

MISSOULA CONNECT

Summary of Scenario Analysis Findings (11/30/20)

INTRODUCTION

This document summarizes the approach and findings of analyses conducted to compare the transportation network scenarios developed for the Missoula region's long-range transportation plan (LRTP), Missoula Connect. Details on the two growth scenarios and three transportation network scenarios can be found in the *Scenario Planning Approach & Proposed Scenarios* memo (10/30/20).

To conduct this analysis, the transportation network scenarios were coded into the regional travel demand model and analyzed against the two regional growth scenarios for 2050 to assess how well each scenario performs against key metrics estimated by the model, such as vehicle miles traveled (VMT). In addition, post-processing of the model runs and additional off-model analysis was conducted to better account for project benefits that may not be well understood by the travel demand model. The metrics analyzed are presented in the following order in this document:

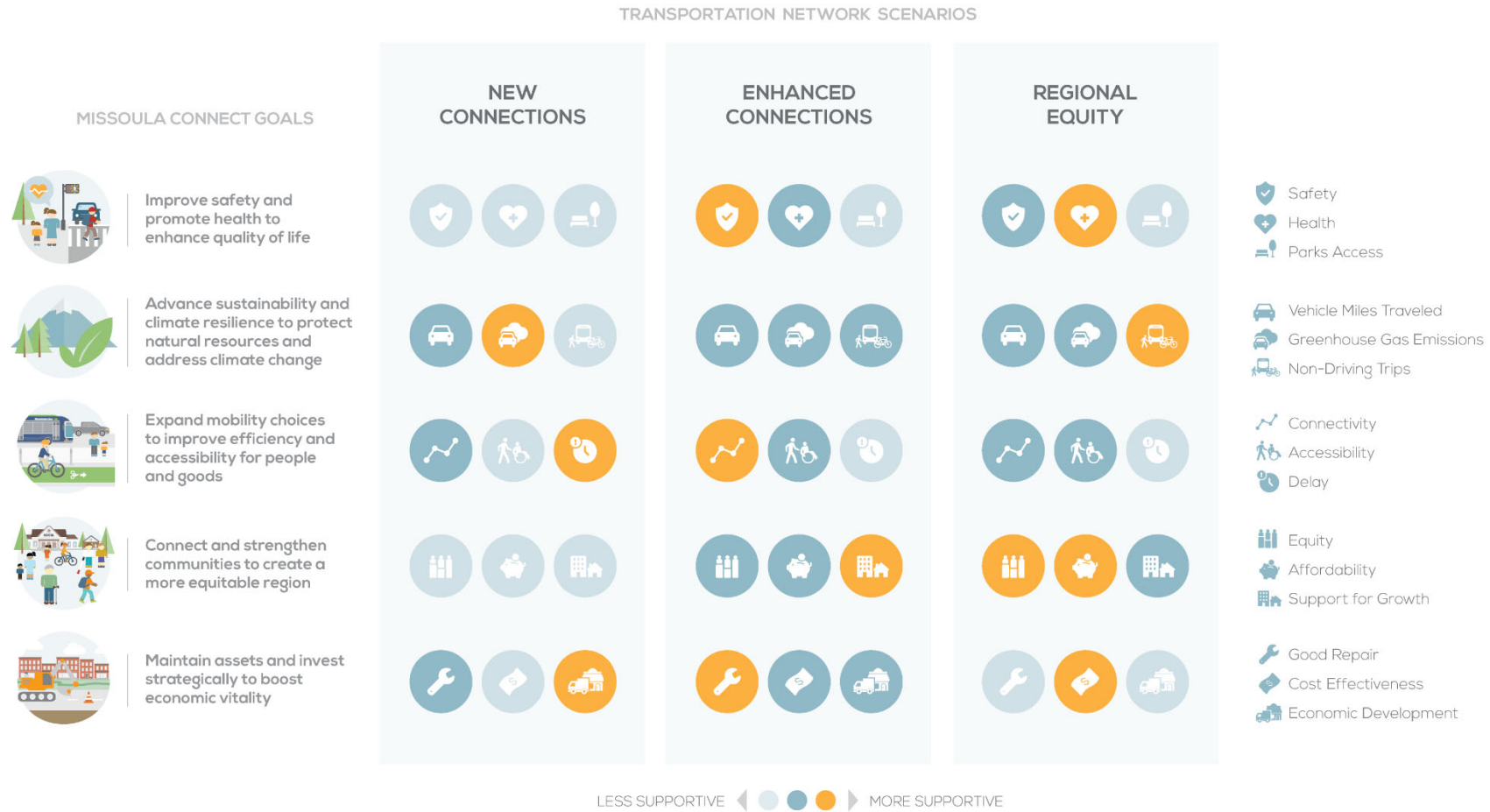
- Jobs Accessibility
- Parks Accessibility
- School Accessibility
- Social Services Accessibility
- Bicycle Connectivity
- Affordability
- Safety
- Ability to Support Growth
- Good Repair
- Equity
- Vehicle Miles Traveled (VMT)
- Vehicle Hours of Delay (VHD)
- Automobile Mode Share
- Transit Mode Share
- Walk Mode Share
- Bike Mode Share
- Greenhouse Gas (GhG) Emissions

Table 1 on the following page shows the level of support each transportation scenario provides for the [Goals and Desired Outcomes of Missoula Connect](#). The table reports on 15 metrics, using a “less supportive” (light blue) to “more supportive” (orange) scale to demonstrate the relative performance of each scenario compared to the other two scenarios.

SUMMARY OF SCENARIO ANALYSIS FINDINGS

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Table 1 Summary of Scenario Performance



JOBS ACCESSIBILITY

Supporting the regional economy and improving access to jobs and opportunities is a vital component of the Missoula Connect vision. This analysis reveals how each transportation network scenario provides accessibility to jobs within a 15- and 30- minute walking or biking commute under both Business as Usual and Strategic Growth scenarios in 2050.

Maps were created by calculating the extent to which someone walking or riding a bicycle could reach jobs by using the active transportation facilities provided by each transportation network (Base, New Connections, Enhanced Connections, and Regional Equity). The network for walking includes sidewalks and streets with a Level of Traffic Stress 1 (LTS 1). To estimate access to jobs, the coverage of each network was then overlaid with the estimated number of jobs by Traffic Analysis Zone (TAZ) for each growth scenario.

Maps provided in Figure 1 through Figure 12 illustrate the area that encompasses all accessible bicycle or pedestrian pathways that are within a 15-minute or 30-minute walk or bike commute from the center of a TAZ. If a proposed project improves connectivity to another proposed or existing facility in a certain area, the broader network becomes more accessible in those areas. The expansiveness of the network does not directly correlate to increased job access, though it does provide a rough estimation. If a proposed facility or roadway improvement expands the network in a neighborhood where projected job growth is minimal, for instance, the maps will show an expansion of the network; however, that does not necessarily indicate an increase in access to jobs. Table 2 and Table 3 indicate overall changes in walking and biking access by growth and transportation network scenario. Key findings are as follows:

- The Enhanced Connections scenario includes more projects that integrate pedestrian improvements than the other scenarios. However, given that the pedestrian network is well connected in areas with expected job growth, the change from base conditions is not as significant as it is with the bicycle network.
- Enhanced Connections includes projects that improve pedestrian connectivity in the Northside area, where job growth is expected.
- The Regional Equity scenario provides the biggest increase in access to jobs via bicycle within 15 minutes under the Business as Usual scenario, whereas Enhanced Connections performs slightly better in the 15-minute range under the Strategic Growth scenario.
- Regional Equity and Enhanced Connections provide very similar increases in access when bike commute times are increased to 30 minutes in both growth scenarios
- Regional Equity and Enhanced Connections projects improve the connectivity of the base bicycle network within the central core, as well as in Hellgate, Lower Rattlesnake, and near the University, where there is anticipated job growth. Unlike the Enhanced Connections scenario, the Regional Equity Scenario provides connections to Wye and Frenchtown, where there is also anticipated job growth.
- Proposed projects in the New Connections scenario expand on the base bicycle network. However, expansion would occur in areas where projected job growth is not as great as the projected job growth in areas served by the facilities proposed in the Enhanced Connections and Regional Equity scenarios.

SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Table 2 **Changes in Walking Access to Jobs – 2050**

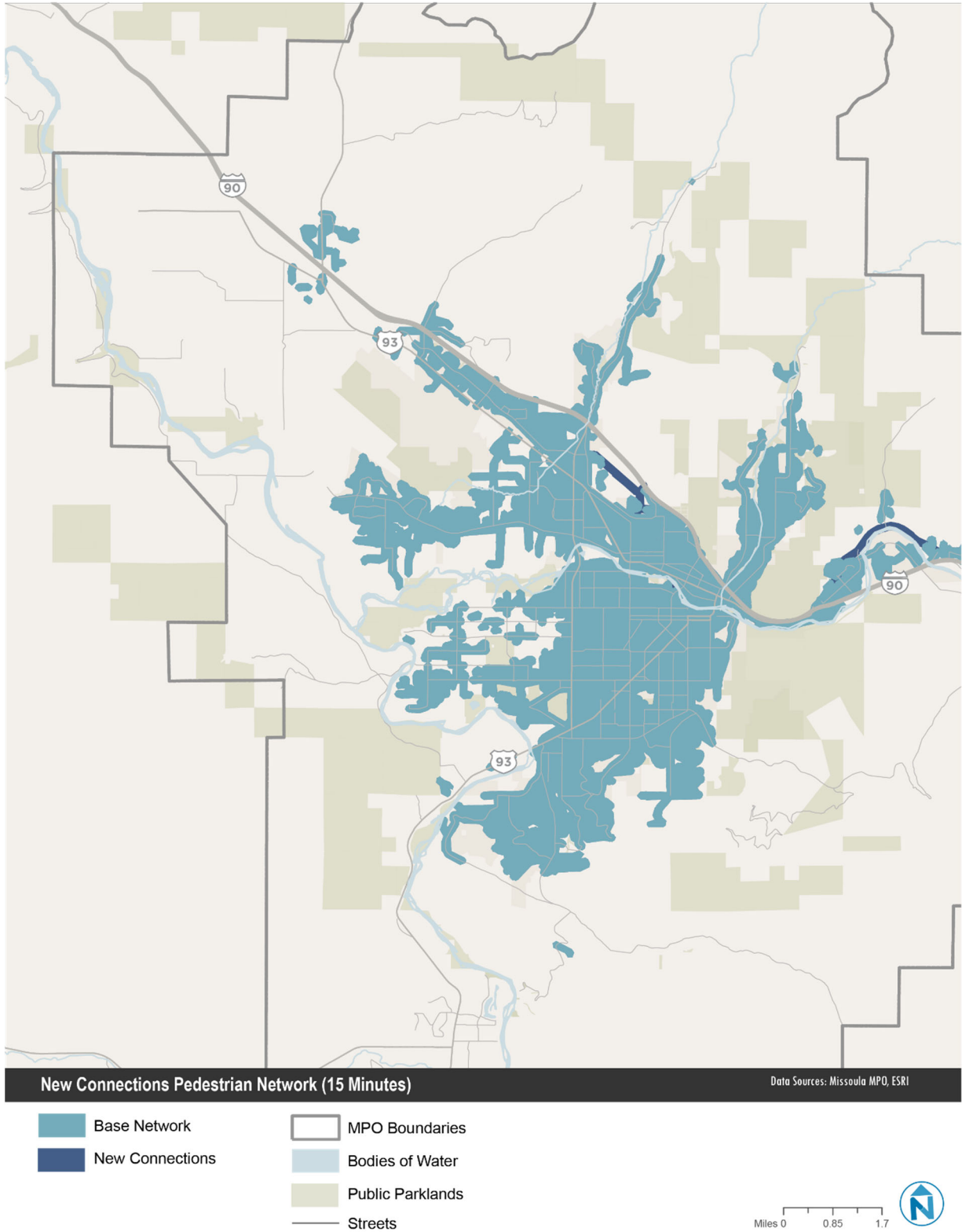
Growth Scenario	Commute Time	Base	New Connections	Change from Base	Enhanced Connections	Change from Base	Regional Equity	Change from Base
Business as Usual	15 min	80,598	80,931	0%	82,229	2%	81,786	1%
	30 min	89,664	89,997	0%	91,278	2%	90,950	1%
Strategic Growth	15 min	80,594	80,929	0%	82,174	2%	81,698	1%
	30 min	89,546	89,881	0%	91,109	2%	90,748	1%

Table 3 **Changes in Biking Access to Jobs – 2050**

Growth Scenario	Commute Time	Base	New Connections	Change from Base	Enhanced Connections	Change from Base	Regional Equity	Change from Base
Business as Usual	15 min	57,353	58,717	2%	59,834	4%	60,928	6%
	30 min	67,059	67,959	1%	68,936	3%	68,990	3%
Strategic Growth	15 min	58,730	59,906	2%	60,906	4%	59,764	2%
	30 min	67,059	68,232	2%	69,108	3%	69,240	3%

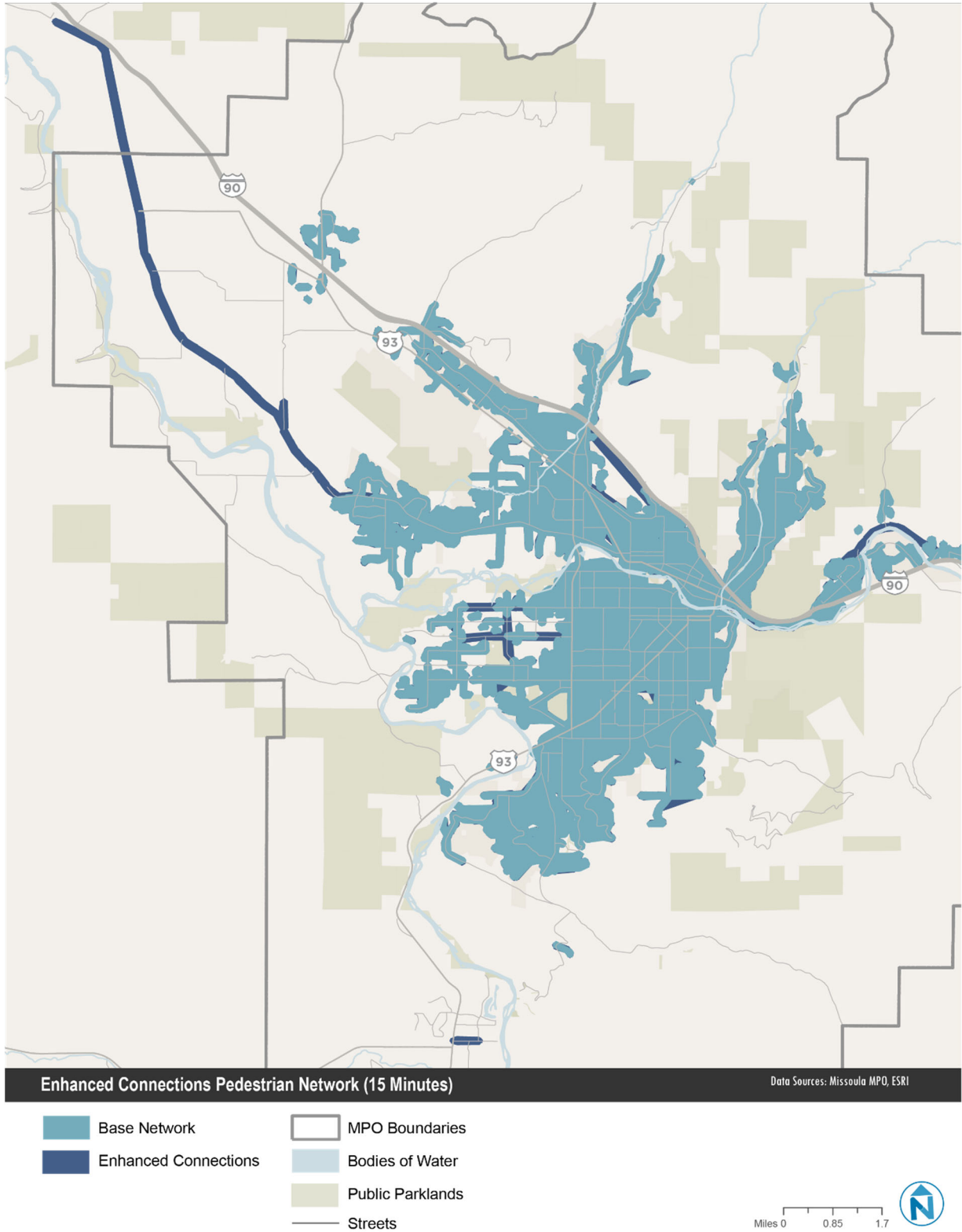
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 1 Walking Access to Jobs (15 mins) – New Connections



