Metropolitan Transportation Commission and the Association of Bay Area Governments
Regional Advisory Working Group

November 5, 2019   Agenda Item 3

Plan Bay Area 2050: Draft Needs Assessments for Transportation, Housing and Resilience

Subject: Overview of the draft financial needs associated with transportation, affordable housing, and resilience for Plan Bay Area 2050, the next-generation regional plan.

Background: As MTC and ABAG work to develop a more comprehensive regional plan, it is important to consider the financial needs and revenues for a broader array of issue areas. Building upon the successful work from prior iterations of Plan Bay Area, Plan Bay Area 2050 will include needs and revenue estimates for the traditional suite of transportation operations and maintenance (O&M), as well as equally critical needs for affordable housing and resilience.

Needs and revenue assessments have proven valuable in prior cycles of Plan Bay Area as they have identified what it would take to fully fund fundamental issue areas like roadway maintenance, as well as the reasonably anticipated funding that could fill those gaps. Staff continue to work on the revenue assessments for each of the topic areas; draft revenue estimates, both with and without new revenues under consideration, are expected to be available in draft form in December.

Draft assessments of needs for each topic area – between 2021 and 2050 – were completed over the summer; staff are currently seeking feedback on this work as we begin work on the Draft Blueprint for Plan Bay Area 2050. Additional information on each assessment can be found in the attachments to this memo. Findings of the draft needs assessments are also summarized below, with all costs shown in year-of-expenditure (YOE) dollars for state of good repair:

- **Transportation:**
  - Public Transit O&M: $302 billion in needs
  - Roads, bicycle/pedestrian infrastructure*, Bridges, and Highways O&M: $115 billion in needs
- **Affordable Housing:** $473 billion in needs
- **Resilience:**
  - Sea Level Rise: $15 billion in needs
  - Earthquake: $17 billion in needs *(for residential units only)*

Next Steps: Staff will continue to work with stakeholders and technical experts on each of the needs and revenue assessments over the coming months. It is anticipated that the needs and revenue estimates will be finalized in early 2020 in time to begin analysis of the Draft Blueprint for Plan Bay Area 2050.

Attachments: Attachment A: Draft Transportation Needs Assessments
Attachment B: Draft Affordable Housing Needs Assessment
Attachment C: Draft Resilience Needs Assessments
Attachment D: Presentation

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* Includes on-pavement but not dedicated off system bicycle or pedestrian paths.

Draft Transportation Needs Assessments

Plan Bay Area 2050, the next-generation plan for transportation, housing, the economy, and the environment, will span 30 years from fiscal years 2021 through 2050. Plan Bay Area 2050 must meet or exceed federal and state requirements, including RTP/SCS requirements related to fiscal constraint. This requires the estimation of costs and available revenues for the operation and preservation (capital maintenance) of the existing transportation system. The information presented below is a preliminary draft estimate of the region's transportation operations and preservation needs over the lifespan of the Plan. This information is being provided for your review in advance of being presented to the MTC/ABAG boards in December.

For the Local Streets and Roads and Transit Capital categories, the system preservation needs were calculated for two different "condition level" scenarios:

1. **Maintain Existing Conditions**
   - Local jurisdictions maintain the existing pavement condition index (PCI) and deferred maintenance costs are held relatively stable but continue to grow at the rate of inflation
   - Transit operators maintain the existing percentage of capital assets over useful life (PAOUL). In this scenario, the total backlog dollar maintains the present-day replacement cost value of all assets beyond their useful life, adjusting for inflation.

2. **State of Good Repair (SGR)**
   - Pavement conditions reach a "best management practices" level within the first ten years of the analysis period, and then maintain that level for the duration of the Plan period. A best management practices condition level equates roughly to a low-to-mid 80s pavement condition index (PCI). Deferred maintenance is eliminated.
   - All transit capital assets are replaced and rehabilitated within the first ten years of the analysis period--to 0% percent of assets over useful life (PAOUL)-- and then maintained at that level for the duration of the Plan period. In this scenario, all assets are replaced when they reach the end of their useful lives and existing assets that are in marginal or poor condition (TERM Lite Score 2 or 1) are replaced in the first decade.

Only one condition level scenario was calculated for local bridges, state highways, and regional bridge capital maintenance and operations due to limited data availability and/or modeling capability. For transit operations, the only scenario calculated was the cost to maintain existing service levels, since expanded service levels would be proposed as part of the Plan's project submittal process.

Table 1 below shows the total transportation operations and preservation needs calculated for Plan Bay Area 2050. Results by mode and methodologies used to estimate the needs are contained in subsequent pages of this attachment.

Table 1. Plan Bay Area 2050 Draft Transportation Operation and System Preservation Needs (in millions of $YOE)

Mode	State of Good Repair	Maintain Conditions
Local Streets, Roads, and bicycle/pedestrian infrastructure	$68,395	$61,859
State Highways[2]	$24,427	$24,427
Local Bridges[2]	$2,554	$2,554
Regional Bridges[2,3]	$19,415	$19,415
Transit Capital	$84,561	$59,385
Transit Operating[4]	$217,819	$217,819
Total	$417,171	$385,460

Notes:

1) Includes $20.5 billion in operations costs/needs.
2) Needs associated with maintaining existing condition levels is not available for the state highway system or bridges.
3) The regional bridge category does not include the Golden Gate Bridge.
4) The transit operating needs assessment only considers what is needed to maintain existing service levels, therefore the transit operating needs are the same for both State of Good Repair and Maintain Conditions.

Local Streets and Roads

As shown in Table 2 below, to maintain existing conditions on the region's 43,500 lane miles of local streets, roads, and on-system bicycle/pedestrian, and other non-pavement infrastructure, approximately $41 billion is needed over the Plan period. To reach a state of good repair, with a corresponding condition level for non-pavement assets (signs, signals, sidewalks, storm drains, etc.), an investment of $48 billion is needed over the next 30 years. These costs do not include the estimated $20.5 billion in operations cost and overhead that will be needed to perform routine maintenance, pothole filling, street sweeping, and other requirements that keep local streets and roads serviceable.

