IN TOD

BART's 2016 [Transit-Oriented Development \(TOD\) Policy](#) sets ambitious goals for station land uses, mixed-income transit-accessible housing, and value capture mechanisms to support

transit and TOD. TOD policy also seeks to increase off-peak and reverse-peak ridership, combating peak hour crowding through job and commercial growth in the East Bay.

The District has a long history of building and supporting transit-friendly development projects at its stations, with 11 completed projects totaling \$1.2 billion in private investment. MacArthur Station Transit Village (875 homes on a 7.76-acre site in Oakland) is one such project now under construction. The project participated in the LEED Neighborhood Development (ND) pilot program. As part of the program, BART had the opportunity to help shape the LEED ND program and served as a national example of TOD. The project received a LEED Gold rating under the first phase of the program.

BART TODs (either new construction or redevelopments) deliver sustainability benefits including increased ridership, decreased traffic congestion, lower vehicle miles traveled (VMT), reduced GHG emissions, and improved public health. By better using BART land



assets, TOD projects secure additional annual revenue and capital offsets, reducing the taxpayer subsidy.

[For Next Steps See SLU 2](#)

STATION ACCESS – CONNECT TO COMMUNITY

BART has a clear policy directive to improve how its stations connect to and are accessed by communities. BART's 2016 [Station Access Policy](#) is fundamental to BART's sustainability goals, making the system safer, healthier and greener. The policy directs BART to focus first on active, human-powered transportation modes and better transit connections. Over the next four years, BART staff will work to enhance multi-modal access to stations by focusing on facility improvements for walking and cycling, facilitating better local service connections, and supporting strategies for increased transit use in the reverse peak direction.

BART staff is also working to conduct a comprehensive review of the system's access infrastructure.

BIKES ON BART

BART has embraced a suite of strategies that are supportive of bicycling. In addition to access strategies, BART has prioritized

investments for in-station circulation, secure bike parking, bike stations, off-station circulation, and bikes on BART.

[For Next Steps see SLU 3](#)

EQUITY & AFFORDABILITY

BART currently offers a youth discounted fare from age 5 through 18. Riders in this age range currently receive a 50% discount off regular fares. Children under the age of 5 ride for free. Staff are working with regional partners on a Means-Based Fare Study to develop options to make transit more affordable for low income residents, move toward a more consistent regional standard for fare discount, and develop implementation options that are financially viable and feasible.




BART's Board adopted performance measures to increase the number of affordable housing units on BART property and the share of housing units system-wide that are affordable. The BART Access Policy seeks to ensure investments improve access choices for all riders, particularly those with the fewest choices.

[For Next Steps See SLU 5](#)









ACTIONS TABLE

The following section includes a series of recommended actions to achieve BART **Smart Land Use and Livable Neighborhoods** Goals.

ACTIONS – Smart Land Use and Livable Neighborhoods		STATUS/ PRIORITY	DEPARTMENT
SLU 1 Improve Station Character and Community Fit Co-benefits to:  Patron Experience	1.1 Implement the “Connect & Create Great Places” Work Plan and focus on investing in place-making at BART facilities and in surrounding neighborhoods, particularly in those areas of highest need.		Stations Planning Strategic Planning Customer Access
	1.2 Continue to seek funding for place-making improvements via grants, bonds, joint development strategies and third-party partnerships.		Grants Stations Planning Strategic Planning
	1.3 Collaborate with local jurisdictions to blur the line between “city” and “station” by having local jurisdictions implement complementary improvements on city streets adjacent to BART.		Stations Planning Customer Access
SLU 2 Continue to Lead the Region in Transit-Oriented Development	2.1 Continue to implement BART’s TOD policy to enhance active station environments.		Real Estate & Property Development Stations Planning
	2.2 Dedicate staff to coordinate with local partners on Specific Plans or Station Area Plans to create urban design, parking and land use policies that support transit friendly land uses including the introduction of creative parking management measures.		Stations Planning
	2.3 Explore the potential for community investment, housing and commercial activation opportunities in coordination with system expansion.		Stations Planning Strategic Planning

Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program



ACTIONS – Smart Land Use and Livable Neighborhoods		STATUS/ PRIORITY	DEPARTMENT
<p>SLU 3 Connect to Community – Station Access</p> <p>Co-benefits to:</p>    <p>Patron Experience; Resource Conservation – Energy and GHG Emissions</p>	<p>3.1 Implement the Station Access Policy.</p>	 	<p>Stations Planning Customer Access</p>
	<p>3.2 Implement the BART Bike Plan, 2015 Bike Parking Capital Program and its 2016 update. Partner with, and deploy, Bay Area Bike Share.</p>		<p>Customer Access Stations Planning</p>
	<p>3.3 Incorporate Multimodal Access Design Guidelines into the BFS and educate BART staff on its use.</p>		<p>Customer Access Stations Planning ODA</p>
	<p>3.4 Continue to partner with jurisdictions and other agencies to improve multi-modal transfers. Fund access upgrades and priority projects as identified.</p>		<p>Stations Planning Strategic Planning Customer Access</p>
<p>SLU 4 Participate in Local/Station and Regional Partnerships</p>	<p>4.1 Continue to engage with MTC on Plan Bay Area and identify opportunities for Plan Bay Area implementation to be more effective in supporting BART’s needs.</p>		<p>Strategic Planning Grants</p>
	<p>4.2 Serve on Technical Advisory Committees and lend expertise on initiatives led by other agencies that impact BART (e.g. Oakland Pedestrian Master Plan update, Tri-Valley Park-and-Ride Study). Serve as a stakeholder for city-led planning efforts that support access and land use goals.</p>		<p>Stations Planning Strategic Planning</p>



ACTIONS – Smart Land Use and Livable Neighborhoods		STATUS/ PRIORITY	DEPARTMENT
	<p>4.3 Continue to participate in state legislation and rule-making pertaining to funding and regulation for TOD and similar activities, particularly the California Cap and Trade program.</p> <p>Review/comment on legislation, policies, regulations, and plans affecting BART (e.g. new CEQA Guidelines, Cap and Trade Grant Guidelines, Station Area Plans), and serve as conduit of information and best practices across the region.</p>		<p>Government and Community Relations RE+PD</p>
<p>SLU 5 Support Affordable Fares</p>	<p>BART is participating in the MTC’s Regional Means-Based Transit Fare Pricing Study, the purpose of which is to develop scenarios for funding and implementing a regional means-based transit fare program and determine the feasibility of implementing the scenarios.</p> <p>Continue to explore strategies to:</p> <ul style="list-style-type: none"> • Make transit more affordable for the Bay Area’s low-income residents. • Move towards a more consistent regional standard for fare discount policies. • Define a transit affordability solution that is financially viable and administratively feasible and does not adversely affect the transit system’s service levels and performance. 		<p>Grants Financial Planning Budgets</p>



2025 TARGETS

BART Operations Department reports quarterly on a variety of safety and performance indicators

BART aims to meet all adopted Performance Standards for Safety and Patron Comfort

GOAL: Improve the quality of ambient environment at BART stations and on the BART system for patrons and employees.

The American Public Transportation Association (APTA) classifies transit sustainability in the ambient environment in three principal areas: comfort, health and safety. When valued, each contributes to a positive riding experience by boosting a sense of security and safety at the station. For sustainability, cross-sectoral attention to the ambient environment supports pride of ownership and rider confidence. APTA points out that effective design features “do not just help make transit safer and more comfortable, but also influence new riders’ perceptions of transit as a viable mobility option.”²⁹

Highlighted in this category are actions that focus on safety, appearance, effectiveness of spaces as well as patron movement.

²⁹ <http://www.apta.com/resources/standards/Documents/APTA%20SUDS-UD-RP-003-11.pdf>

10 ACTIONS | Patron Experience



More people relying on BART for their daily travel needs places extra stress on station facilities, such as ticket machines, fare gates, escalators, elevators, and passenger amenities, such as bathrooms. To address these challenges, BART has launched a series of initiatives to upgrade operating stations and renew patron elements.

These patron-focused programs include:

- Upgrading fare gates to reduce fare evasion and aesthetic quality of fare barriers;
- Improving Universal Access and clarifying navigation throughout the system;
- Prioritizing materials that are durable and high quality, reducing maintenance;
- Activating station locations with retail, housing and other uses;
- Designing effective interior circulation spaces, and reducing pedestrian conflicts;
- Optimizing sound quality and mitigating sound overflow into neighborhoods;
- Improving the quality of stations through the District Art Program.

BART's Engineering and Operations Committee reports quarterly to the Board on over 40 Key Performance Indicators (KPIs). These indicators measure how BART is doing by using an internal standard to track its achievement over time. Indicators range from on-time performance and reliability to crime statistics and elevator function. A snapshot of KPIs that are important to Patron Experience are included below.