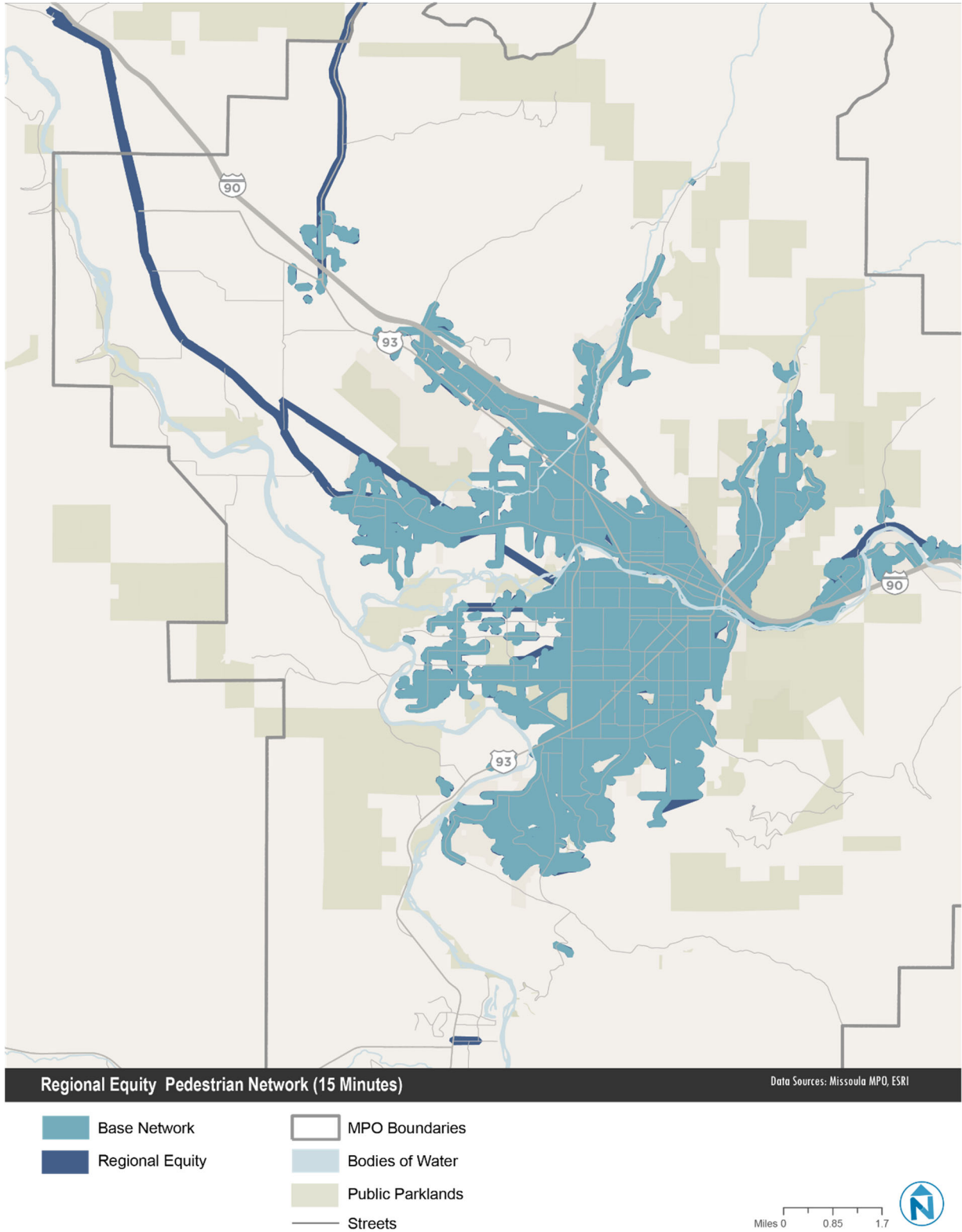
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 2 Walking Access to Jobs (15 mins) – Enhanced Connections



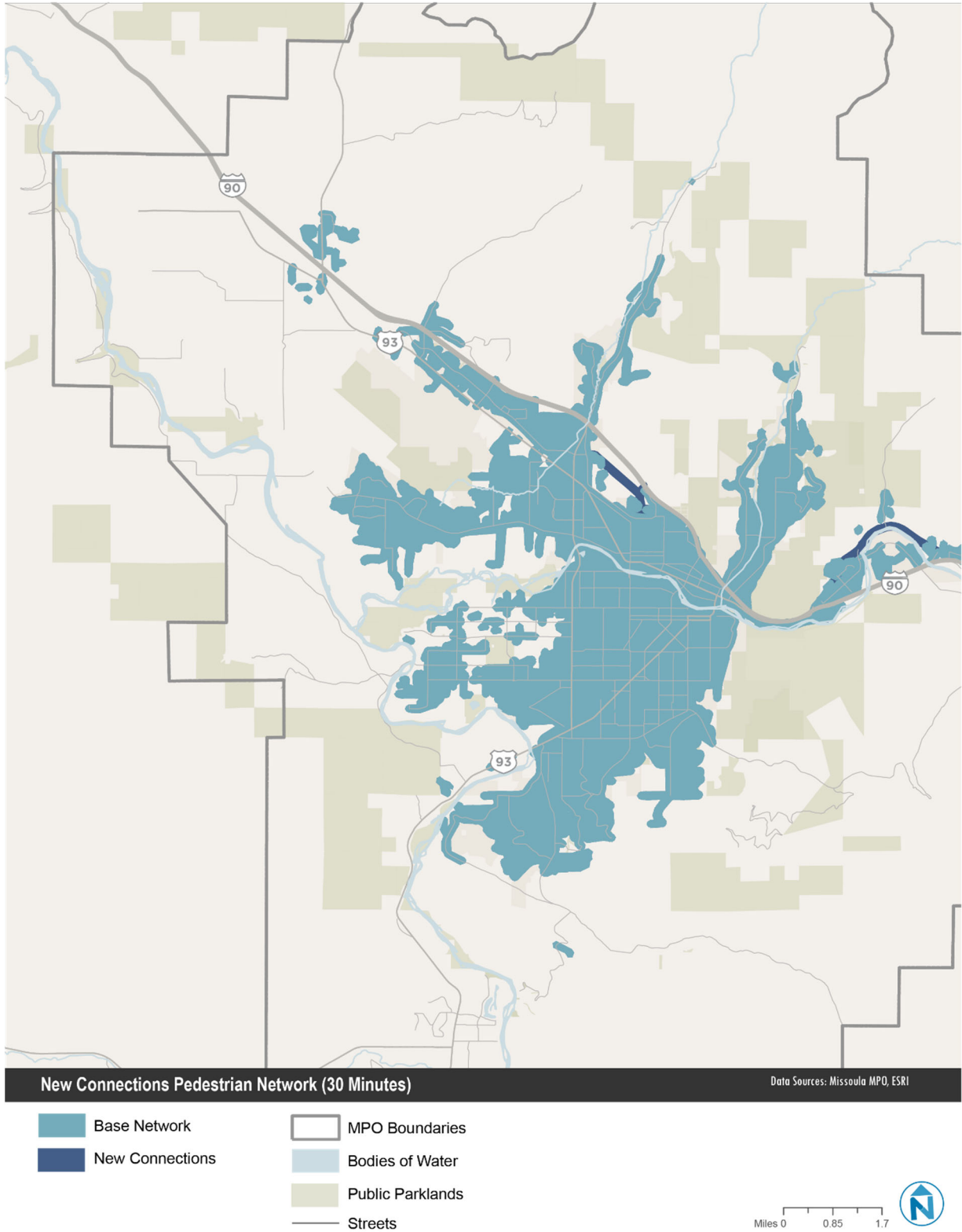
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 3 Walking Access to Jobs (15 mins) – Regional Equity



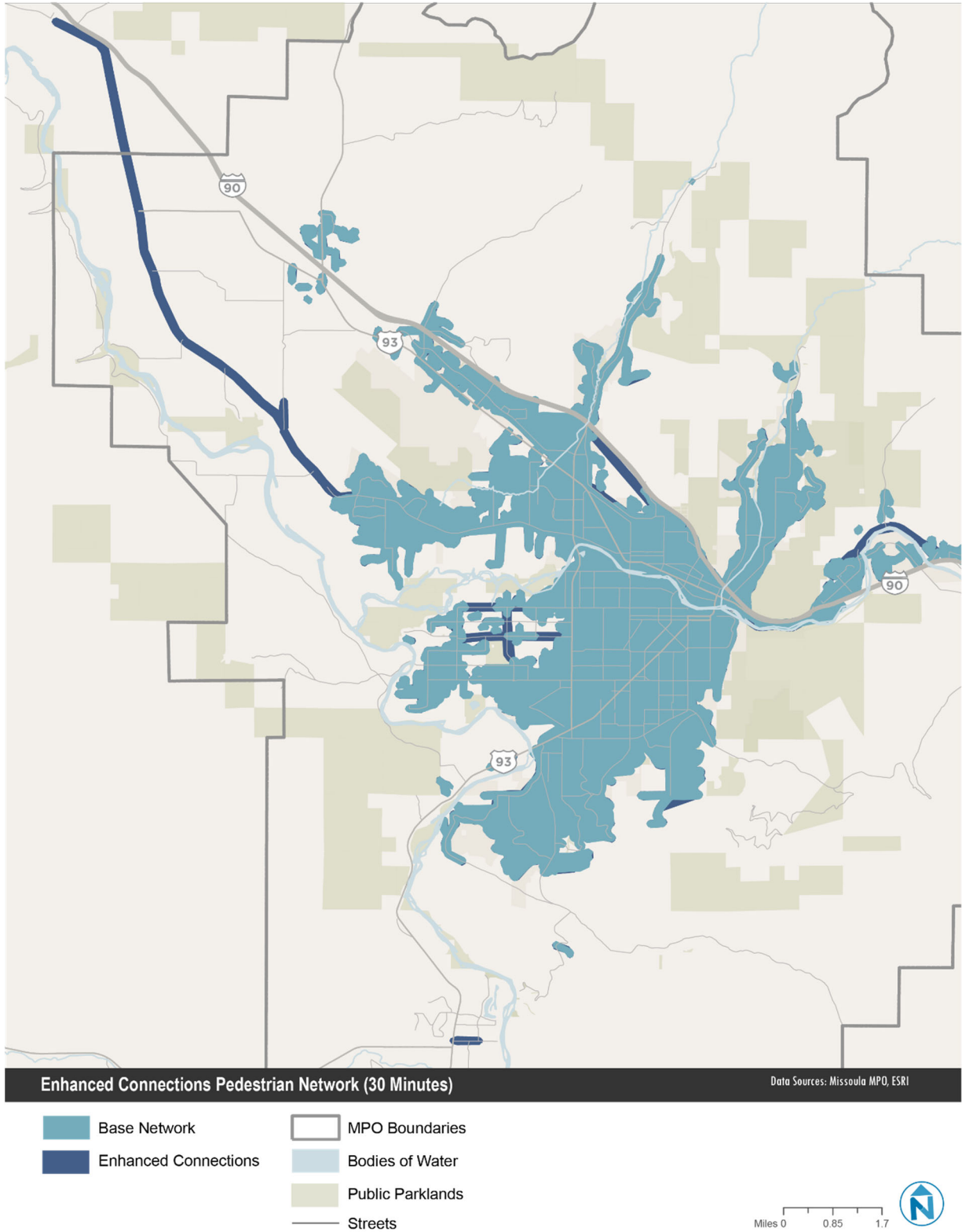
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 4 **Walking Access to Jobs (30 mins) – New Connections**



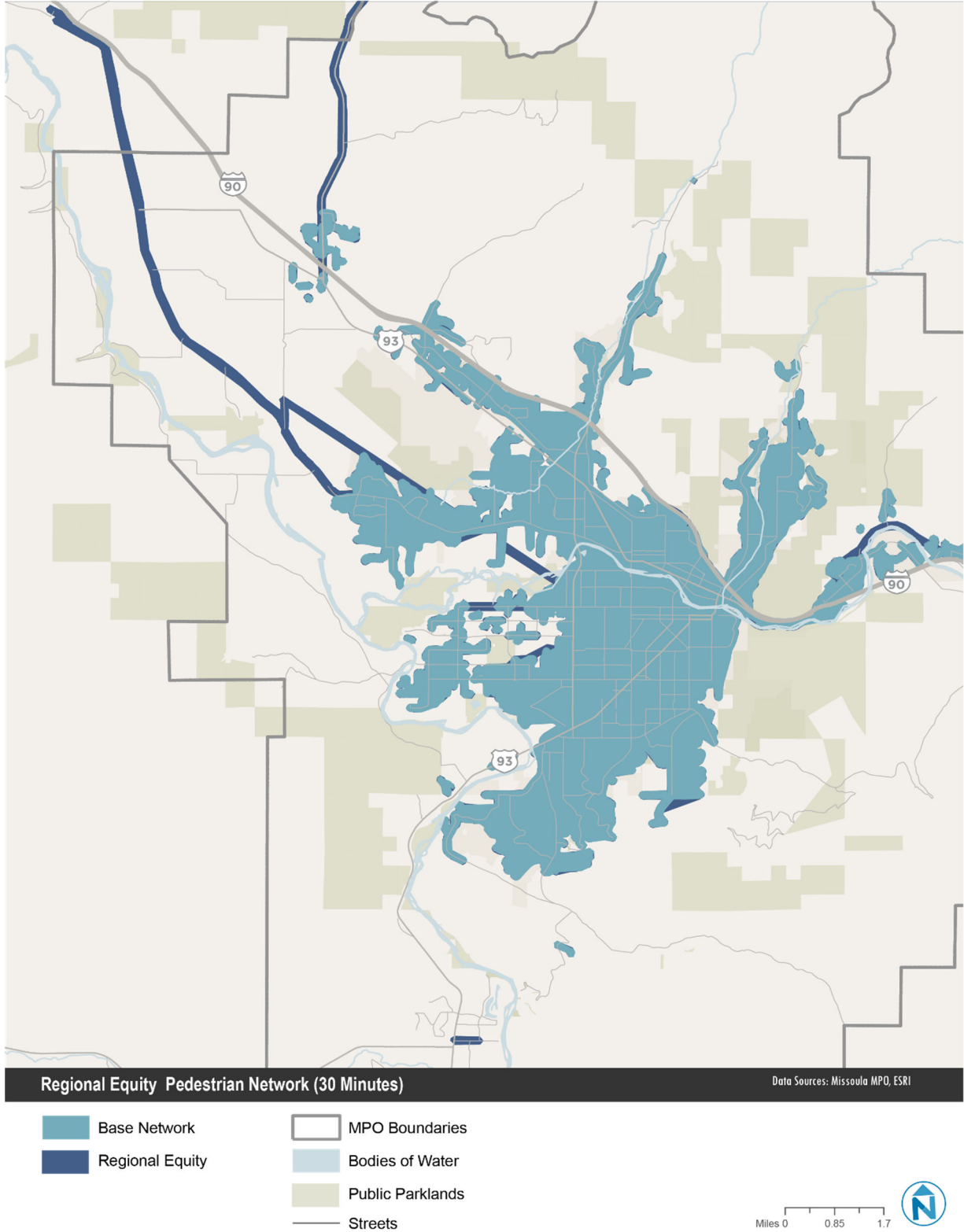
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 5 Walking Access to Jobs (30 mins) – Enhanced Connections