For comparison, on *an annualized basis* (as each iteration of Plan Bay Area has a different number of years included within the planning horizon), the draft Plan Bay Area 2050 preservation needs for local streets and roads are approximately six percent higher than those estimated for Plan Bay Area 2040 (the current Plan). The increase in maintenance need is largely due to higher costs for maintenance materials and contract labor resulting from a strong economy and market competition.

Table 2. System Preservation Draft Needs for Local Streets, Roads, and bicycle/pedestrian infrastructure — By County (in millions of $YOE)

County	Maintain Conditions	State of Good Repair
Alameda	$7,940	$8,977
Contra Costa	$6,101	$6,878
Marin	$1,374	$1,676
Napa	$871	$1,290
San Francisco	$5,189	$5,759
San Mateo	$3,824	$4,220
Santa Clara	$10,186	$11,290
Solano	$2,838	$3,351
Sonoma	$3,028	$4,446
Total	$41,351	$47,886

To calculate the pavement maintenance need, MTC's pavement management software, StreetSaver® was used to determine how much funding would be needed for each jurisdiction to reach the condition level for each scenario. Average maintenance costs, a key input into the StreetSaver® model, were estimated by county, using information submitted by local jurisdictions to the 2018 California Local Street and Road Needs Assessment survey.

Non–Pavement needs include the capital maintenance of assets that are required for a functioning street and road system. Primary examples of these assets include storm drains, sidewalks, curb & gutter, streetlights, signs, and signals. To estimate the Non-Pavement needs on the local street and road system, MTC used a prediction model developed by consultants that uses information provided by local jurisdictions on non-pavement asset inventory and useful life to estimate long term costs to maintain non-pavement assets. It was determined that replacement costs can be predicted by the inventory of two non-pavement assets—curb and gutter and streetlights—using a regression formula. The total regional non-pavement asset replacement cost is then divided by the average useful life for each of the major non-pavement asset groups to estimate an annual preservation cost. The regional totals are then distributed across all jurisdictions based on a formula comprised of population share and lane mileage. The prediction model was updated with asset inventory and replacement cost information provided by local jurisdictions in responses to the 2018 California Local Street and Road Needs Assessment survey.

State Highways

The needs assessment for the state highway system relies on information provided by the California Department of Transportation in its 2019 State Highway System Management Plan (SHSMP), and analysis of the District 4 (Bay Area) pipelined projects and remaining needs for all SHOPP expense categories. Future adjustments to the state highway needs assessment may be made to account for specific Bay Area operational and maintenance needs over and above the assumed Bay Area population share of these needs as incorporated in the SHOPP forecast, and additional input that may be provided on the estimate by Caltrans staff.

The SHSMP is produced every two years and integrates the maintenance, rehabilitation, and operation of the state highway system into a single management plan that incorporates state and federal asset management requirements. The SHSMP includes a 10-year needs assessment to achieve established performance targets for the following asset classes:
- Pavement
- Bridges and Tunnels
- Drainage
- Transportation Management Systems
- Supplementary assets including – drainage pump plants, highway lighting, overhead signs, weigh in motion scales, and other facilities of various types

To estimate the 30-year state highway need for Plan Bay Area 2050, MTC staff added pipe-lined projects in the District 4 Project Book, with the SHSMP reported cost associated with meeting stated performance targets for each of the above listed asset classes within District 4 by FY 2028-29. For FYs 2030-2050, staff took the annualized need over the first 10-year period and reduced it by 75%, then escalated the annual need by 2.2% from FY 2030 through FY 2050. This shift to a lower needs level after year 10 assumes that the needs estimated in the first 10 years are to bring the state highway system to a state of good repair, after which ongoing maintenance costs would be significantly lower. This assumption and the level of reduction applied is consistent with the those made in the local street and road and transit capital maintenance needs assessments.

Local Bridges
The nearly 2,000 locally-owned bridges in the San Francisco Bay Area are essential links that help connect the state's communities, provide mobility for travelers, support efficient movement of freight, and relieve traffic congestion. The 2018 California Local Streets and Roads Needs Assessment included the cost to maintain the locally owned bridges in the state over the next ten years, by county. The assessment used the Federal Highway Administration's National Bridge Investment Analysis System (NBIAS) system to develop the projections of capital maintenance need for the state's locally-owned bridges. Though NBIAS is populated with default costs, deterioration models and other parameters, these were calibrated to regional costs and conditions in order to provide as realistic a projection as possible of the cost to maintain locally-owned bridges.

Since the 2018 California Local Streets and Roads Needs Assessment only covered 10 years of maintenance needs, MTC staff extrapolated the needs to cover the 30-year Plan period.

Regional Bridges
The estimated operations, preservation, and replacement needs for the seven regional toll bridges was forecasted using information provided by the Bay Area Toll Authority (BATA). The BATA toll bridge maintenance, repair, and rehabilitation assessment incorporates cost information for major capital projects from the Caltrans 20-year maintenance plan and forecasted inspection and maintenance costs for lesser projects to estimate the capital costs per bridge through FY 2036. For FYs 2037 through 2050, staff assumed an annual average of the previous 15 years, adjusted for inflation.

Operations needs for the regional bridges includes those estimated by Caltrans in addition to BATA expenses for the FasTrak Customer Service Center, the ATCAS (toll-collection IT system) banking costs, and other indirect toll collection expenses. The operations costs budgeted for FY 2020, were adjusted for inflation and extrapolated to FY 2050.

Transit Operating
In spring 2019, MTC distributed a Transit Operating Needs Assessment survey to each of the Bay Area's 25 transit operators as well as the Transbay Joint Powers Authority. The Transit Operating Needs Assessment survey gathered information from transit operators on current and planned service levels; existing and projected operating costs; and existing and projected local operating revenues over the Plan Bay Area 2050 period.