KPI (2016 Q4 Quarterly Report)	Status
Comfort	
Station Interior Environment	
Station Exterior Environment	
Health	
OSHA Recordable Injuries	
Train Temperature	
Safety	
Station Incidents/Million Patrons	
Vehicle Incidents/Million Patrons	



Current Achievements and Initiatives

STATION BRIGHTENING – CLEAN STATION ENVIRONMENTS

Clean and well-maintained stations and trains contribute to the atmosphere of a safe, well cared for environment. Cleanliness helps preserve the intended use of the station, as well as contributes to civic pride and customer experience. In 2014, BART initiated its Station Brightening Program to address deferred maintenance and target easy, low cost improvements in the heaviest used stations. Station Brightening focuses on replacing broken lighting, freshening paint, repair work, and scrubbing walls and floors. These and other cleaning efforts help to alleviate the strain of increased passenger ridership. This program financed an increased number of cleaning staff and paid for the deep cleaning of four stations in 2016.

For Next Steps See PE 1

ATTENUATING NOISE

BART train noise can be divided into two categories based on where it occurs. On-board refers to inside the BART vehicle itself and wayside refers to the area adjacent to the tracks, but can include areas that are somewhat distant from the tracks. The dominant source of noise adjacent to the trackway is generated by the rolling of steel wheels on rail. In areas where the BART trackways and stations are elevated or adjacent to freeways, wayside noise can be uncomfortably loud. Additionally, in the Transbay Tube, on-board noise can also reach uncomfortable levels for patrons.



10 ACTIONS | Patron Experience

The head (top) of the rails of BART tracks tend to develop a distinct roughness pattern over time due to wear (corrugation) caused by the BART vehicle wheels. BART has developed and is implementing a solution to mitigate wayside noise using a new wheel profile. The new wheel profile will be included in the new trains and BART is currently updating the profile of the existing fleet and replacing old track as part of regular maintenance. The new wheel profile and replaced track will reduce the corrugation, which results in less noise.

SAFE STATION ENVIRONMENTS

The safety and security of passengers and employees is the District's highest priority. Security measures are implemented at all levels of the organization through both operational activities and capital projects. The BART police department has the lead role for operational security activities and works with all other District departments to coordinate security programs that are risk-based and intelligence-driven. The BART Police Department uses the principals of a Community Oriented Policing and Problem Solving (COPPS) philosophy to partner with stakeholders and identify solutions that address root causes of crime and disorder.

The District identifies security gaps through threat and vulnerability assessments and data analysis. Security committees and change control boards use this information to provide direction and focus for projects that address identified security gaps. The District's BART Facilities Standards (BFS) incorporate Crime Prevention Through

Environmental Design (CPTED) concepts to ensure that capital improvement projects provide security by design. The District's Safety and Police Departments both provide input and oversight to ensure that capital projects meet the BFS requirements for safety and security.

It is estimated that the cost of upgrading the District's facilities to modern security standards is approximately \$200 million. Desired security upgrades include, but are not limited to, replacing aging analog CCTV systems, upgrading access control systems, and deploying intrusion detection and intelligent video analysis systems. Operational activities such as emergency drills and exercises, public awareness campaigns, and front-line employee training are also included in the District's unfunded security needs. The funding for security upgrades comes from the District's own funds as well as federal, state, and local sources. The District will continue to aggressively pursue federal and state grant funds to complete these important projects as quickly as possible.

[For Next Steps See PE 2](#)

PUBLIC ART

Integrating quality art into BART facilities improves the customer experience, infuses stations with elements of surprise and wonder, and reflects the vibrancy of communities throughout the District. Public art has the potential to enhance a station's identity by communicating the history of a place. It can enhance a sense of ownership, translating into a reduction of vandalism and an increased perception of safety. There are nearly 50 works of community initiated or commissioned art throughout the BART system. In April 2015, BART's Board adopted an Art Policy to expand and develop the art program. The policy supports art that includes collaborations, partnerships, work with local communities, community cohesion and the function of BART.

For Next Steps See PE 3

TRANSIT AND PUBLIC HEALTH

Transit already supports public health by contributing to reduced pollution and emissions, as well as eliminating vehicles from already congested freeways.³⁰ Taking BART also offers a daily opportunity for meeting recommended physical activity guidelines. BART supports walking, cycling, and healthy modes of travel to and from its stations. Designing for public health includes support for bike and pedestrian access and improvements to public facilities and more walkable communities. Taking transit has also been shown to reduce stressful commutes by improving access to education and employment activities, providing positive

interactions within the community, and improving access to social and recreational activities.³¹

For Next Steps See PE 4







³⁰ Federal Transit Administration, "Public Transportation's Role in Responding to Climate Change," *United States Department of Transportation*, (2010), <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf>.

³¹ Todd Litman, "Evaluating Public Transportation Health Benefits," *Victoria Transport Policy Institute*, (2010), http://www.apta.com/resources/reportsandpublications/Documents/APTA_Health_Benefits_Litman.pdf.