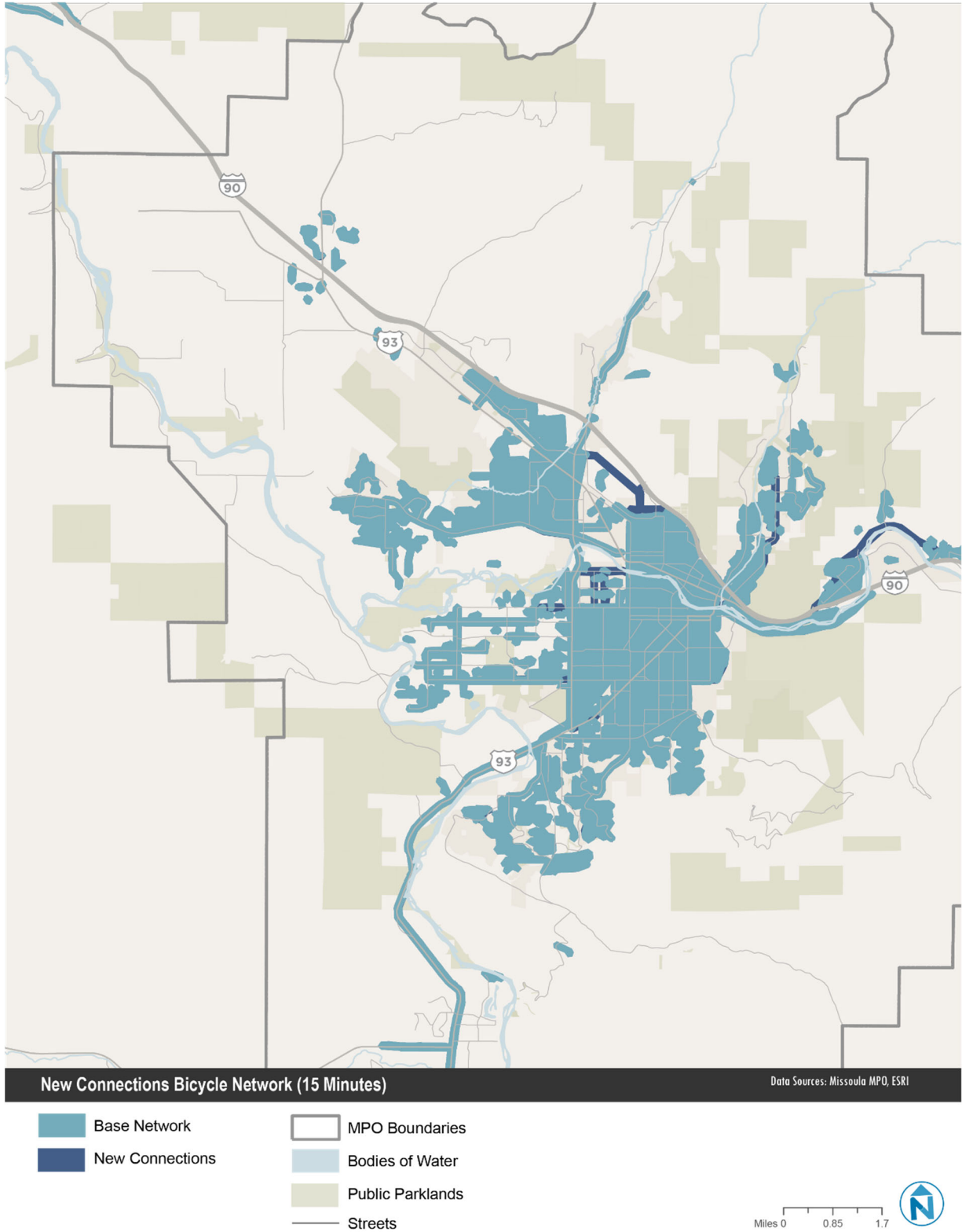
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 6 Walking Access to Jobs (30 mins) – Regional Equity



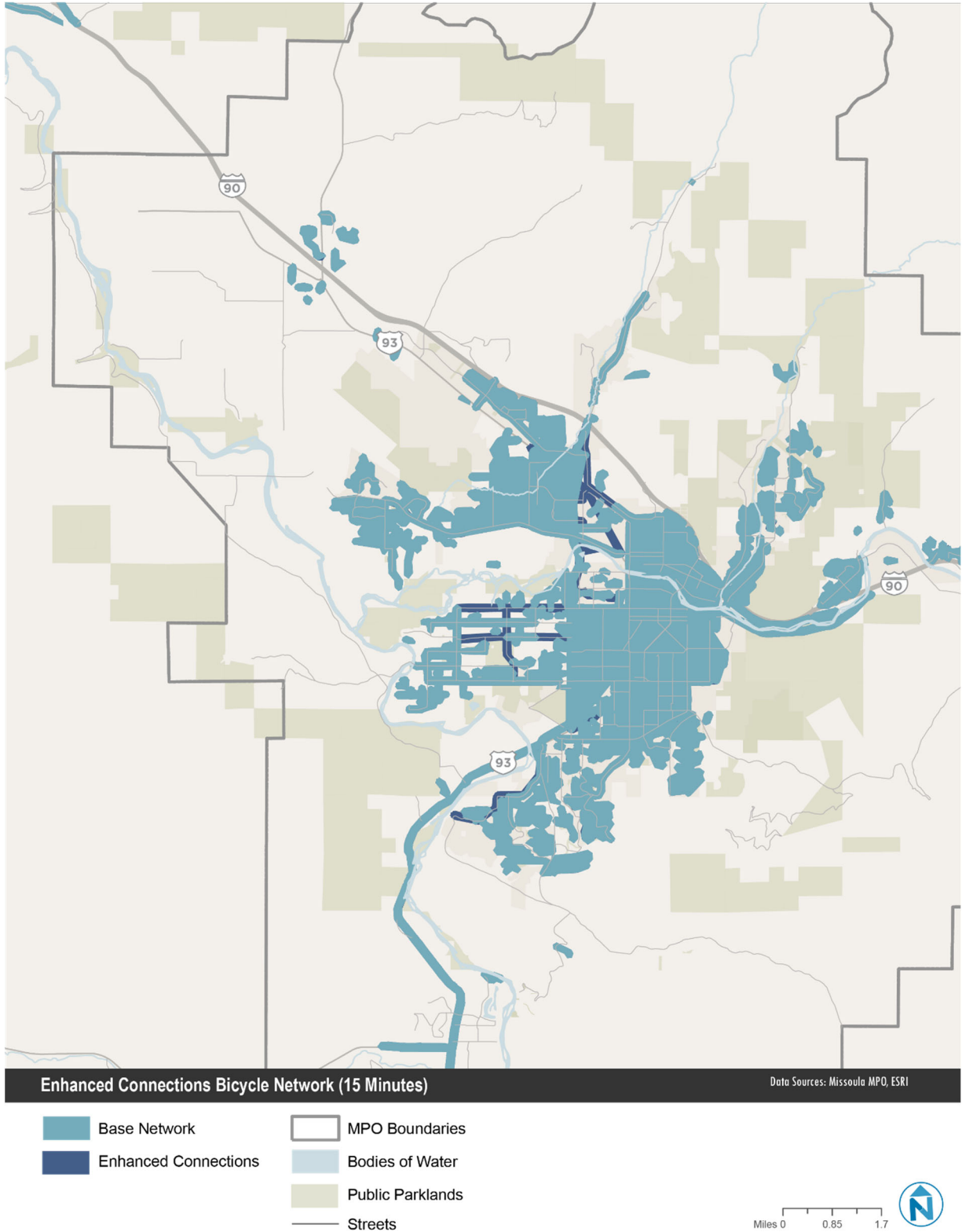
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 7 Biking Access to Jobs (15 mins) – New Connections



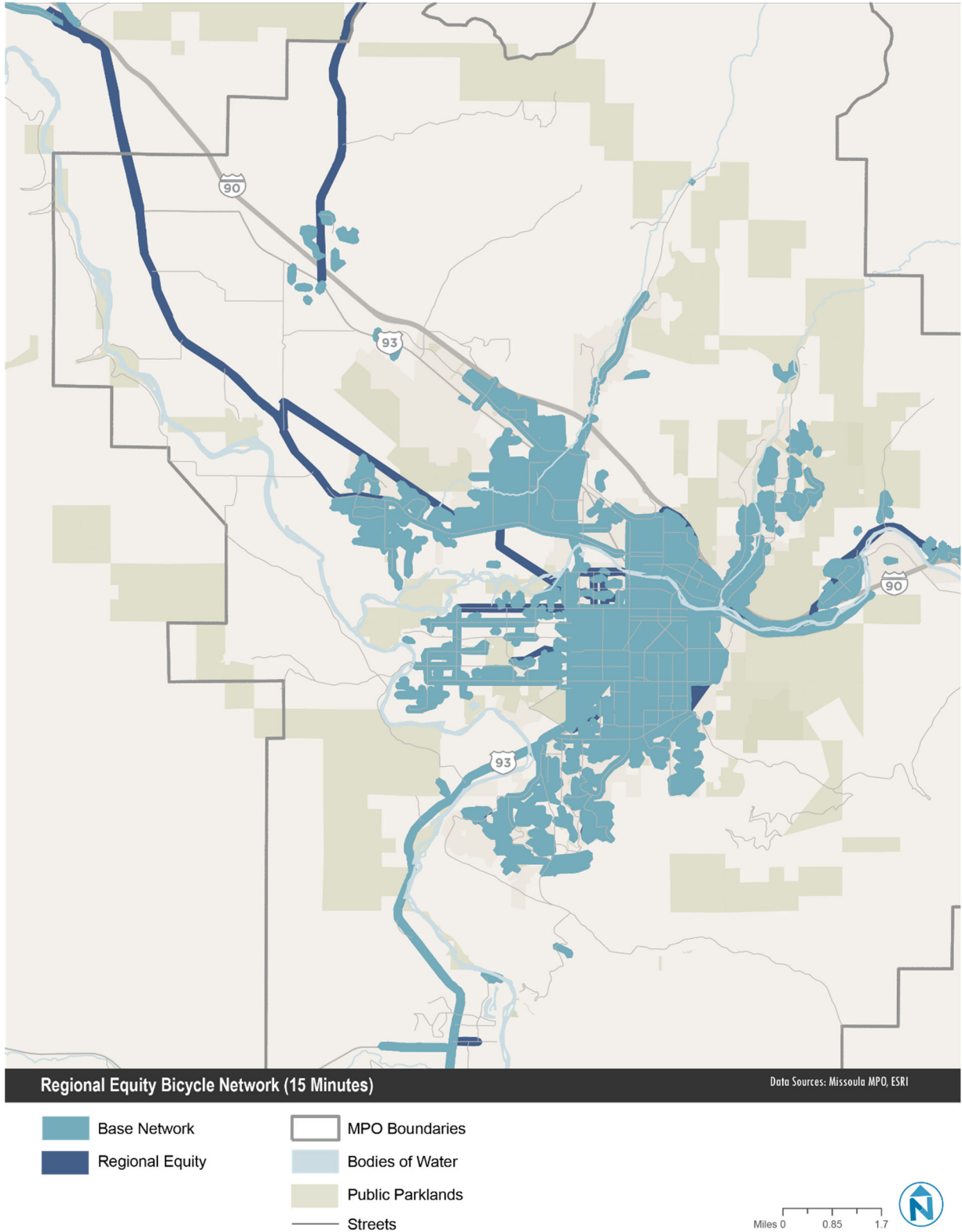
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 8 Biking Access to Jobs (15 mins) – Enhanced Connections



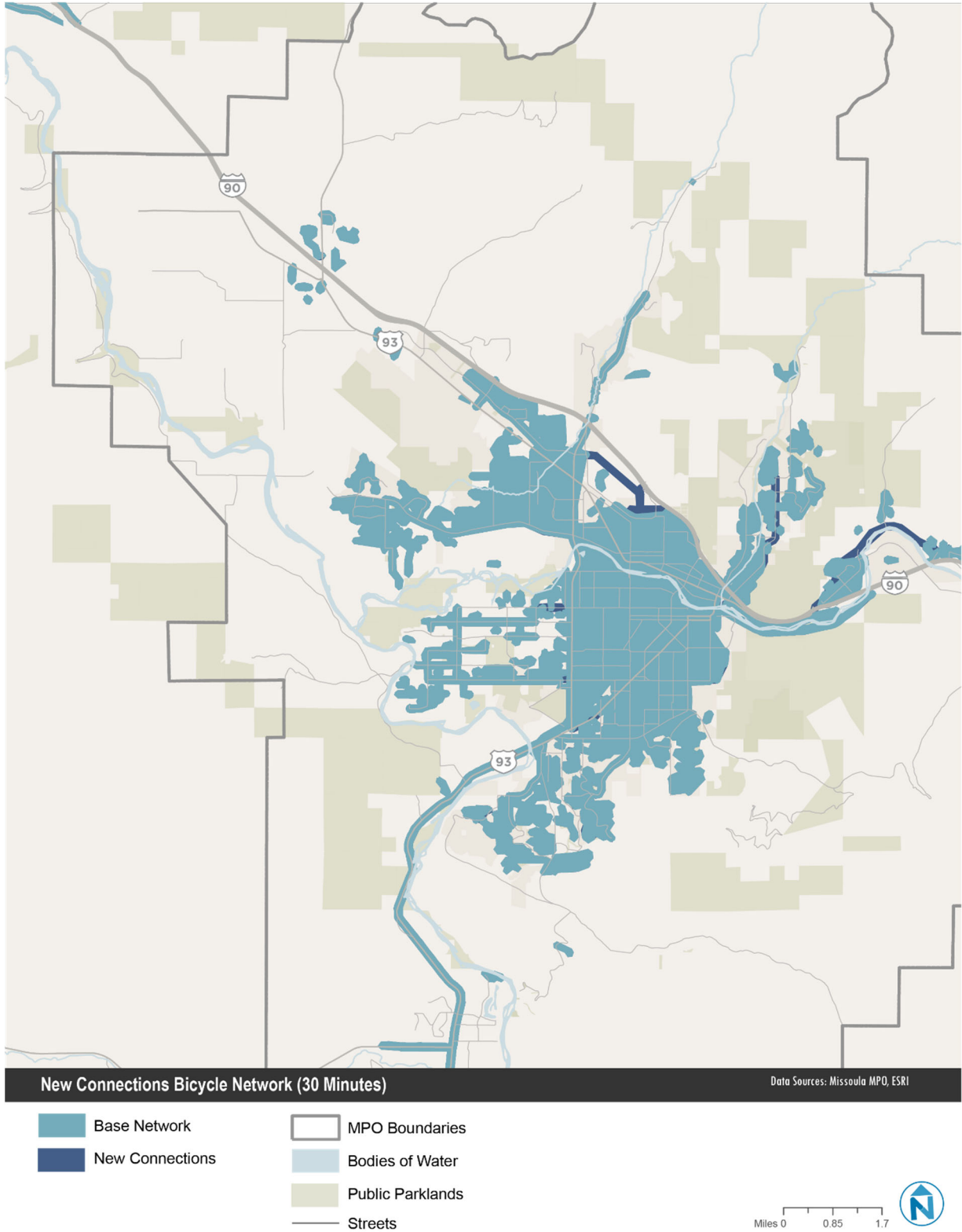
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 9 Biking Access to Jobs (15 mins) – Regional Equity



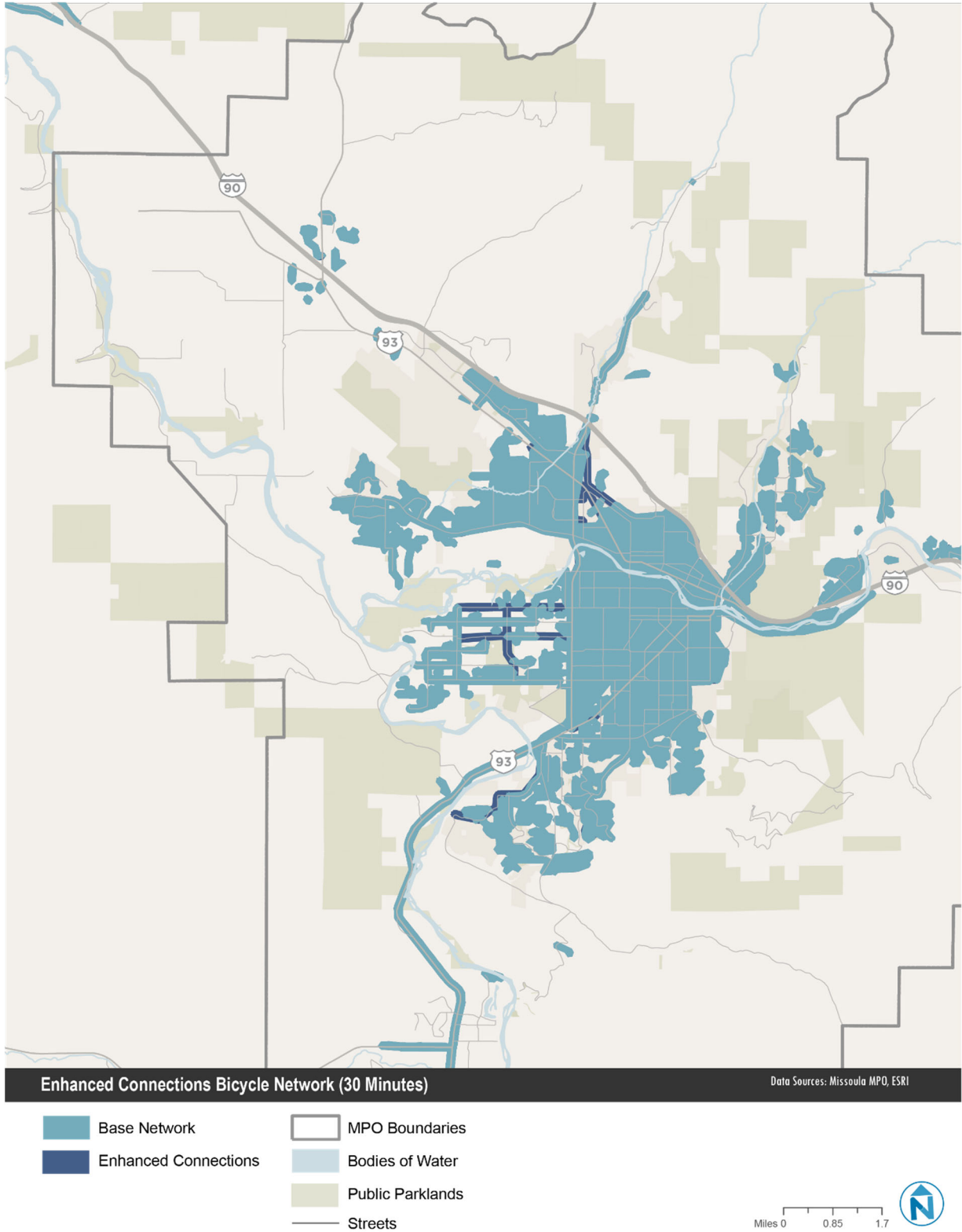
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 10 Biking Access to Jobs (30 mins) – New Connections