The cost to operate and maintain existing service levels was projected by the transit operators. MTC requested a cost breakdown of expenses by mode (bus, paratransit, rail, etc.) and system-wide non-operating expenses including debt service by year-of-expenditure. Transit operators also provided planned service changes associated with committed capital projects and/or fully funded future increases in service hours over the Plan Bay Area 2050 period.

Inflation assumptions were checked for reasonableness across similar expense categories. The cost impact of projected changes in service levels during the plan period was accounted for only in instances where those changes are a result of the transit operators' policy directives. The operating cost projections included in Table 3 include existing service levels and cost projections for committed expansion projects. Over Plan Bay Area 2050 period, transit operators identified approximately $218 billion in costs associated with operating the existing system and committed expansions to the system.

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Transit Capital

The information presented in Table 3 is a draft estimate of the cost to maintain the Bay Area's existing transit infrastructure in a state of good repair. The Transit Capital Needs are developed based on the operator submitted information housed in MTC's Regional Transit Capital Inventory (RTCI), covering existing transit assets. Operational (routine maintenance, cleaning, overhead, etc.) or expansion costs are not included in the estimate of capital maintenance needs and revenues.

To maintain existing transit capital conditions, approximately $59.4 billion is needed, and to reach a state of good repair (0% PAOUL), an investment of approximately $84.6 billion is needed over the next 30 years for the region.

Under the SGR scenario, there is an increase of approximately $37 billion in total need as compared to the $47.6 billion from the 2016 Plan Bay Area SGR assessment included in Plan Bay Area 2040 (PBA 2040). Change between the analyses is not unexpected – agencies have had an additional three years to update and amend their data. Changes to cost, date built, and useful life have significant impacts on modeling. The increase is caused by multiple factors; the values below are rough estimates of the major causes of the increase:

- $17 billion (approx.) – due to six additional years in PBA 2050 vs PBA 2040.
- $5 to 10 billion (approx.) – new assets and new replacement cost information added to the inventory since 2016, including major new projects.
- $2 to 6 billion (approx.) – per TERM Lite calculations, the base inventory value has increased by 14% since 2016. All unit costs are escalated to the current year nominal value. $1,000 in 2016 dollars would be escalated to $1,144 for the 2020 model start year in TERM Lite. All subsequent modeling assumptions are then based on this elevated rate.

Transit capital and operating needs projections by operator are shown in Table 3 on the following page.

Table 3. Draft Transit Capital and Operating Needs Projections – By Operator (in millions of $YOE)

Operator	Transit Capital Needs – SGR	Transit Capital Needs-Maintain Current Conditions	Transit Operating Needs
AC Transit	$6,175	$4,583	$22,043
ACE	$247	$163	$2,214
BART	$31,278	$21,824	$58,043
Caltrain	$5,375	$3,943	$8,349
CCCTA County Connection	$537	$471	$1,904
Clipper	$823	$773	TBD
Delta Breeze	$25	$14	$53
Dixon	$20	$12	$66
ECCTA Tri Delta Transit	$324	$279	$1,174
FAST	$228	$165	$1,179
Golden Gate Transit	$3,497	$1,786	$3,606
LAVTA	$324	$184	$1,068
Marin Transit	$328	$250	$1,472
NVTA	$189	$146	$975
Petaluma Transit	$71	$60	$123
SamTrans	$4,462	$2,188	$11,427
Santa Rosa CityBus	$151	$124	$661
SCT	$332	$243	$843
TJPA	TBD	TBD	$2,096
SFMTA	$21,234	$16,035	$67,139
SMART	$726	$601	$2,169
SolTrans	$311	$159	$795
UCT	$87	$75	$347
Vacaville City Coach	$98	$46	$205
VTA	$6,264	$4,242	$26,669
WestCAT	$396	$164	$740
WETA	$1,058	$855	$2,460
Grand Total	$84,561	$59,385	$217,819

Note: Sum of all agency values may not equal grand total due to rounding issues.

Draft Affordable Housing Needs Assessment

This attachment provides more details on the methodology and analysis results for estimating existing needs (through 2020) and future needs (2021 to 2050) for affordable housing. This assessment is designed to help quantify the needs for deed-restricted affordable housing in the context of Plan Bay Area 2050 with a similar aim to the parallel work for transportation – to understand the full needs to reach ideal conditions and then determine associated funding gaps.

There are two components to determining housing needs for low-income households – households that earn approximately less than $45,000 per year (in today's dollars). For both components, staff has assumed, for calculation purposes, that all low-income households may need to live in deed-restricted subsidized units, especially with the rising cost of living in the San Francisco Bay Area. While many low-income households currently live in what's referred to as "naturally affordable" units, these units are provided by the private market and may become unaffordable over time. Some units will also be protected through acquisition and rehabilitation (preservation). But since the level of subsidy needed for preservation is often comparable with production, this estimate does not differentiate between the two.

The two components of estimating housing needs for low-income households are:
- Forecasted household growth, or how many new low-income households will live in the region in future years; and
- Existing shortfall, or how many existing low-income households do not live in deed-restricted subsidized units.

To do this, staff used the household growth projections by income group for the Clean and Green Future from Horizon. These household forecast numbers will be updated with the Draft and Final Growth Forecasts for Plan Bay Area 2050 when available. Clean and Green was merely selected as a placeholder given that it was the moderate-growth Future explored in the predecessor Horizon process (for more information on Horizon, go to: https://www.planbayarea.org/2050-plan/horizon).

Table 2 below shows the forecasted household growth by four income categories, for the Clean and Green Future in Horizon. Key takeaways from this table include:
- There are anticipated to be roughly 766,000 low-income households in year 2020.
- These will grow by around 70,000 between 2020 and 2050, or on an annualized basis, a little more than 2,300 per year.
- Per the methodology described above, the first component of housing needs is therefore 2,300 new deed-restricted subsidized units per year between 2020 and 2050.