ACTION TABLES

The following section includes a series of recommended actions to achieve BART **Patron Experience** Goals. Many of these strategies support multiple sustainability categories, including **Smart Land Use and Livable Neighborhoods**, as well as **Materials and Construction Operations Optimization**.






ACTIONS – Patron Experience		STATUS/ PRIORITY	RESPONSIBILITY
PE 1 Create Cleaner Station Environments	1.1 Continue to invest in the Station Brightening program, and, as feasible, hire additional BART staff committed to keeping the stations and trains clean.	 	Transportation and System Service M&E (Facilities Maintenance) Stations Planning Budgets
	1.2 Commit to additional ground and maintenance-related crews at BART stations to improve parking lot cleanliness and trash removal.		M&E (Facilities Maintenance: Grounds) Budgets Stations Planning
PE 2 Create Safer Station Environments	2.1 Continue to support the efforts of BART Police and the community-based policing program.	 	BART Police
	2.2 Support the analysis of high crime stations and increase police presence at these locations.		BART Police CIO
	2.3 Update the public announcement system (in stations) to ensure that important safety messages can be shared.		Office of District Architect
	2.4 Improve real-time display messages to improve communication of safety or issues on the BART system.		Office of District Architect

Department abbreviations: CIO – Chief Information Officer, M&E – Maintenance and Engineering, NRV – Non-Revenue Vehicle, ODA – Office of the District Architect, PD&C – Planning, Construction and Design, RE+PD – Real Estate and Property Development, RS+S – Rolling Stock and Shops, ROW – Right-of-Way, SE/CM – Stations Engineering/Construction Management Capital Program



ACTIONS – Patron Experience		STATUS/ PRIORITY	RESPONSIBILITY
<p>PE 3 Support Art in Transit</p> <p>Co-benefits to:</p>  <p>Smart Land Use and Livable Neighborhoods</p>	<p>Develop an art program master plan to guide the integration of new art into the BART system, including guidelines and procedures for program implementation, plans for maintenance and cleaning, and a strategy for funding and implementation. Include metrics to measure the program’s success.</p>		<p>Strategic Planning Budgets</p>
<p>PE 4 Invest in Employee Health and Wellness</p>	<p>BART takes seriously the health and safety of its workers. All California rail transit agencies comply with a comprehensive set of safety requirements. As noted in the FY 2016 Preliminary Budget Memo, BART is implementing the following programs to enhance worker safety:</p> <ul style="list-style-type: none"> • Safety culture improvement (goal to reduce injury rates); • Roadway worker protection; • Wayside safety; • Safety management software. <p>Continue to support Worker Health and Safety programs in the District. HR is developing an Employee Wellness program and will continue to present and make recommendations on additional programs.</p>		<p>Employee Relations System Safety</p>



ACTIONS – Patron Experience		STATUS/ PRIORITY	RESPONSIBILITY
PE 5 Design Stations for Patron Comfort Co-benefits to:  Smart Land Use and Livable Neighborhoods	Develop guidelines and other procedural tools to promote quality of life at stations. Tie patron-focused design guidance to sustainability objectives including community and neighborhood livability, personal security, legibility, resource conservation (water and energy), and system resilience.		Office of District Architect Stations Planning
PE 6 Attenuate Noise Co-benefits to:  Smart Land Use and Livable Neighborhoods	6.1 Building on the West Oakland Station Study, determine the feasibility of piloting a physical barrier on aerial track to mitigate noise impacts to the local community.		Operations Planning
	6.2 Continue regular wheel and rail maintenance to mitigate noise.		Rolling Stocks + Shops (R&S) M&E (ROW Maintenance) Operations Planning
	6.3 Specify materials in BFS that help noise attenuation.		Office District Architect RS+S (Revenue Vehicle Maintenance Engineering)
PE 7 Support an Enhanced Wayfinding Program	Update Wayfinding Program and expand the use of electronic signs with real-time information. Broaden the application of legible, attractive and easy-to-understand signage. Include as feasible, intuitive and design-oriented wayfinding that helps to define paths and routes without obstructing movement.		Office of District Architect Stations Planning



ACTIONS – Patron Experience		STATUS/ PRIORITY	RESPONSIBILITY
PE 8 Build Awareness: Transit's Relationship to Public Health	8.1 Explore collaborative opportunities to support healthy behaviors, such as public art projects and awareness campaigns.		Stations Planning Strategic Planning Marketing and Research
Co-benefits to: Smart Land Use and Livable Neighborhoods	8.2 Reflect public health benefits in emerging guidance for Station Design, e.g. treatments to encourage the use of stairs for exercise and bike channels.		Stations Planning ODA Customer Access