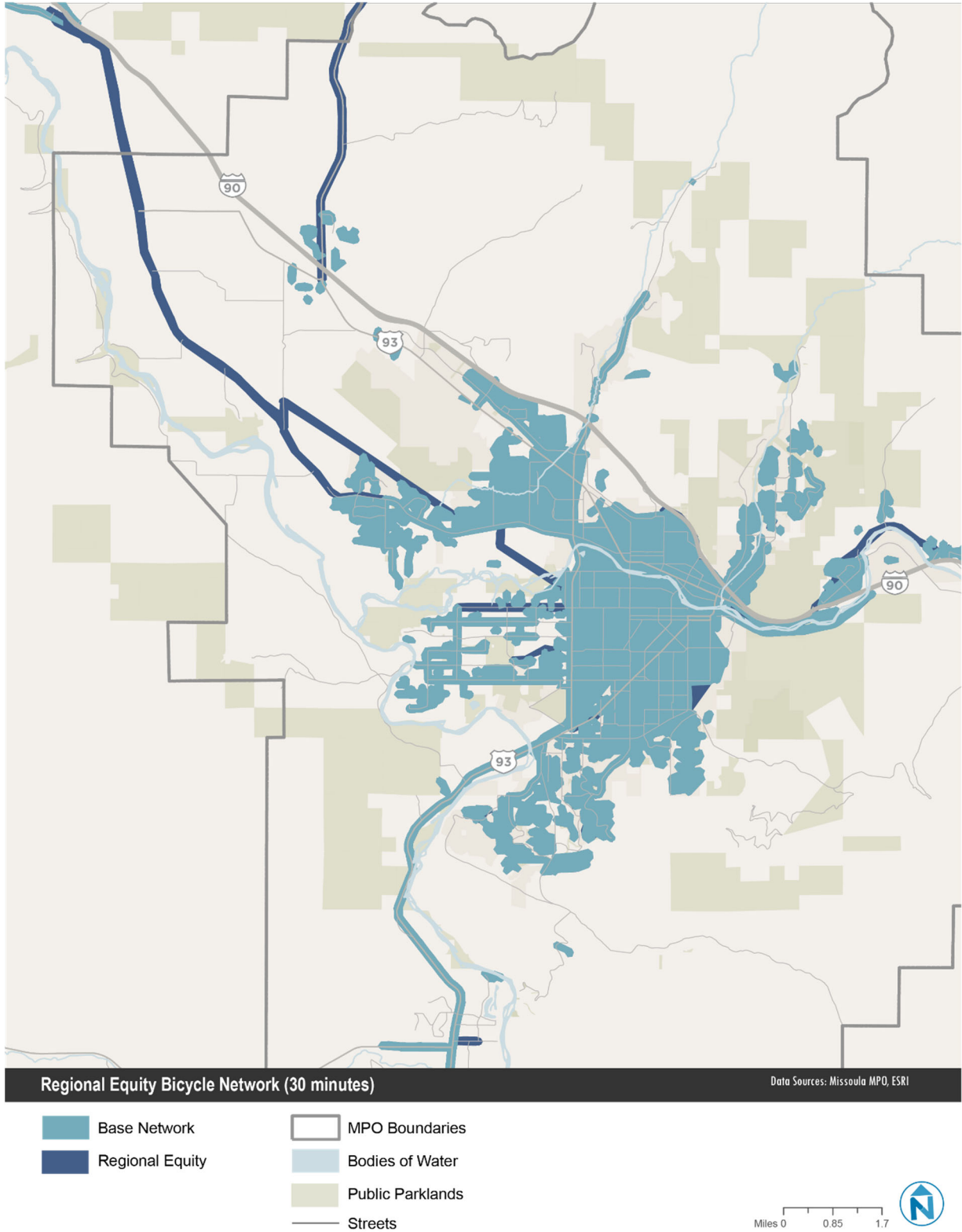
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 11 Biking Access to Jobs (30 mins) – Enhanced Connections



SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 12 Biking Access to Jobs (30 mins) – Regional Equity



PARKS ACCESSIBILITY

Increased access to parks is an indicator that the transportation network is supportive of enhanced quality of life, access to recreation, and improved public health outcomes. This analysis reveals how each transportation network scenario provides accessibility to parks within a 15- and 30-minute walk or bicycle ride. For the destination to be considered accessible, the entire journey must be possible without the traveler deviating from designated pedestrian or bicycle facilities. For example, the accessibility of the trip would be “broken” if someone riding a bicycle to a park needed to ride on an arterial street without a bicycle lane or adjacent shared-use path for a few blocks to bridge a gap between bicycle facilities.

As with jobs, maps were created by calculating the extent to which someone walking or riding a bicycle could reach a park by using the active transportation facilities provided by each transportation network (Base, New Connections, Enhanced Connections, and Regional Equity). The network for walking includes sidewalks and streets with LTS 1. The network for biking includes on-street bicycle facilities, commuter trails, and LTS 1 streets.

To estimate access, the coverage of each network was then overlayed with the point location of parks in the region. Due to the high number of locations classified as parks in local land use data, facilities included in this analysis are regional, community, and neighborhood parks. Facilities classified as right-of-way, open space, special use, special use trails, trails, and green space adjoining trails have been excluded.

Figure 13 through Figure 24 are maps indicating overall changes in walking and biking access to parks by transportation network scenario. Key findings are as follows:

- Enhanced Connections includes pedestrian projects that improve connectivity to parks in the Miller Creek and South 39th Street neighborhoods.
- The Enhanced Connections network results in a 14% increase in accessibility from the base for a 30-minute walk to a park.
- Proposed projects within the transportation network scenarios do not significantly increase bicycle access to parks in Missoula. In general, parks are already well served by the base bicycle network.
- Overall, the Enhanced Connections and Regional Equity scenarios provide greater connectivity to parks than New Connections.

Table 4 and Table 5 (see following page) show the change in the number of future (2050) households with walking and biking access to parks for one transportation network scenario compared to the base network. For this calculation, we used the transportation network that showed the greatest increase in overall coverage from the base.

The most significant increase is shown by the number of households that would be able to reach parks within a 30-minute walk under both growth scenarios in the Regional Equity transportation scenario. As with overall network coverage, an increase in households with access to parks by bicycle would be nominal for all three transportation scenarios. The change for the Enhanced Connections scenario is shown here.

SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Table 4 Household Walking Access to Parks with Regional Equity Scenario – 2050

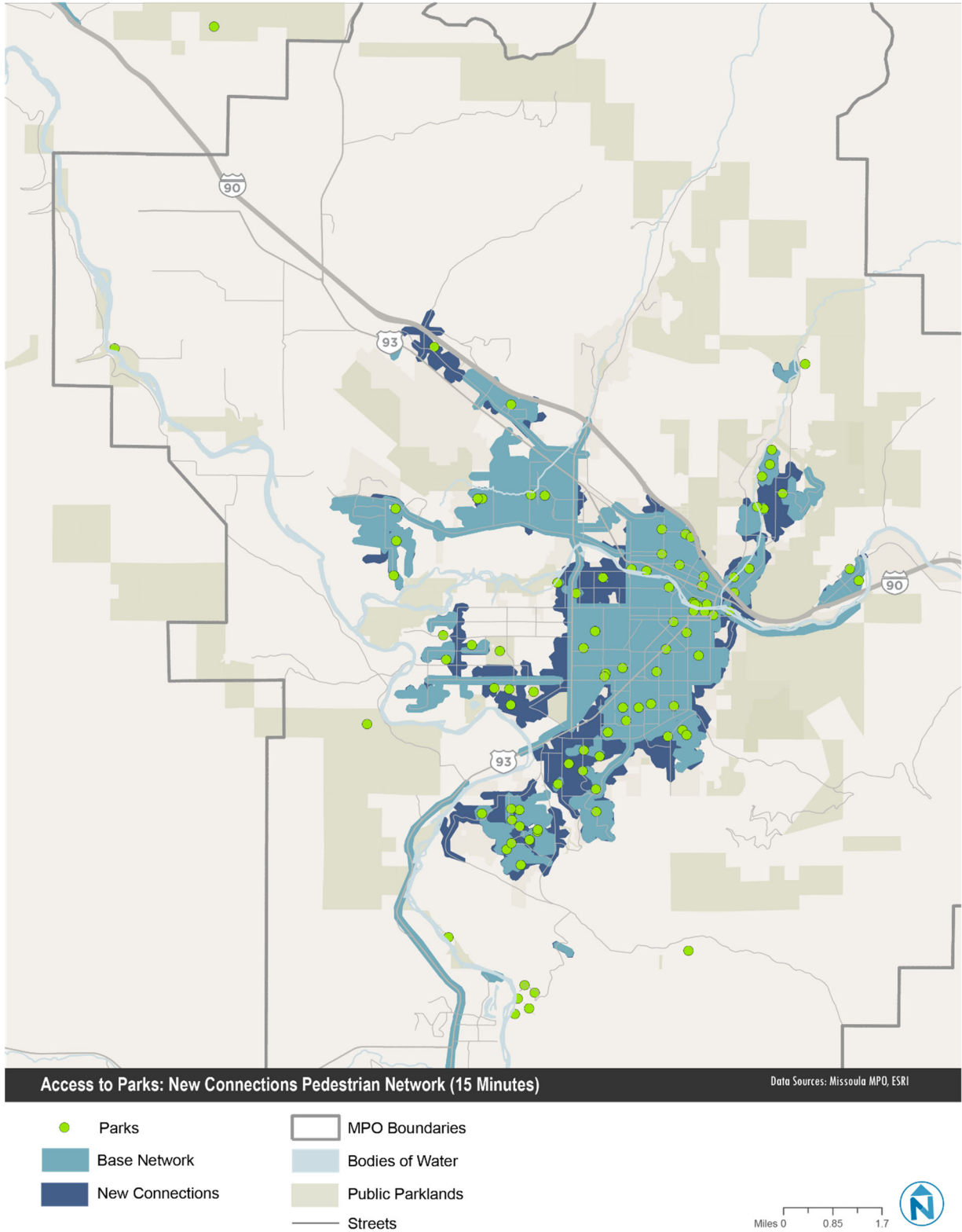
Growth Scenario	Commute Time	Base	Regional Equity	Change from Base
Business as Usual	15 min	28,870	28,903	0.1%
	30 min	33,135	41,553	25.4%
Strategic Growth	15 min	31,522	31,570	0.2%
	30 min	35,920	43,915	22.3%

Table 5 Household Biking Access to Parks with Enhanced Connections Scenario – 2050

Growth Scenario	Commute Time	Base	Enhanced Connections	Change from Base
Business as Usual	15 min	28,870	28,900	0.1%
	30 min	33,135	33,176	0.1%
Strategic Growth	15 min	31,522	31,551	0.1%
	30 min	35,920	35,967	0.1%

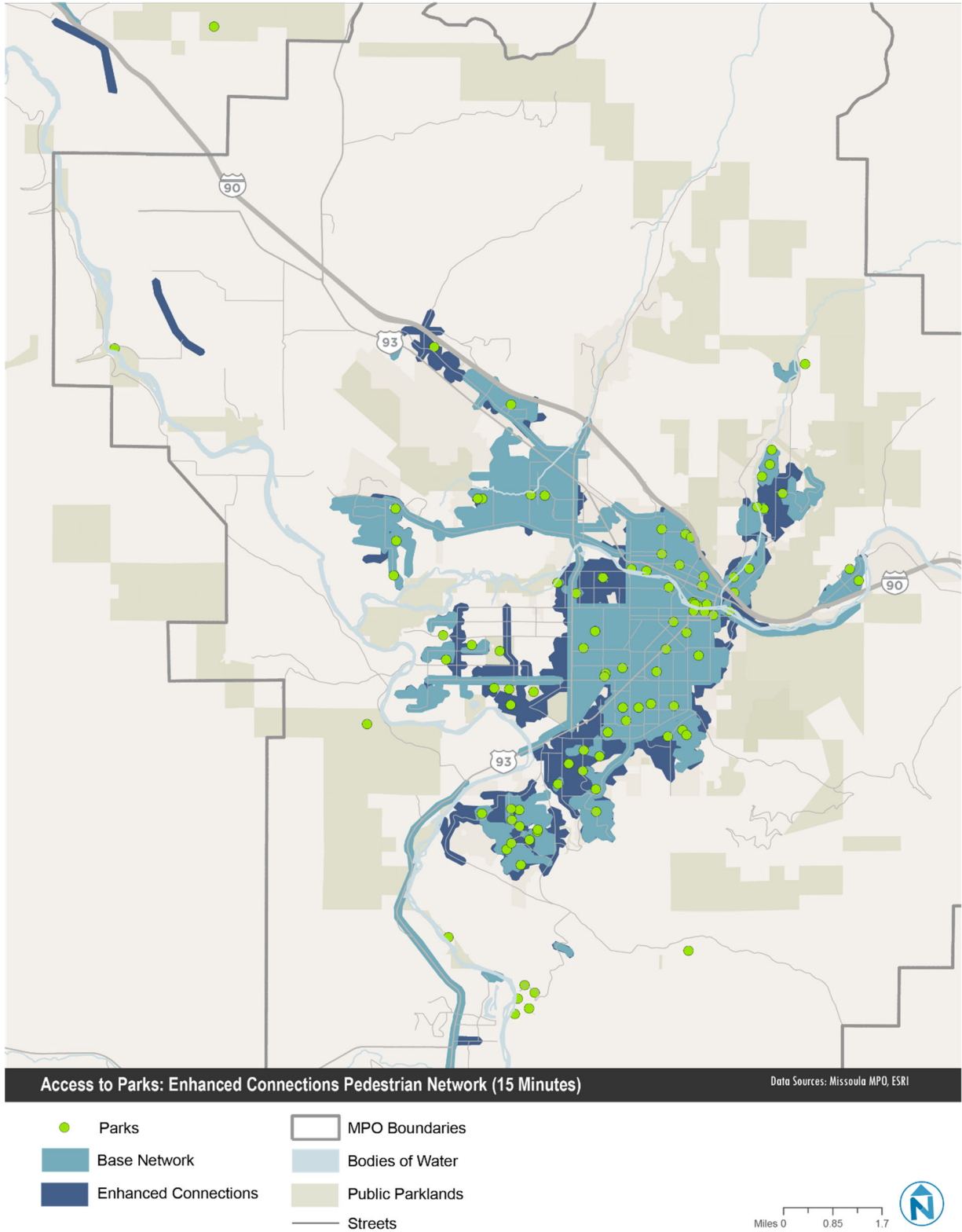
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 13 Walking Access to Parks (15 mins) – New Connections