Table 2: Household Growth Forecast by Income Category for *Clean and Green* (Horizon)

Income Ranges	2020	2025	2030	2035	2040	2045	2050
Low (Q1)	**766,400**	**800,400**	**836,000**	**895,600**	**857,900**	**844,600**	**836,600**
Moderate-Low (Q2)	672,500	683,600	693,600	715,200	686,900	675,900	667,200
Moderate-High (Q3)	654,200	701,700	746,300	756,500	868,000	960,400	1,042,800
High (Q4)	843,200	922,400	996,900	1,020,600	1,183,100	1,345,000	1,488,800
Total	*2,936,300*	*3,108,200*	*3,272,800*	*3,387,900*	*3,595,900*	*3,826,000*	*4,035,400*

While there is no good data available on the total number of deed-restricted subsidized units in the Bay Area, estimates from NPH/CHPC put the number around 100,000 units. Additional takeaways from Table 2 include:

- Of the 766,00 low-income households, 100,000 currently live in affordable units.
- The remaining 666,000 households, per the methodology described above, constitute the existing shortfall.
- On an annualized basis, this would amount to around 22,200 new units per year between 2020 and 2050.

For this analysis, the housing need for lower-income households is therefore determined to be approximately 24,500 units per year. With an inflation rate of 2.2 percent and an anticipated per-unit subsidy of $450,000 (in today's dollars) as developed in CASA, the estimated affordable housing needs would total **$473 billion** through the year 2050 (in year of expenditure dollars).

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Draft Resilience Needs Assessments

As part of creating a more comprehensive regional plan, Plan Bay Area 2050 is expanding the scope of the Needs & Revenue Assessment to include challenges related to seismic safety and sea level rise adaptation. Over the next three decades, the region will have to plan and adapt the expansive shoreline to rising sea levels with uncertain flooding timeframes, in addition to continuing to address the seismic safety challenge that has always been present in our earthquake-prone region. The Resilience Needs & Revenue Assessment will provide an underlying context/framework to consider strategies.

The Bay Area is not starting from scratch in understanding the level of need for resilience challenges, nor in raising revenues to address the challenges. In the three decades since the Loma Prieta earthquake, the Bay Area has leveraged an estimated $10.7 billion[1] in local, state, and federal dollars to upgrade the region's public and private infrastructure. Over that period, 11[2] local measures directly addressed seismic risk, and another 103[3] measures built seismic readiness into capital improvement of public buildings such as schools and libraries. The region has also invested in the mitigation of its transportation infrastructure, utilizing $650 million of 1996's Prop 192 going toward the seismic mitigation of the area's state-owned toll bridges. Additionally, the region has made strides toward addressing Sea Level Rise. The ground-breaking Measure AA, passed in 2016, provides $25 million a year for the explicit protection of the Bay, integrating a slew of restoration and green mitigation initiatives. Additionally, cities have taken on their own local projects, such as Foster City's $90 million bond initiative in 2018 to protect its entire city from becoming a FEMA designated Special Flood Hazard Area. In the same year, San Francisco passed a $425 million bond to repair the Embarcadero seawall that protects its downtown.

This draft Resilience Needs & Revenue Assessment is the first time ABAG and MTC have attempted to quantify the financial gap associated with these two important topic areas. Of course, resilience is more wide-ranging than just sea level rise and earthquakes. However, these two topics were seen as the most high priority, due to the widespread vulnerability of the region to both of these risks, and their resulting community and economic impacts. The scope of this assessment focused further on the most significant needs, specifically residential seismic safety, and near-term sea level rise. As previously mentioned, the region has been mitigating the public realm – including both infrastructure, public buildings, and transportation - for years regarding earthquakes. However, residential mitigation is both critical, and critically underfunded. None of the $10.7 billion has gone toward housing in the last few decades, and only two public programs: CEA's Brace and Bolt, and FEMA's grant programs, currently address private structures. Additionally, ABAG has identified the need for housing protection as a top priority in maintaining the communities and economy within the region. Regarding Sea Level Rise, this assessment begins with only near-term coastal Sea Level Rise adaptation, in order to focus on the most immediate vulnerabilities and most significant impacts. Other forms of resilience, including wildfire, riverine flooding, extreme heat, and other hazards and climate impacts are important to consider, but have been left outside the scope of Plan Bay Area 2050. In the meantime, it is worth noting that there are additional resources to support local planning related to these other hazards through the MTC/ABAG resilience program, NGOs and the State of California. Additionally, other hazards and refinements to this methodology may be recommended as key Implementation Actions of this Plan. Future iterations of Plan Bay Area may also utilize this assessment framework to integrate the additional hazards.

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[1] Including all direct local bonds and taxes, and all seismic FEMA grants. Assumptions include 20% of state seismic bonds, proportional to the Bay's share of population, and 10% of indirect local revenues – a broad assumption made on the case study of several local initiatives.
[2] Local direct bonds and taxes focused on seismic mitigation.
[3] Indirect local bonds and indirect special taxes.

Draft Need: Seismic Needs for Residential Buildings

A major earthquake on one of the Bay Area's many faults can damage tens of thousands of homes in a matter of seconds, adding an acute housing crisis to the region's chronic one. Additionally, with a lack of historical funding for residential buildings, public infrastructure is well protected, but there is critical unmet need for housing mitigation. This significant housing vulnerability therefore makes up the Resilience Need for Earthquakes, in order to compensate for the crucial regional financial gap.

No regional data set is available that describes the structural characteristics of every building, but staff have used available building information in the region (primarily building use, year built, number of units, and number of stories) to develop high level estimates for the number of common seismically vulnerable building types. These include single-family cripple walls where an unbraced and unbolted crawl space can shift a house off its foundation, or multi-family soft stories where a weakened first floor, often with large garage openings, can pancake on the first floor. Additional assumptions, as well as a breakdown of seismic needs, can be found in Table 2.