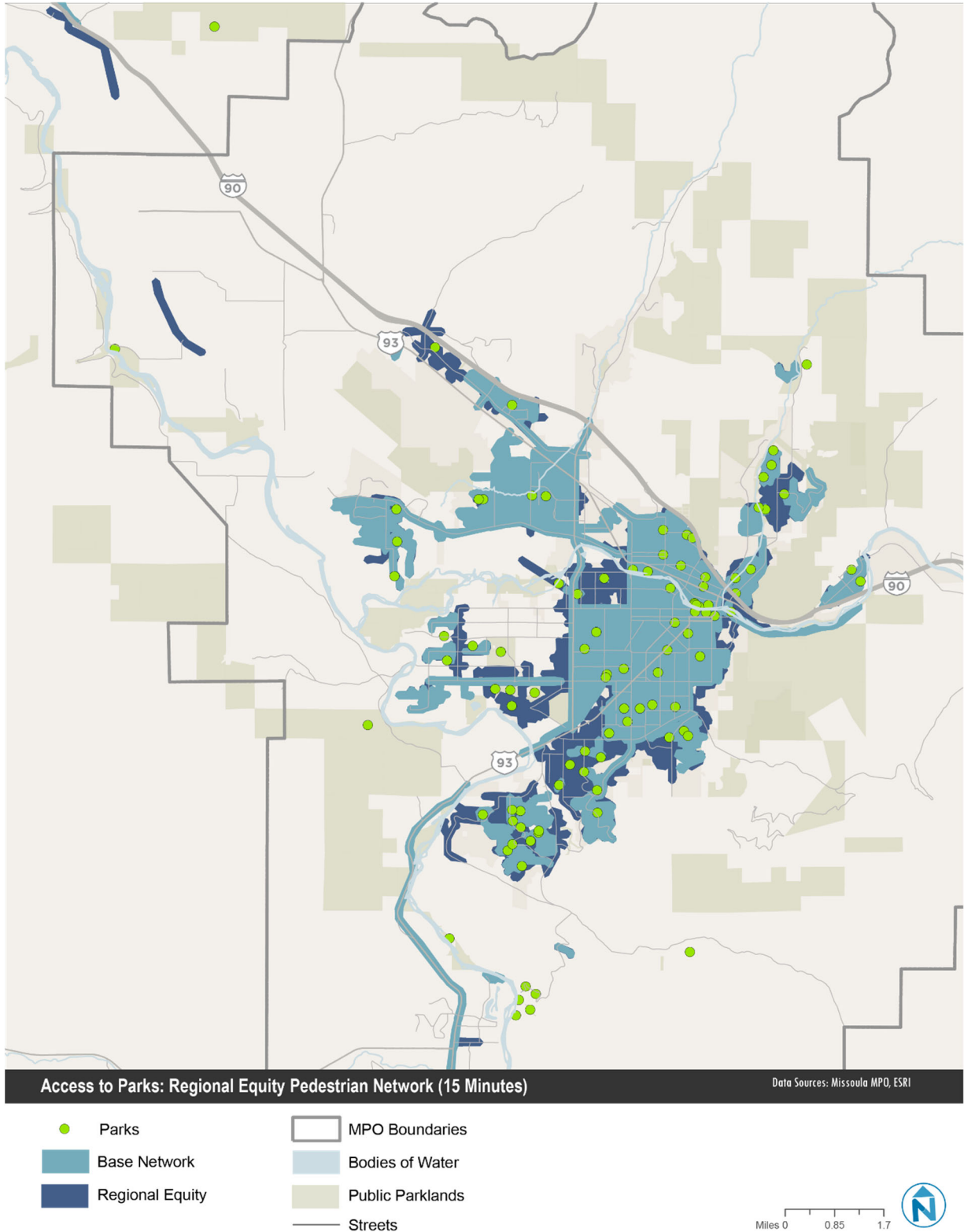
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 14 Walking Access to Parks (15 mins) – Enhanced Connections



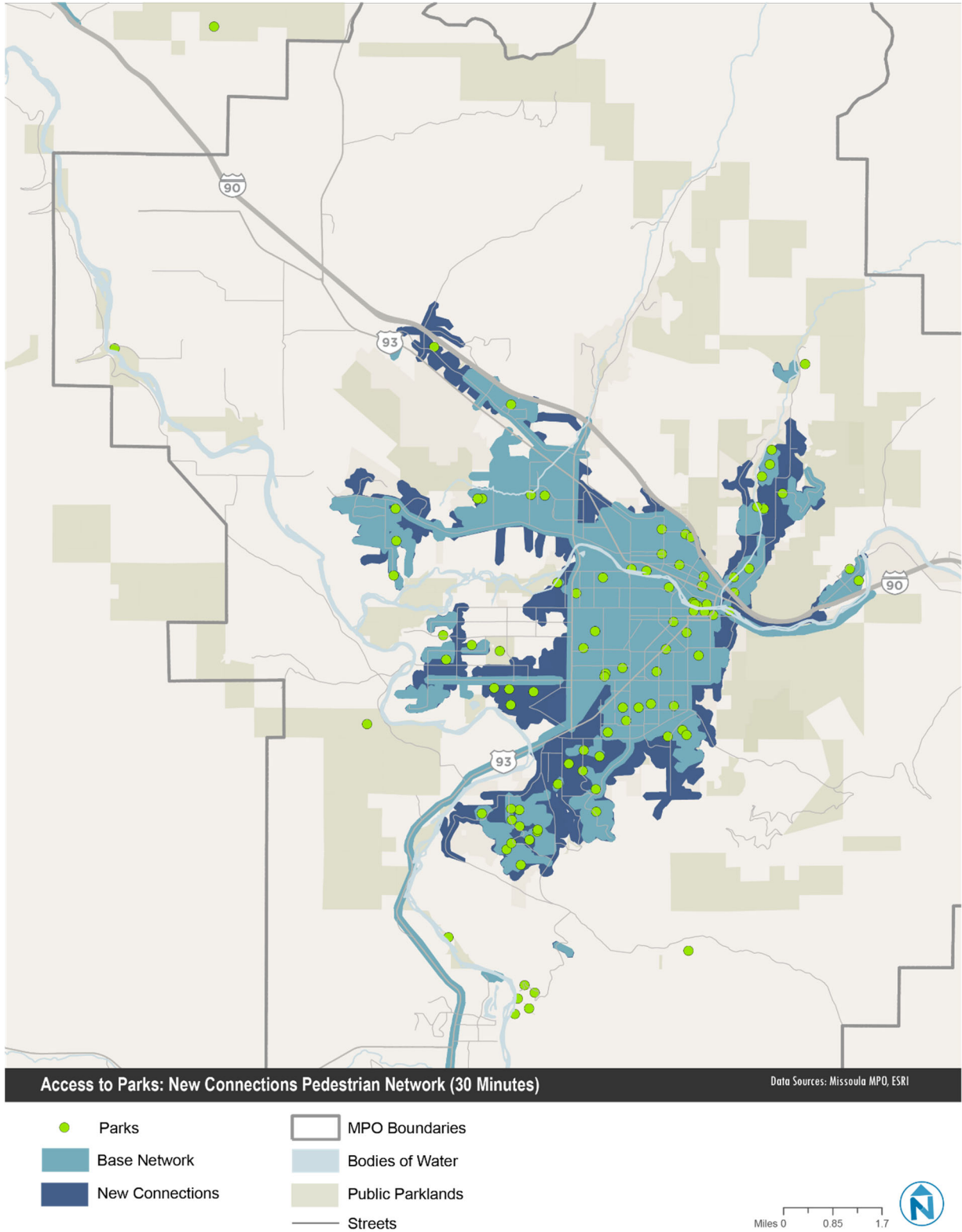
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 15 Walking Access to Parks (15 mins) – Regional Equity



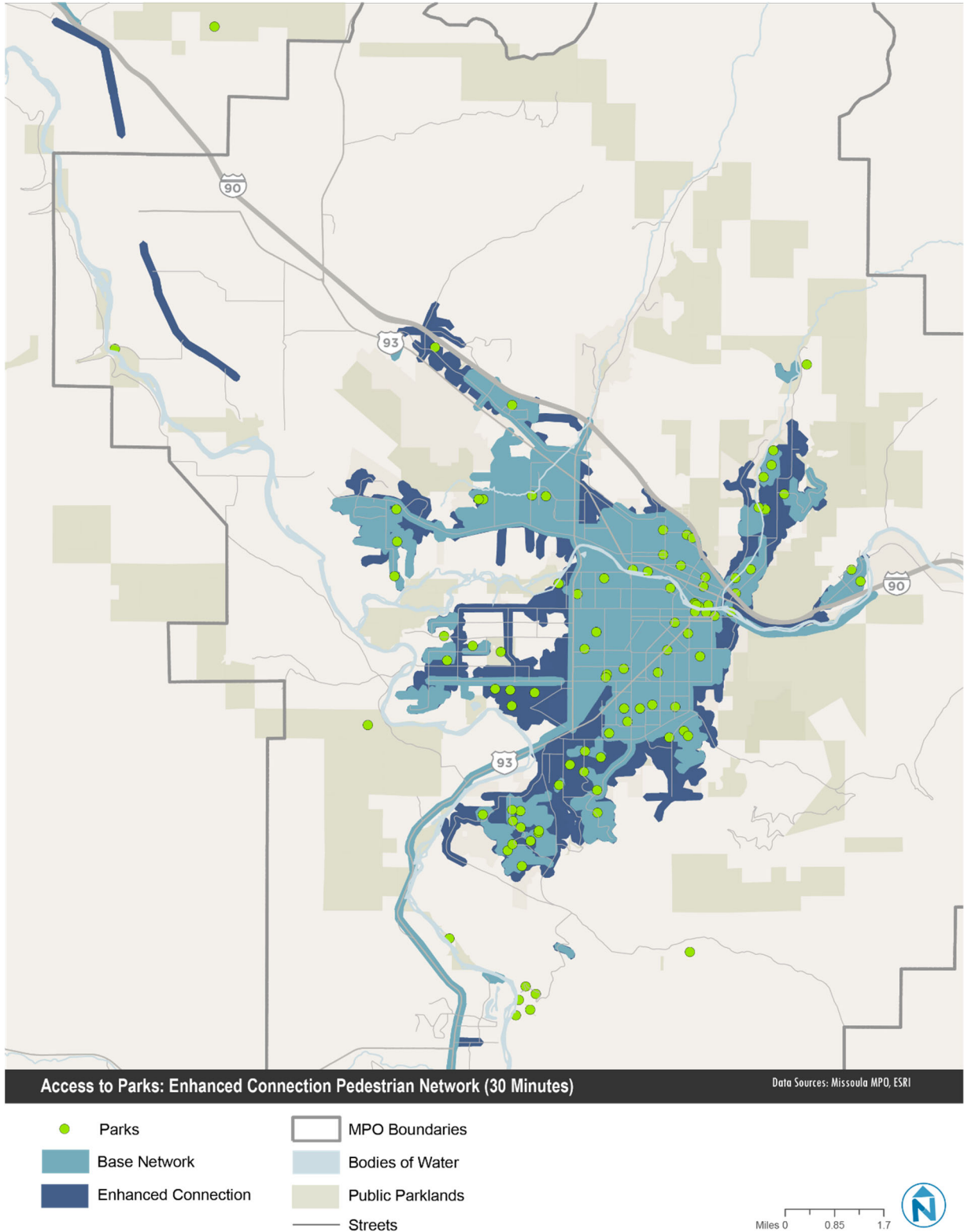
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 16 Walking Access to Parks (30 mins) – New Connections



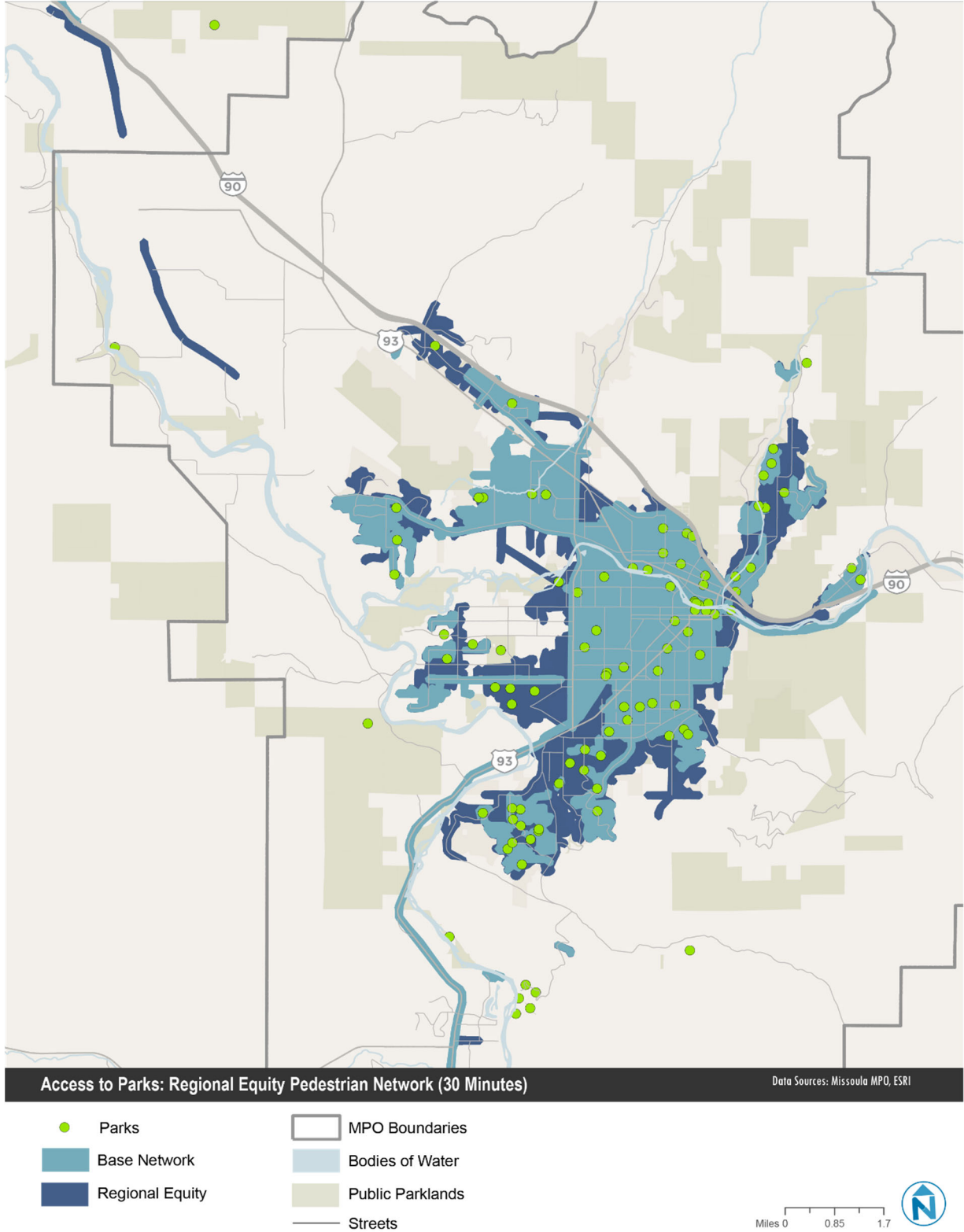
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 17 Walking Access to Parks (30 mins) – Enhanced Connections



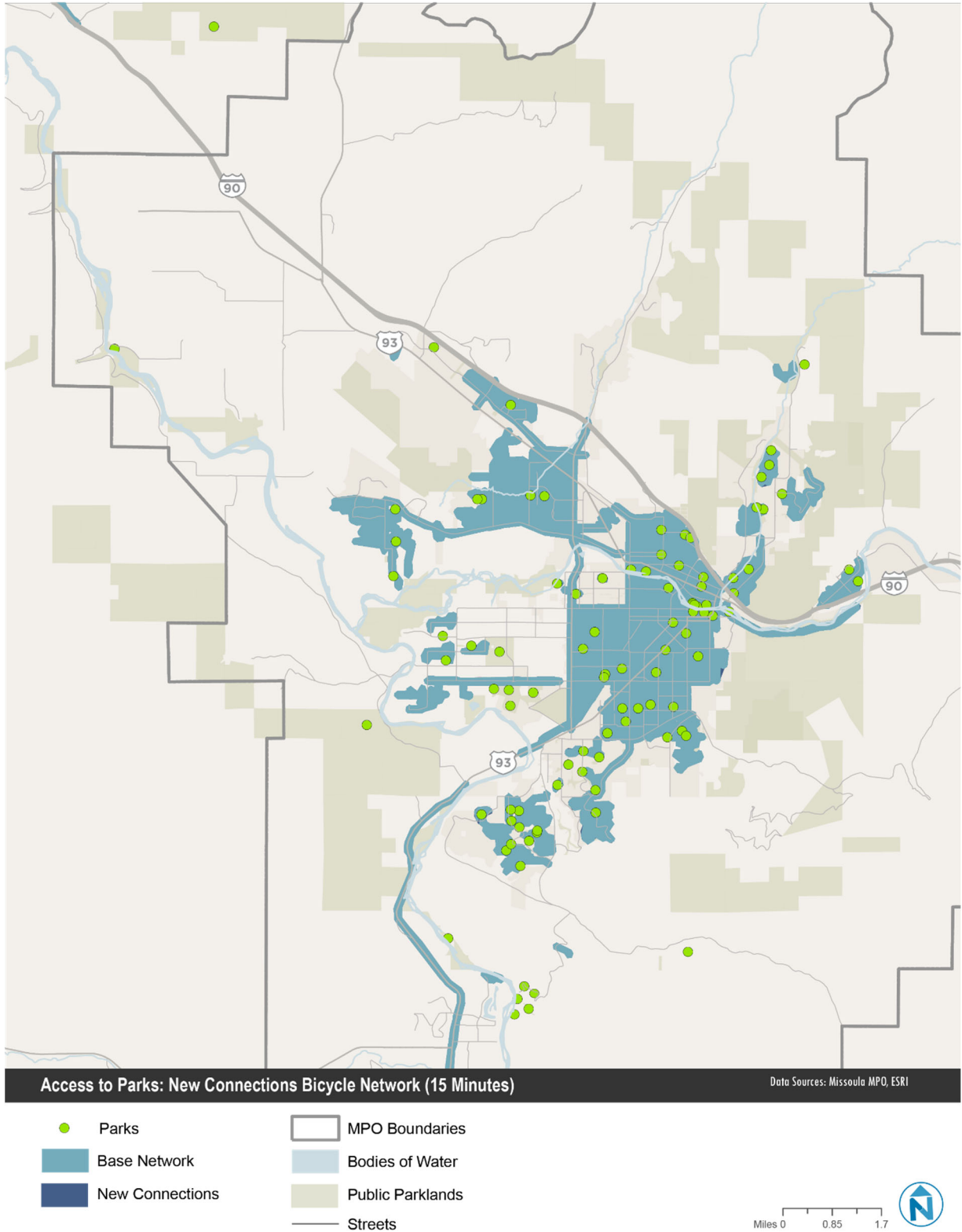
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 18 **Walking Access to Parks (30 mins) – Regional Equity**



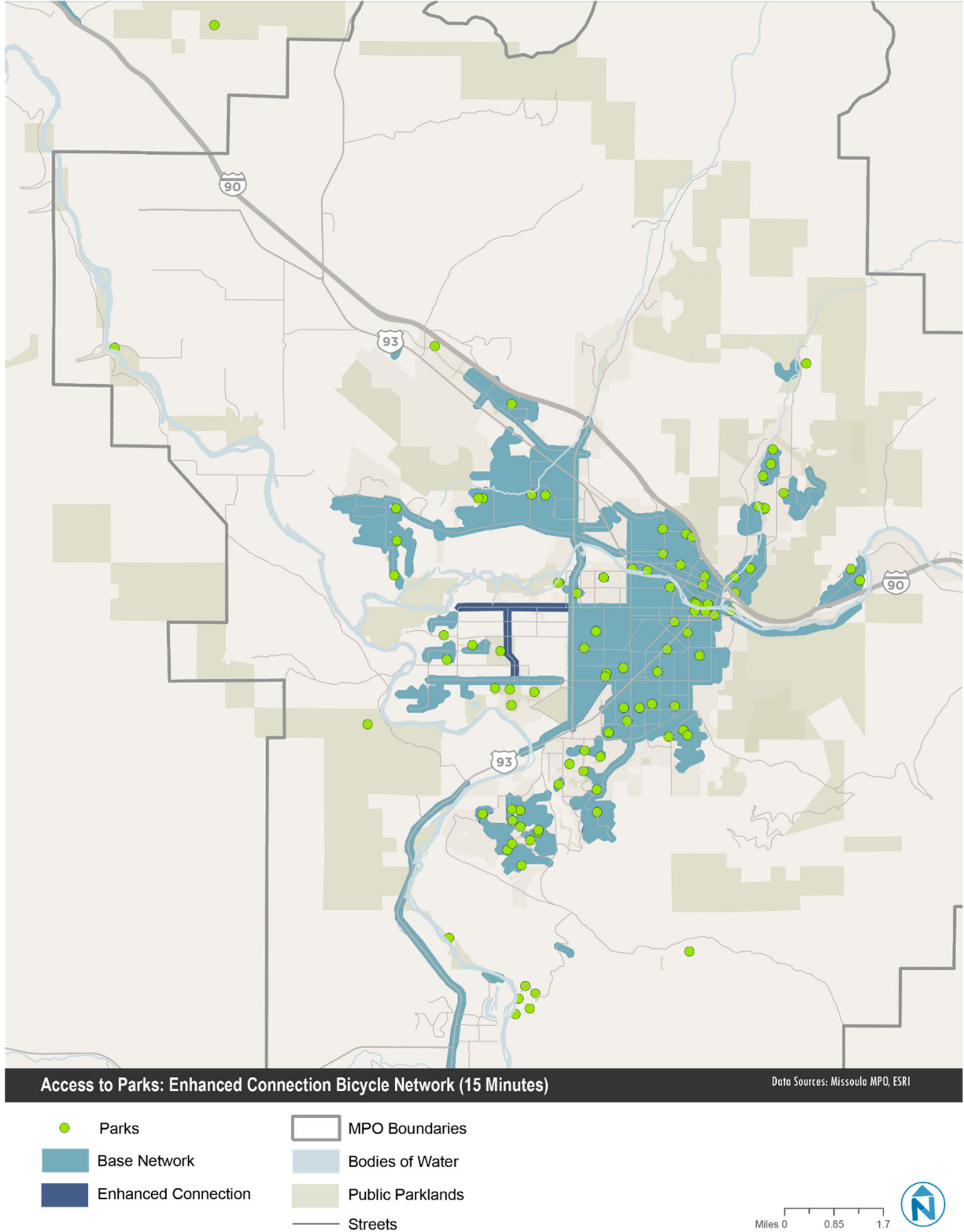
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 19 Biking Access to Parks (15 mins) – New Connections



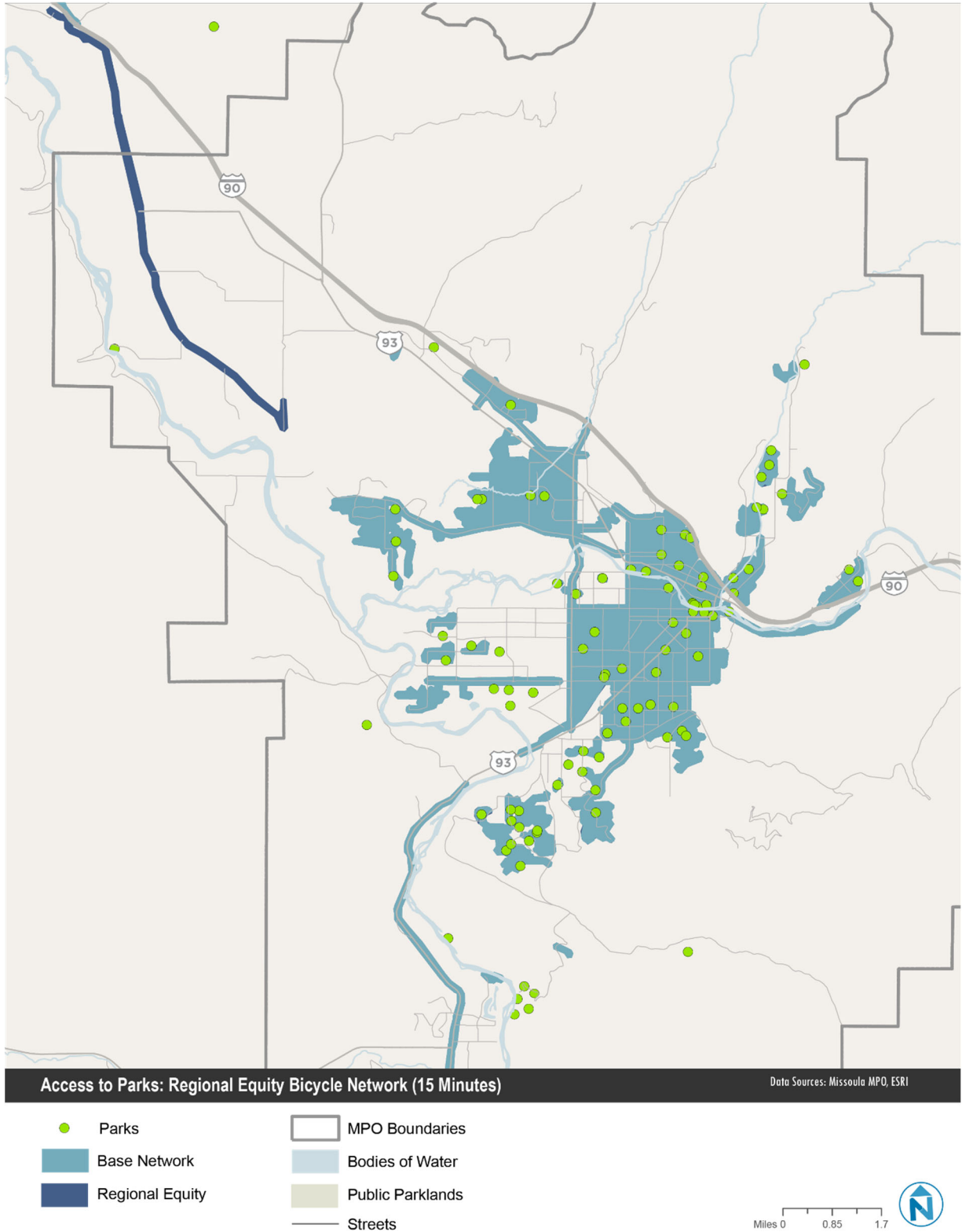
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 20 Biking Access to Parks (15 mins) – Enhanced Connections



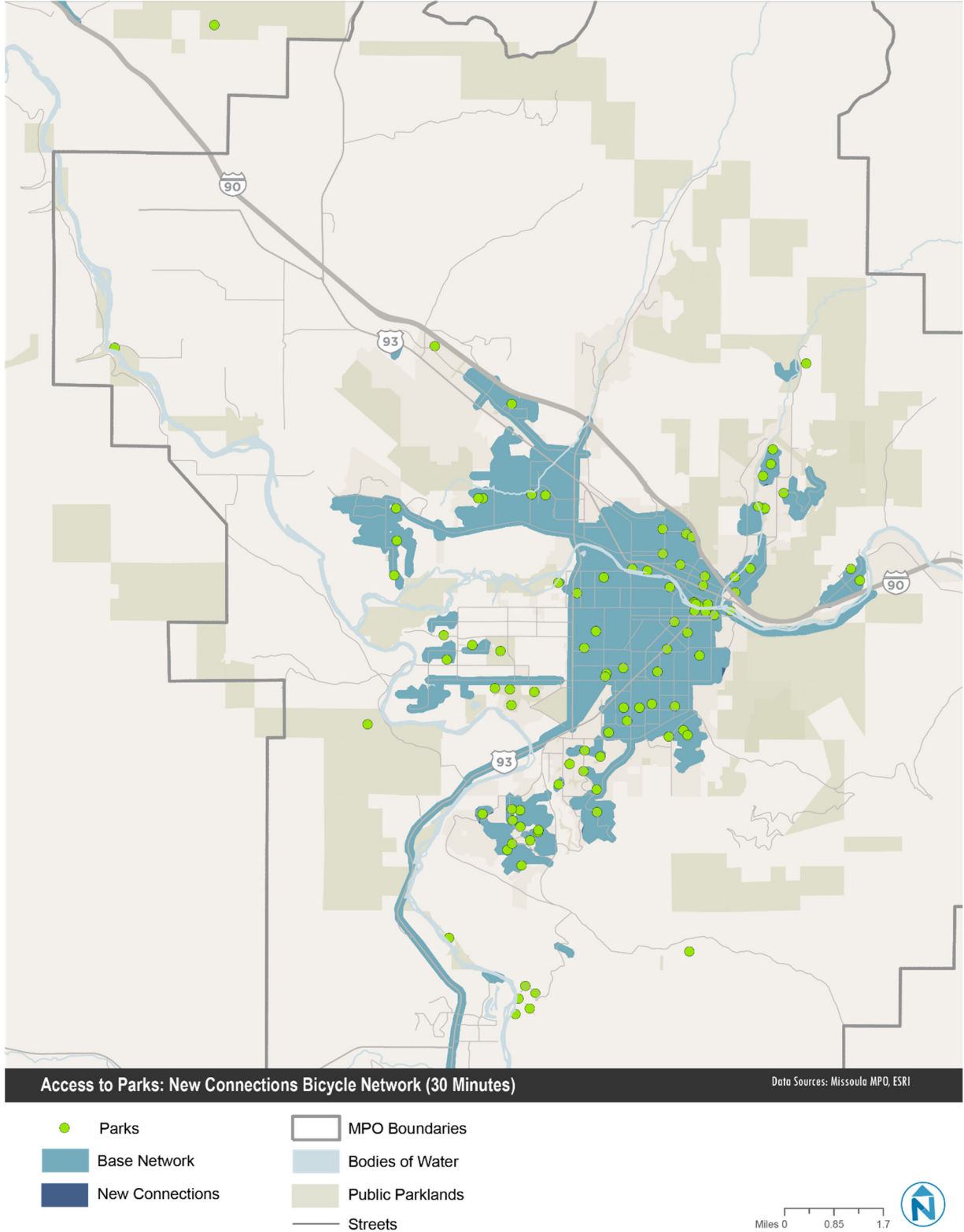
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 21 Biking Access to Parks (15 mins) – Regional Equity



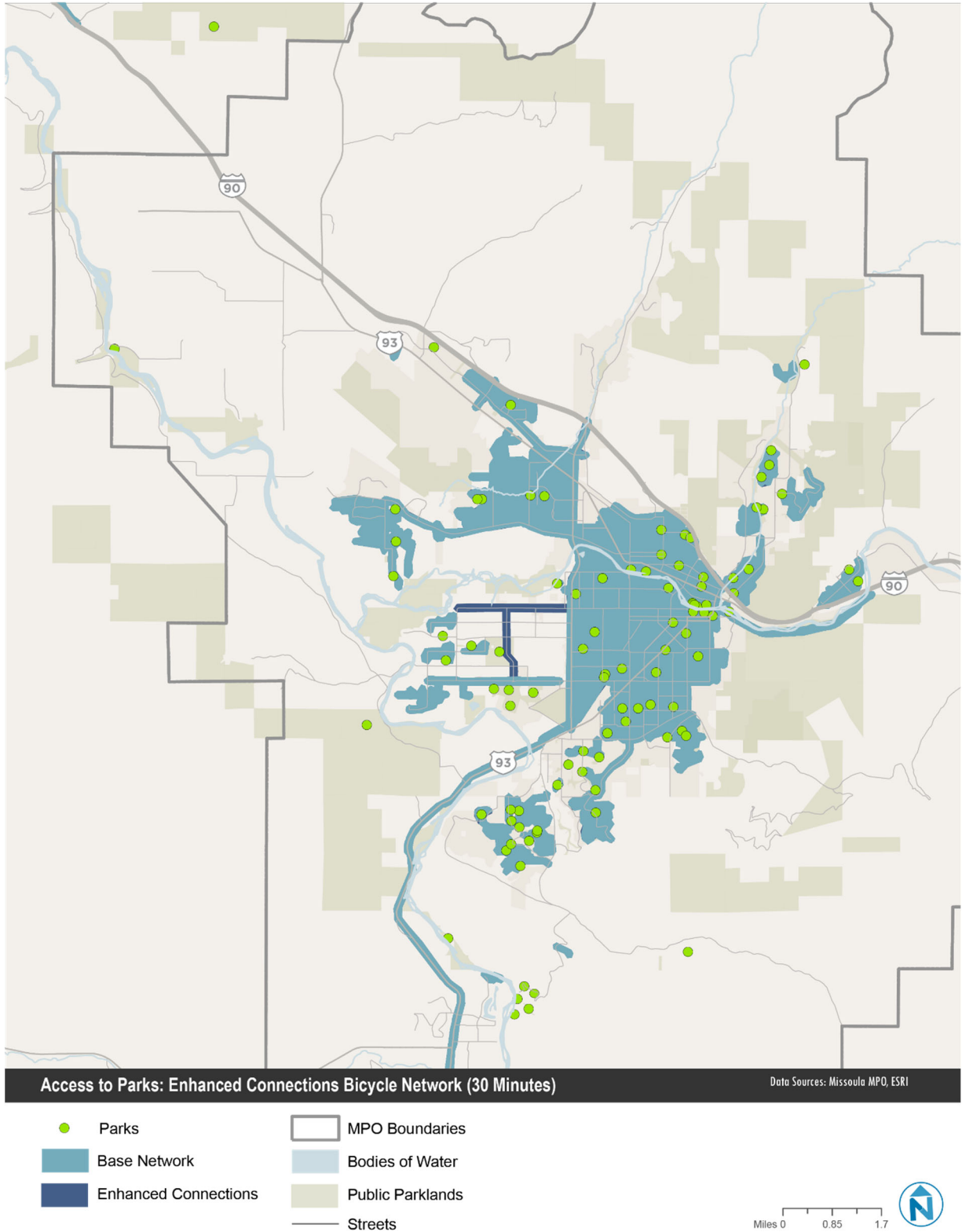
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 22 Biking Access to Parks (30 mins) – New Connections