Some cities in the region are actively requiring owners of soft-story multifamily buildings to retrofit, and the State of California is gradually expanding a grant program designed to incentivize single family homeowners with cripple walls to retrofit. Using assumptions about typical retrofit costs, combined with regional building information, the estimated cost to address these two known vulnerabilities is approximately $13.3 billion. An additional $3.3 billion was added to account for seismic retrofit of other vulnerable building types, primarily single family and multi-family buildings with fewer than 5 units built over a garage. These units suffer the same deficiency as the larger multi-family soft story challenge, and their inclusion leads to a total estimated need of approximately $16.6 billion.

Table 2: Earthquake Need for Residential Buildings (in millions of $YOE)

Vulnerability	Number of Units[4]	Units Built Annually[5]	Inflation	Unit Cost[6]	Subtotal[7]
Cripple Wall (Single Family)	185	12	2.2%	$12,000	$3,003
ROG/HOG (Single Family)[8]	45	3	2.2%	$25,000	$1,530
Cripple Wall (Duplex)	31	6	2.2%	$12,000	$1,526
ROG/HOG (Duplex)	16	3	2.2%	$30,000	$1,984
Soft Story (5+ units)	24	21	2.2%	$20,000	$8,527
Total	**301**	**45**			**$16,570**

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[4] Regional estimates by UrbanSim scan; shown in thousands.

[5] It is assumed that this project may take approximately 15 years, leading to projected costs through 2035. Shown in thousands.

[6] Costs derived from SME guidance.

[7] Rounded to the nearest million.

[8] Room over Garage (ROH); House over Garage (HOG).

Draft Need: Sea Level Rise through 2050
Sea level rise is a different challenge compared with earthquakes – with each year, it becomes progressively worse, with impacts spiking at times when coupled with king tides, and bad storms. For example, a five-year storm (an event that happens roughly every five years), coupled with just one-foot of sea level rise, would flood communities and infrastructure at three feet above today's sea level. To assess need, areas with flooding impacts at three feet were identified using the Bay Conservation and Development Commission's ART Bay Area mapper. Placeholder strategies of 16 different archetypes (including marsh restoration, traditional levees, and roadway elevations, among others) were then created to address communities vulnerable to that level of inundation, and subsequently edited using the input of various stakeholders. Costs were adjusted to account for the regional variance in construction costs. Additional assumptions can be found in Table 3.

The estimated cost to address sea level rise through year 2050 is approximately $15.1 billion. This preliminary cost estimate is focused primarily on shoreline protection measures to prevent flooding from the bay and ocean, and it does not fully consider upstream flooding impacts from streams and rivers, or the Delta. It does include marsh and subtidal restoration and adaptation projects that would provide ecosystem and flood protection benefits. Staff are working with a broader set of ecological, flood control, and sea level rise subject matter experts to further refine this estimate by January 2020.

Table 3: Sea Level Rise Need (in millions of $YOE)

Strategy[9]	Cost Assumption[10]	Units	Subtotal[11]
Levee – Horizontal (Mild)	$5,800	253,199	$1,468
Levee – Horizontal (Steep)	$2,800	31,667	$88
Levee – Traditional (Minimum Trail)	$1,000	29,034	$29
Levee – Traditional (Average Trail)	$1,200	92,534	$111
Levee – Traditional (2-lane Roadway)[12]	$2,310	129,661	$299
Levee – Traditional (4-lane Roadway)	$3,520	57,656	$202
Levee – Raise Existing Levee	$770	18,984	$14
Seawall - Simple	$4,730	42,779	$202
Seawall – Berm or Amenities	$6,800	9,174	$62
Elevate Roadway (2-lane)	$41,470	12,186	$505
Elevate Roadway (4-lane)	$75,790	74,532	$5,648
Elevate Highway (8-lane)	$116,050	3,055	$354
Marsh Restoration	$47,700	74,884	$3,571
Medium Tidal Gate	$3,000,000	14	$42
Large Tidal Gate	$20,000,000	3	$60
Subtotal			$12,600
Operations and Maintenance[13]			$2,520
Total			**$15,120**

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[9] Does not include buyouts or relocation.

[10] Cost assumptions stem from previous research with a consultant. Shown in 2019 dollars.

[11] Subtotal of projects within each strategy; average unit costs per strategy not given due to wide regional variance in project cost. Shown in millions in 2019 dollars- subtotal column may not add up to total as printed due to rounding.

[12] This estimate includes a high level assumption to protect Capitol Corridor, however, no costed archetype was available for railroads specifically. As a result, this estimate is included under Levee – Traditional (2-lane Roadway) for the railroad itself and Elevate Roadway (2-lane) for its bridges.

[13] High-level estimate; assumed to be 20% of the overall total. Subject to further refinement by end of 2019.

Additionally, there is a nexus for adaptation with transportation, as much of the region's infrastructure is susceptible to sea level rise. In some cases, an adaptation measure for transportation may have off-system benefits, as areas adjacent to the transportation asset would benefit from sea level rise protection. In this way, the financing of transportation is simultaneously mitigating the risk for private or public buildings. There may also be the potential for non-transportation adaptation measures to utilize flexible transportation funds if the sea level rise measure is seen to provide a co-benefit a transportation asset. In other scenarios, the transportation asset may be directly adapted, and provide no direct benefit to adjacent areas.

These transportation mitigation projects may have financial benefits for transportation funding. An example of this is the seismic mitigation of the seven state-owned Bay Area toll bridges, which were mitigated by a state seismic bond of in 1996. Today, half of the regular toll fare goes toward the state's Seismic Retrofit Program. In this way, the relationship between resilience and transportation can lead to a series of complex outcomes, which affect both resilience, and even the transportation "bank" of needs and revenues. It is estimated that approximately 60 percent of the regional need for sea level rise has either a direct or indirect nexus with regional transportation assets.