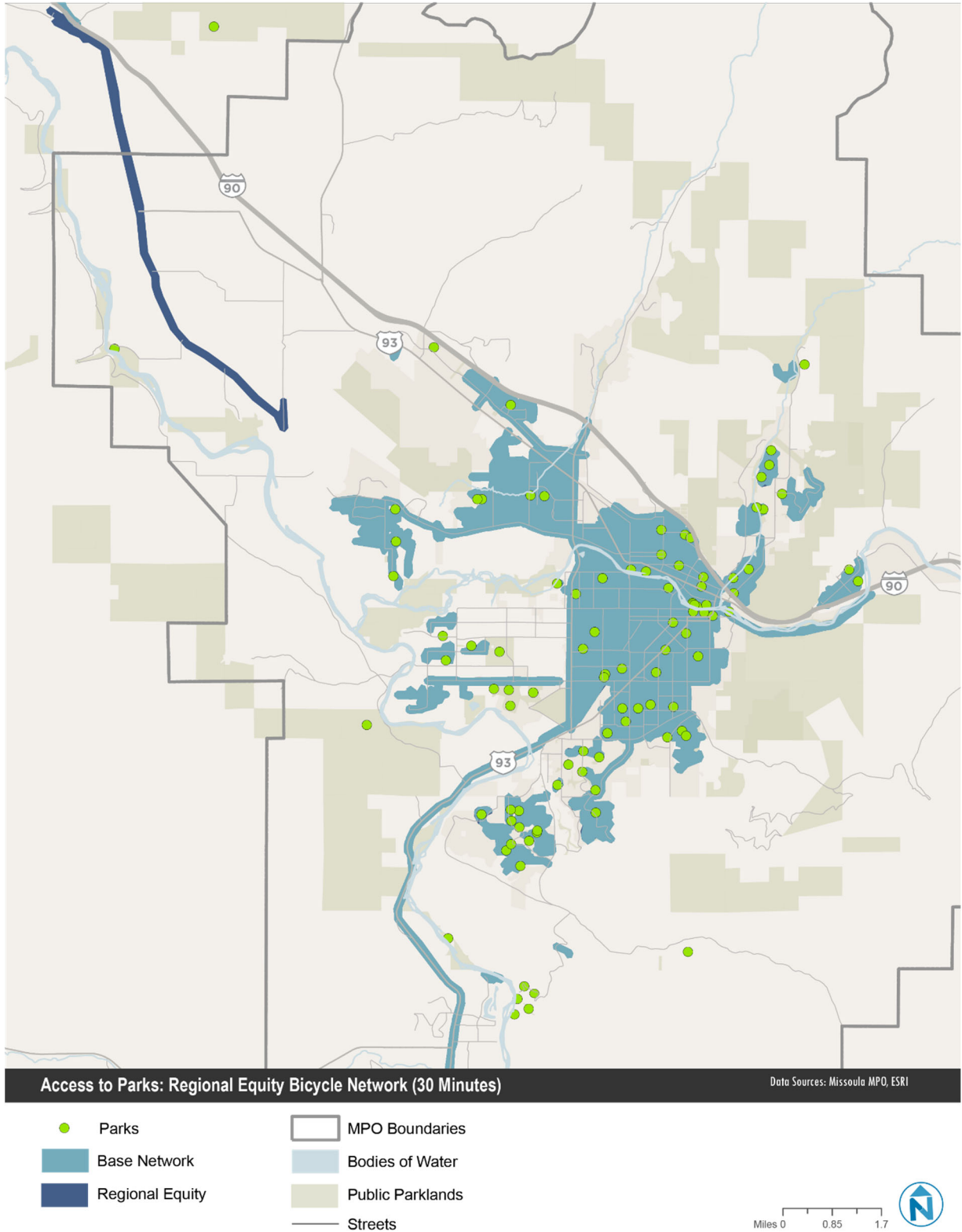
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 23 Biking Access to Parks (30 mins) – Enhanced Connections



SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 24 Biking Access to Parks (30 mins) – Regional Equity



SCHOOL ACCESSIBILITY

Increased access to schools is an indicator that the transportation network is supportive of enhanced equity, access to opportunity, and improved public health outcomes. This analysis reveals how each transportation network scenario provides accessibility to schools within a 15- and 30- minute walk or bicycle ride.

As with parks, maps were created by calculating the extent to which someone walking or riding a bicycle could reach schools by using the active transportation facilities provided by each transportation network (Base, New Connections, Enhanced Connections, and Regional Equity). The network for walking includes sidewalks and streets with LTS 1. The network for biking includes on-street bicycle facilities, commuter trails, and LTS 1 streets.

To estimate access, the coverage of each network was overlayed with the point location of schools in the region. For this analysis both public and private schools were included.

Figure 25 through Figure 36 provide maps indicating overall changes in walking and biking access to schools by transportation network scenario. Key findings are as follows:

- Schools within the region's central core are well served by the base pedestrian network.
- All three transportation network scenarios improve pedestrian access to schools in the Grant Creek, South 39th Street, and Lower Rattlesnake neighborhoods.
- With the exception of Orchard Homes in the Enhanced Connections scenario and Frenchtown in the 30-minute travel shed of the Regional Equity scenario, the proposed transportation network scenarios provide limited increased biking access to existing schools. The region's schools are largely served by the base bicycle network.
- DeSmet School, Clark Fork School, and Rattlesnake Elementary, which are not served by the base network, do not benefit from increased bicycle access in any of the three scenarios.

Table 6 and Table 7 show the change in the number of future (2050) households with walking and biking access to schools for one transportation network scenario compared to the base network. For this calculation, we used the transportation network that showed the greatest increase in overall coverage from the base.

The scenarios have a limited impact on the total number of households with walking access to a school, although Regional Equity has a 1% increase in households within a 15-minute walk of schools under both growth scenarios. As with overall network coverage, there is little to no increase in households with access to schools by bicycle in all three transportation scenarios.

SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Table 6 Household Walking Access to Schools with Regional Equity Scenario – 2050

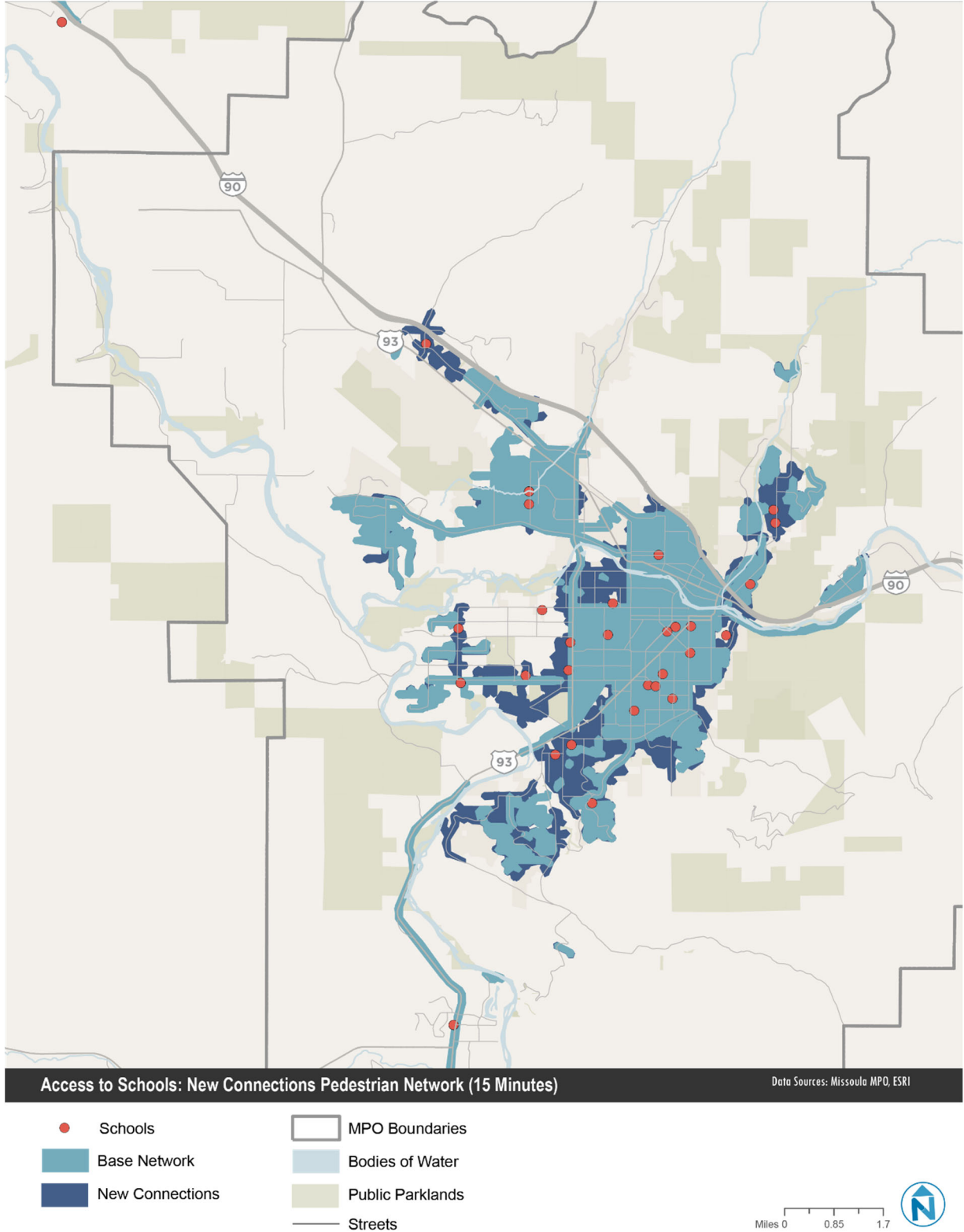
Growth Scenario	Commute Time	Base	Regional Equity	Change from Base
Business as Usual	15 min	21,406	21,610	1.0%
	30 min	36,162	36,197	0.1%
Strategic Growth	15 min	22,710	22,928	1.0%
	30 min	38,556	38,588	0.1%

Table 7 Household Biking Access to Schools with Enhanced Connections Scenario – 2050

Growth Scenario	Commute Time	Base	Regional Equity	Change from Base
Business as Usual	15 min	32,418	32,421	0.0%
	30 min	32,424	32,424	0.0%
Strategic Growth	15 min	35,185	35,189	0.0%
	30 min	35,190	35,190	0.0%

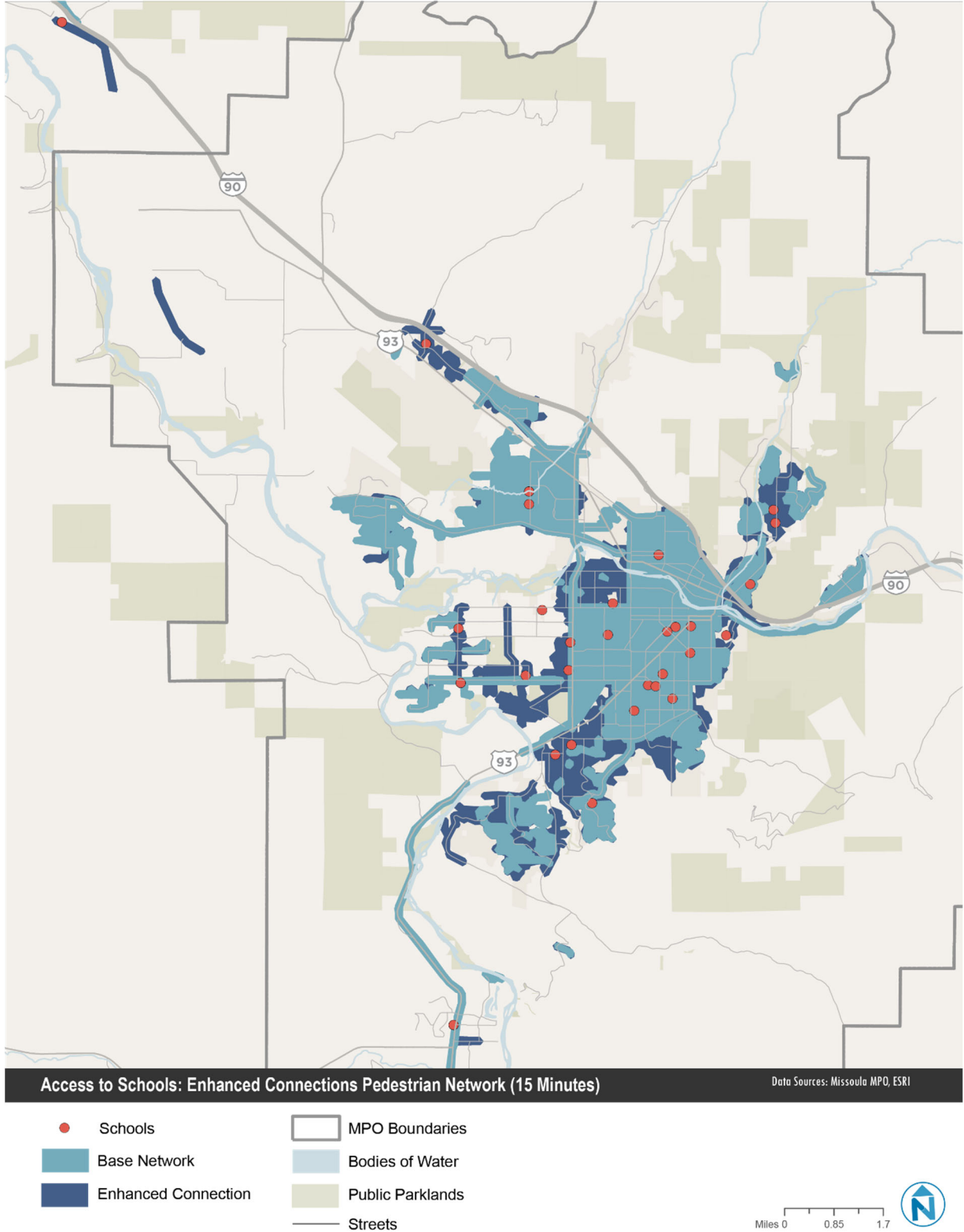
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 25 Walking Access to Schools (15 mins) – New Connections



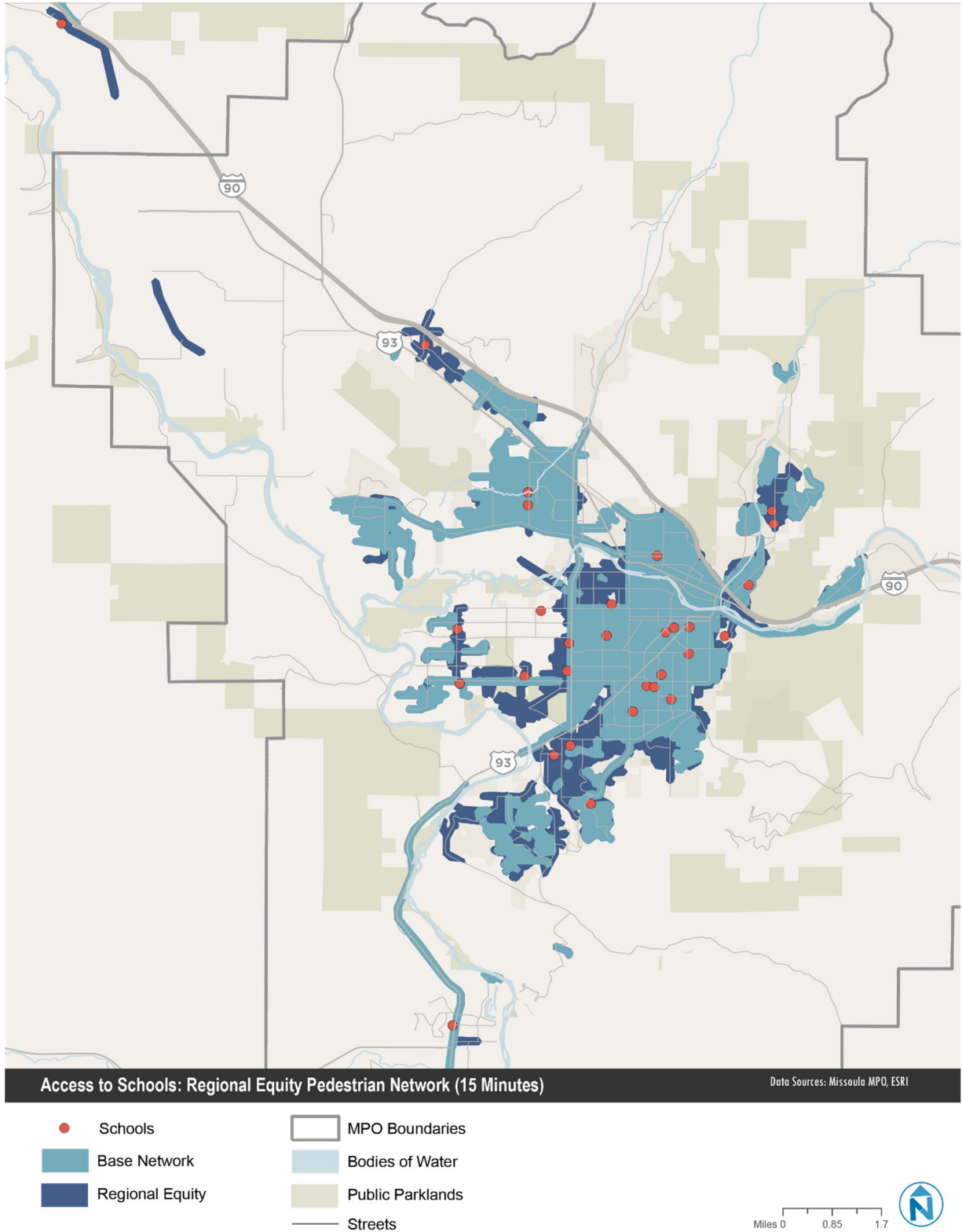
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 26 Walking Access to Schools (15 mins) – Enhanced Connections