Table 4: Relationship of Sea Level Rise Need with Transportation Funding[14]

Direct Nexus	Indirect Nexus	No Nexus	Total
$7,091	$801	$4,769	$12,600[15]
56%	6%	38%	100%

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[14] Shown in 2019 dollars in millions. Shown without operations and maintenance funding.
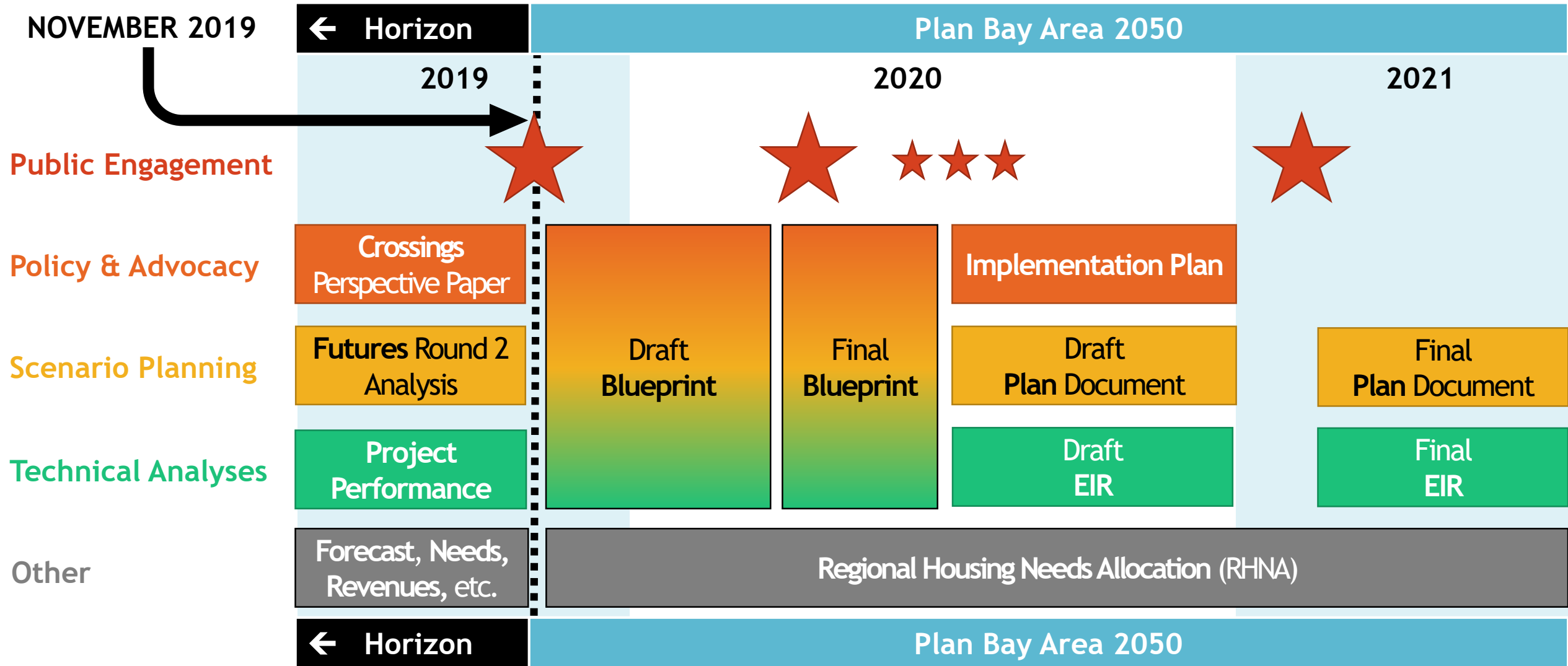[15] Column may not add up to total as printed due to rounding.

Draft Needs Assessments

Transportation O&M: William Bacon

Affordable Housing: Dave Vautin

Resilience: Rachael Hartofelis

Regional Advisory Working Group - November 2019

PLAN BAY AREA 2050

1

Plan Bay Area 2050 Schedule

Needs and Revenue: Objectives & Definitions

Objectives: to understand the unconstrained financial needs related to critical expenditure categories for Plan Bay Area 2050, as well as baseline available revenues.

What do we mean by "financial needs"?

- *Transportation:* investment needed to operate and maintain the *existing* (publicly owned) transportation system
- *Resilience:* investment needed to protect existing infrastructure and communities from hazards
- *Housing:* investment needed to ensure all households have an affordable housing option

What do we mean by "baseline available revenues"?

- Revenue from local, regional, state, and federal sources that are reasonably expected to be available over the Plan period

PLAN BAY AREA 2050

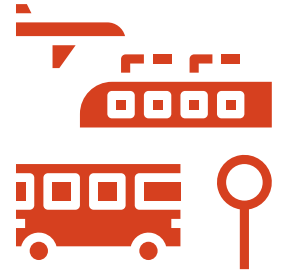# Needs and Revenue: Scope of Work

- **No assessment of baseline needs will capture everything.** Not every critical investment is reflected here; for example, resilience investments go beyond preparing for sea level rise and earthquakes. That being said, we feel it is important to create a "version 1.0" for these critical topic areas.

- **The future is uncertain.** As explored in Horizon, future needs and revenues could be influenced by external forces beyond our control. Despite the uncertainty of the world today, we are doing our best to come up with a likely estimate based on information available today.

- **Consistency is key.** All needs and revenue data is shown in year-of-expenditure dollars with an escalation rate of 2.2%.

PLAN BAY AREA 2050
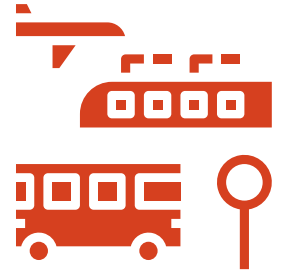
Important Caveats:

All needs estimates are in **preliminary draft** form at this early stage of Plan Bay Area 2050. Revenue estimates will be available in December.
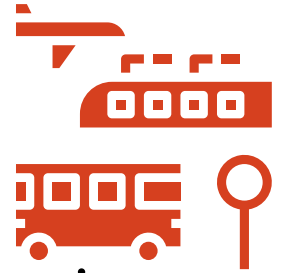
Transportation Needs Methodologies

- **Local street & road and bridge** maintenance needs were estimated using StreetSaver®, a pavement management system used by all Bay Area jurisdictions in combination with input and estimates from the 2018 California LSR Needs Assessment.

- **Bicycle/pedestrian and other non-pavement infrastructure** maintenance needs estimated using StreetSaver® and prediction models for accompanying local street and road infrastructure

- **Regional bridge** needs were estimated using the Bay Area Toll Authority's bridge maintenance, rehab, and replacement schedules and cost estimates.

- **State highway and bridge** needs were estimated using information for District 4 (San Francisco Bay Area) in Caltrans' 2019 State Highway System Management Plan and Fiscal Year 2019/20 Project Book.

PLAN BAY AREA 2050

Transportation Needs Methodologies

- **Transit capital** maintenance needs were developed using the Regional Transit Capital Inventory – an inventory of every public transit asset in the region– and TermLite, a software that models the cost of replacing transit assets over time based on the assets' useful life. Assumes replacement of existing bus fleet with zero emission buses in compliance with CARB's Innovative Clean Transit Regulation. Assumes in-kind replacement, without major upgrade, of other assets.

- **Transit operating** needs are estimated using information provided by the region's public transit operators on the cost of maintaining today's current level of service (16.8 million service hours per year) over the Plan period.

PLAN BAY AREA 2050

Transportation Summary

- **$417 billion** to improve and maintain the system in a state of good repair

- **$385 billion** to prevent further deterioration / maintain existing conditions

30-Year Transportation Operations and Capital Maintenance Needs (in billions of $YOE)

	Local Streets, Roads,& Local Bridges	Regional Bridges	State Highway & Bridge	Transit Capital	Transit Operating	Total Operations and Capital Maintenance Needs	Plan Bay Area 2050 Draft Transportation Revenue
Maintain Existing Conditions	$64.4	$19.4	$24.4	$59.4	$217.8	$385.4	TBD
State of Good Repair	$71.0	$19.4	$24.4	$84.6	$217.8	$417.2	TBD

Note: Two condition scenarios could only be calculated for Local Streets, Roads, and Local Bridges, and Transit Capital

PLAN BAY AREA 2050

Needs and Revenue
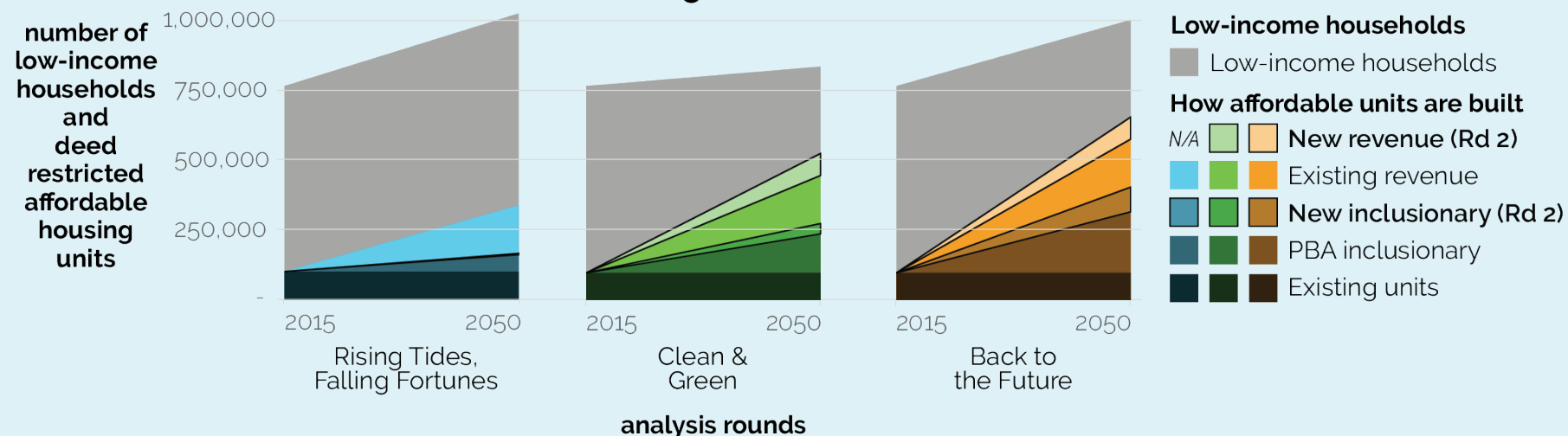# Affordable Housing Overview

- **Key caveat:** this is the first time MTC/ABAG has conducted a Needs & Revenue Assessment for affordable housing; we expect these draft estimates to be further refined this cycle and in future cycles of the long-range plan.

- **Goal:** identify the gap between existing affordable housing and future needs for low-income households, building upon work from the CASA effort.

- **Note:** low-income households are defined as those earning less than $45,000, who are least likely to be served by market-rate development.

Building Upon Work from...

HORIZON

Futures Analysis
Rounds 1 & 2

Number of deed restricted affordable housing units and the number of low-income households

number of low-income households and deed restricted affordable housing units

1,000,000 / 750,000 / 500,000 / 250,000 / -

2015 — 2050
Rising Tides, Falling Fortunes

2015 — 2050
Clean & Green

2015 — 2050
Back to the Future

analysis rounds

Low-income households
- Low-income households

How affordable units are built
- New revenue (Rd 2)
- Existing revenue
- New inclusionary (Rd 2)
- PBA inclusionary
- Existing units

Affordable Housing Needs Methodology

- There are **roughly 100,000 existing deed-restricted affordable housing units** in the Bay Area today. *(source: NPH/CHPC)*

- As of 2020, we expect there will be approximately 766,000 low-income households* in the Bay Area - **an existing gap** of 666,000 deed-restricted units.**

- Between 2020 and 2050, we expect there will be an additional 70,000 low-income households added to the Bay Area* - **yielding a combined gap of 736,000 deed-restricted units by 2050.**

- **A per-unit subsidy of $450,000** - which could come from a variety of different existing and future revenue sources - was assumed to estimate associated financial needs. *(source: CASA)*

* The analysis uses the growth forecast for the Clean and Green Future from Horizon as a placeholder until the Draft Regional Forecast is released.
** Assuming that all low-income households live in a deed-restricted unit by 2050.

PLAN BAY AREA 2050
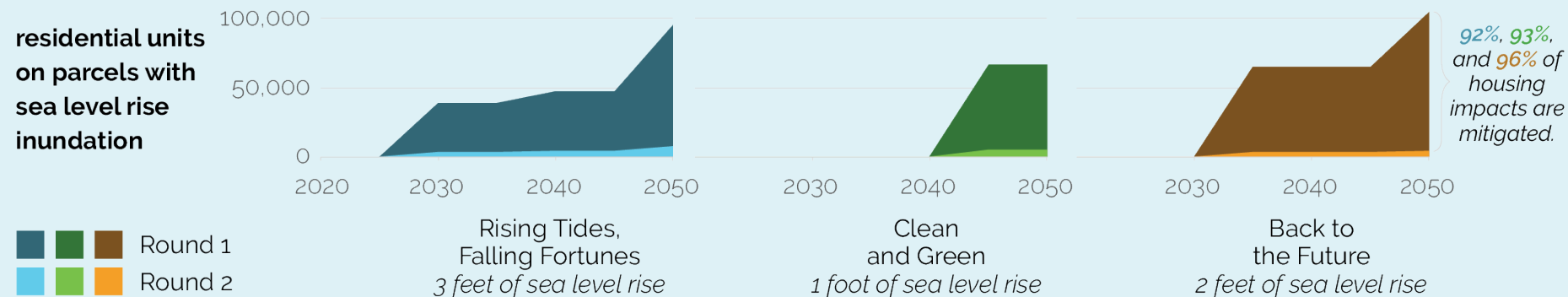
Resilience Overview

- **Key caveat:** this is the first time MTC/ABAG has conducted a Needs & Revenue Assessment for environmental resilience; we expect these draft estimates to be further refined this cycle and in future cycles of the long-range plan.

- Therefore, the Resilience Needs & Revenue Assessment focuses on two specific high-priority resilience issue areas:
  - **Sea Level Rise** *(focus on protecting most of the region's shoreline through 2050)*
  - **Earthquakes** *(focus on residential buildings, given recent investments in transportation infrastructure)*

Building Upon Work from...

HORIZON

Futures Analysis
Rounds 1 & 2

Residential sea level rise impacts in Futures round 1 (without adaptation) and round 2 (with adaptation)

residential units on parcels with sea level rise inundation

100,000

50,000

0

2020   2030   2040   2050   2030   2040   2050   2030   2040   2050

■ ■ ■ Round 1
■ ■ ■ Round 2

Rising Tides,
Falling Fortunes
3 feet of sea level rise

Clean
and Green
1 foot of sea level rise

Back to
the Future
2 feet of sea level rise

92%, 93%, and 96% of housing impacts are mitigated.

Resilience Needs Methodologies

Sea Level Rise (SLR)

Archetype strategies created for areas that **flood with up to three feet of SLR** → Archetype strategies developed with stakeholder input in fall 2018 and summer 2019 → **Sea Level Rise Need Estimate**

- Strategies include both "gray infrastructure" (seawalls, levees, etc.) and "green infrastructure" (marsh restoration, etc.).

- Sea level rise protection height is based upon two feet of permanent inundation and one foot of temporary flooding from a storm. ART Bay Shoreline Flood Explorer was used to identify areas of inundation.

PLAN BAY AREA 2050

Resilience Needs Methodologies

Earthquakes

Gathered building data	→	Applied costs to vulnerable building types	→	Seismic Need Estimate

- No regional structural dataset is available, so high level estimates were created with existing building data. Estimates were determined by UrbanSim.

- Vulnerable types include structures with cripple walls, soft stories, and/or house/room over garage.

PLAN BAY AREA 2050

Category	All costs are in billions of YOE dollars		
	Anticipated Revenue	Anticipated Needs	Anticipated Gap
Public Transit Operations		$218 billion	
Public Transit State of Good Repair[1]		$85 billion	
Local Streets & Bridges State of Good Repair[1]	TBD	$71 billion	TBD
Highways State of Good Repair		$24 billion	
Bridges State of Good Repair		$19 billion	
Affordable Housing[2]	TBD	$473 billion	TBD
Sea Level Rise Adaptation	TBD	$15 billion	TBD
Seismic Mitigation[3]	TBD	$17 billion	TBD
TOTAL	**TBD**	**$922 billion**	**TBD**

Technical Footnotes:
1. *Need reflects funding to get to an ideal state of good repair, rather than simply maintaining existing conditions.*
2. *Need reflects funding to provide deed-restricted affordable housing to all low-income households by year 2050.*
3. *Need is focused solely on residential buildings.*

Remaining fields in this table will be populated in December with anticipated revenues available.

PLAN BAY AREA 2050

Next Steps

- **November:** allow for continued review of needs assessments & refine needs based on feedback received

- **December:** share initial revenue estimates for transportation, housing, and resilience; integrate Draft Regional Forecast

- **January:** finalize Needs & Revenue work in time for Draft Blueprint analysis

PLAN BAY AREA 2050