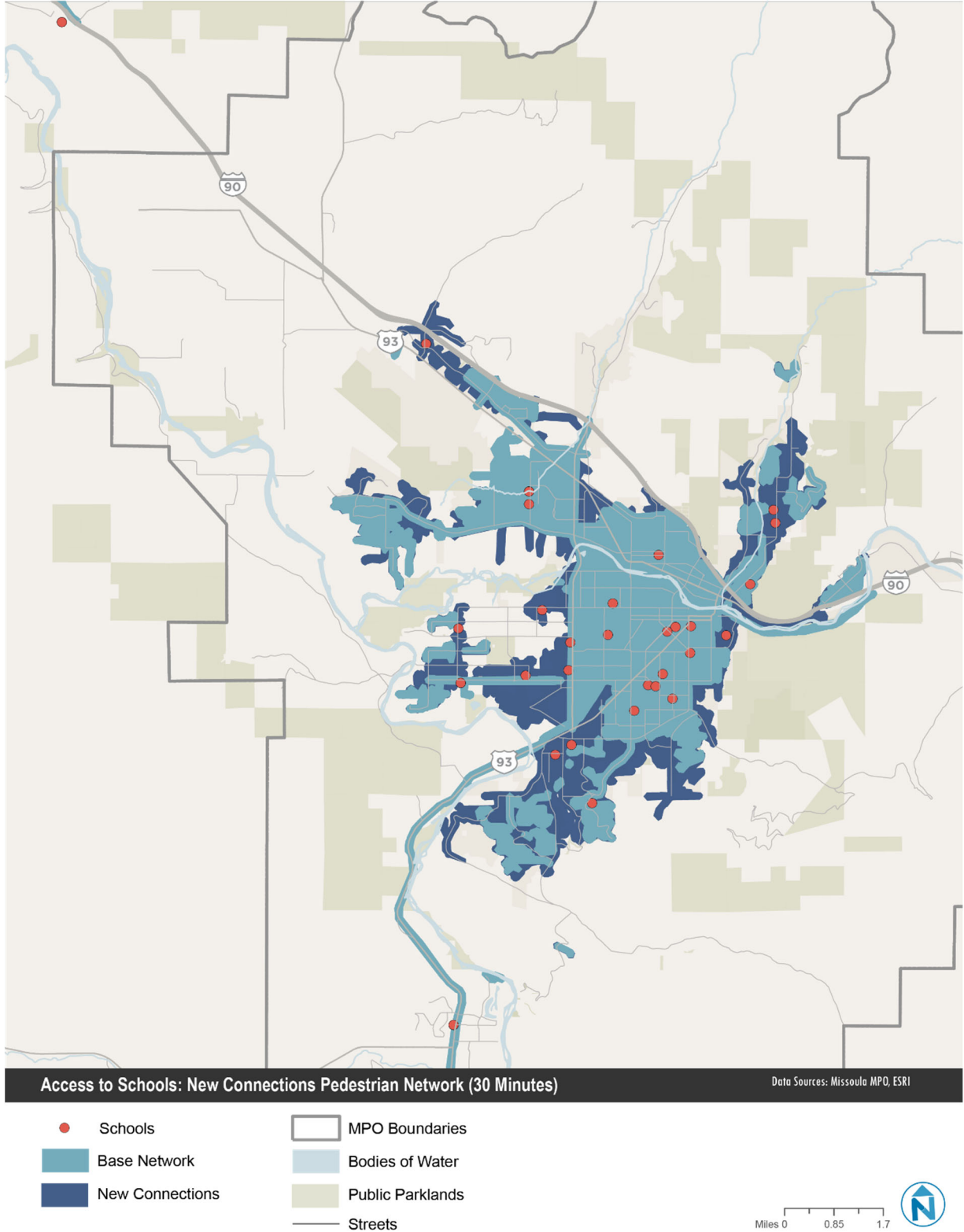
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 27 Walking Access to Schools (15 mins) – Regional Equity



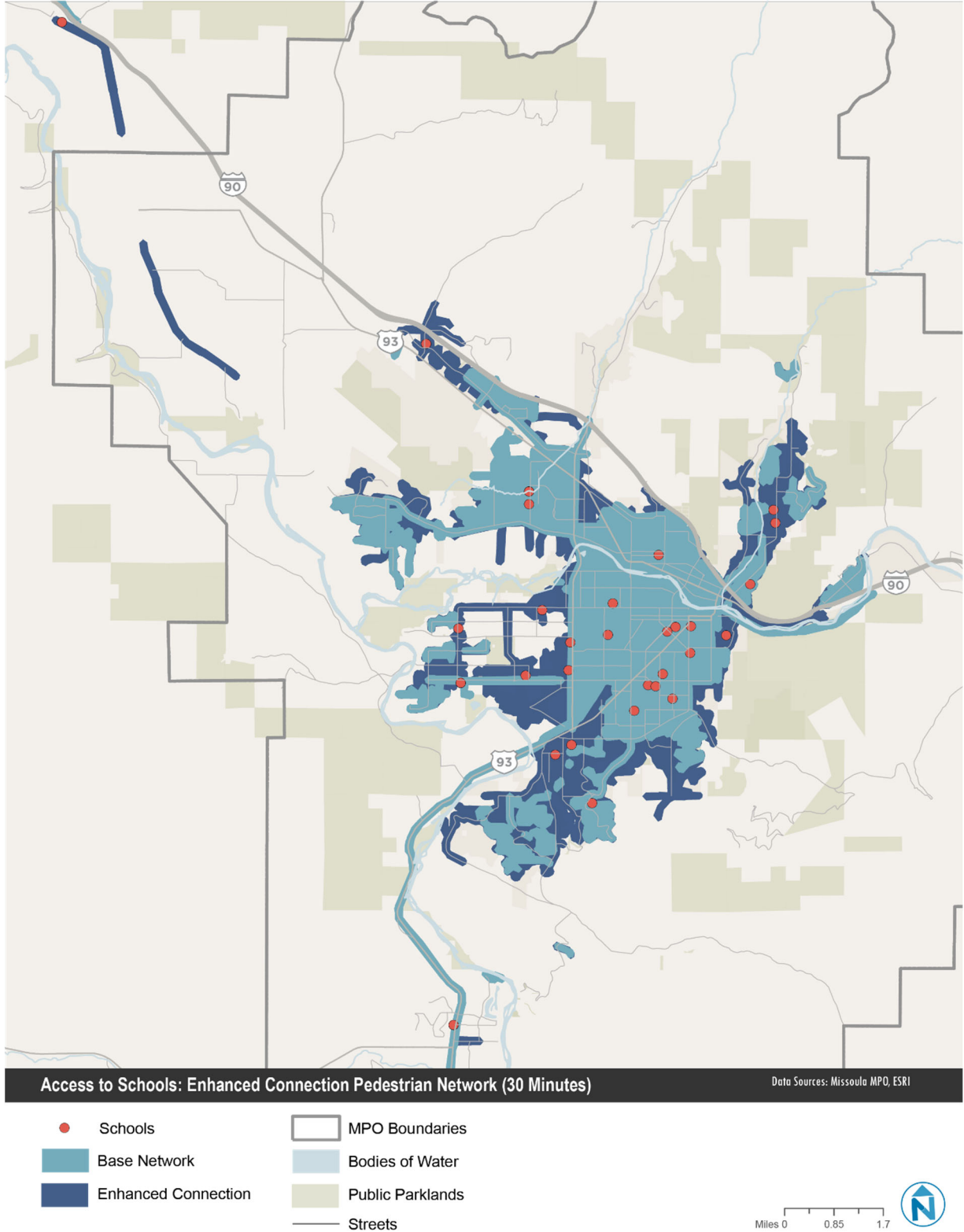
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 28 Walking Access to Schools (30 mins) – New Connections



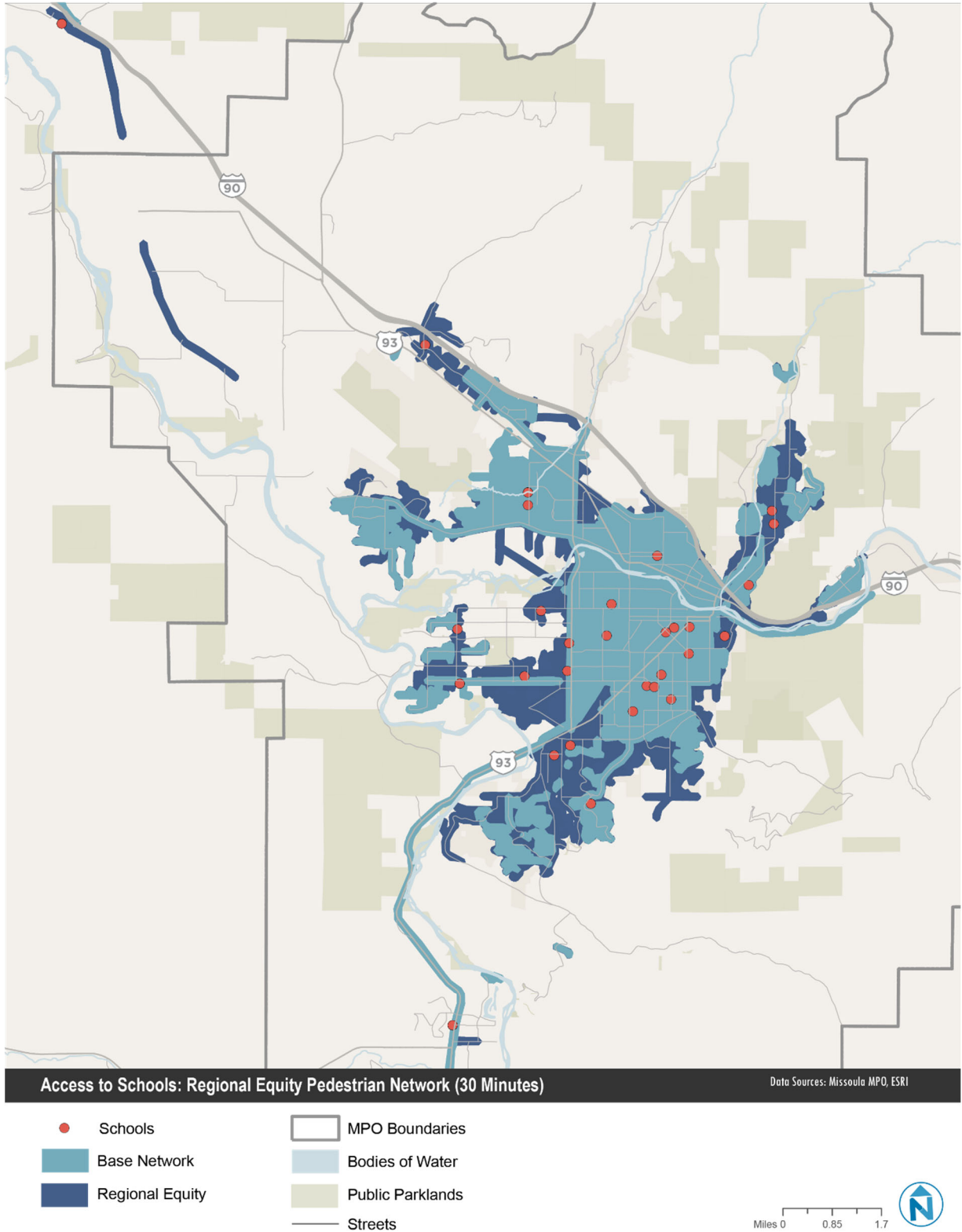
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 29 Walking Access to Schools (30 mins) – Enhanced Connections



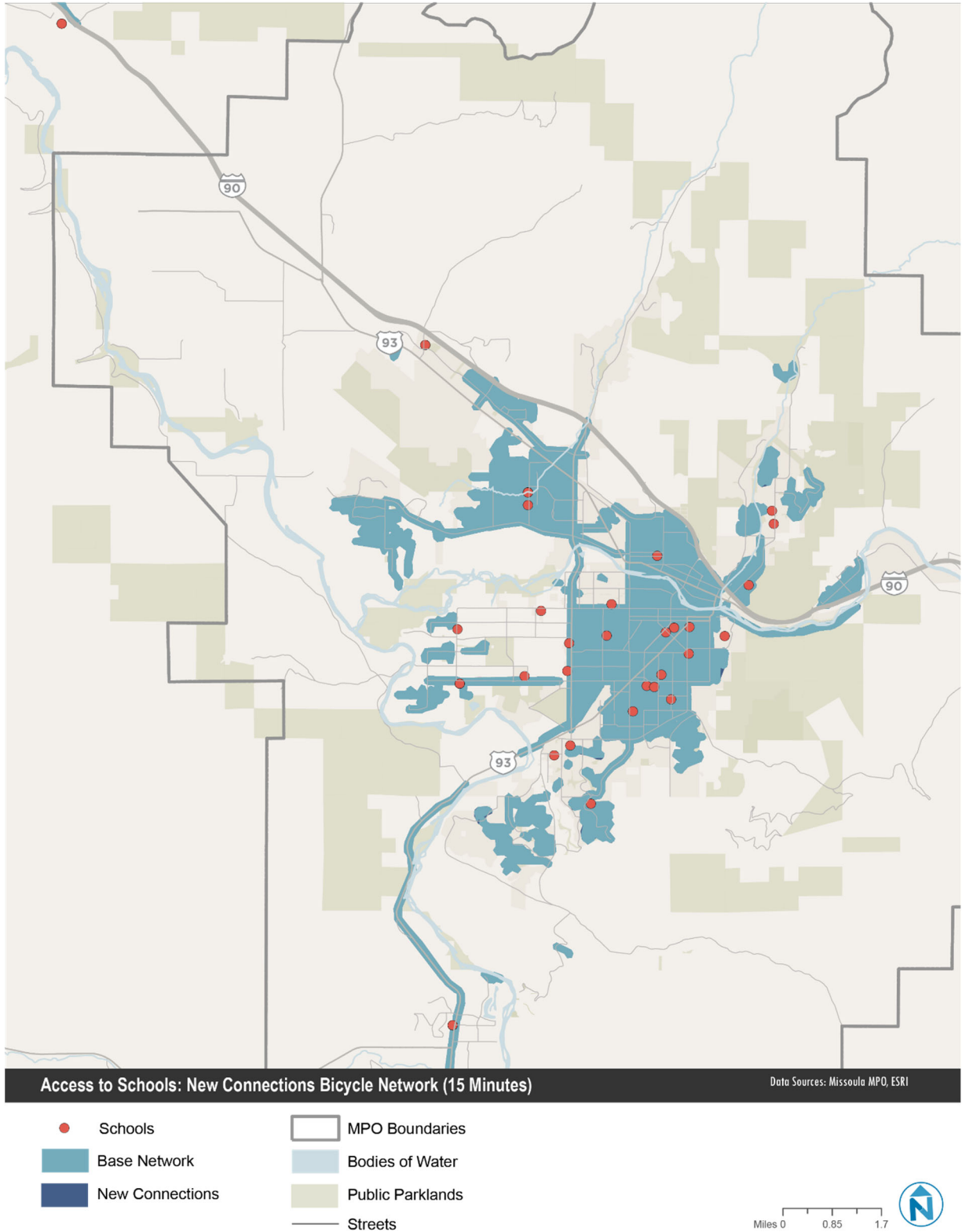
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 30 Walking Access to Schools (30 mins) – Regional Equity



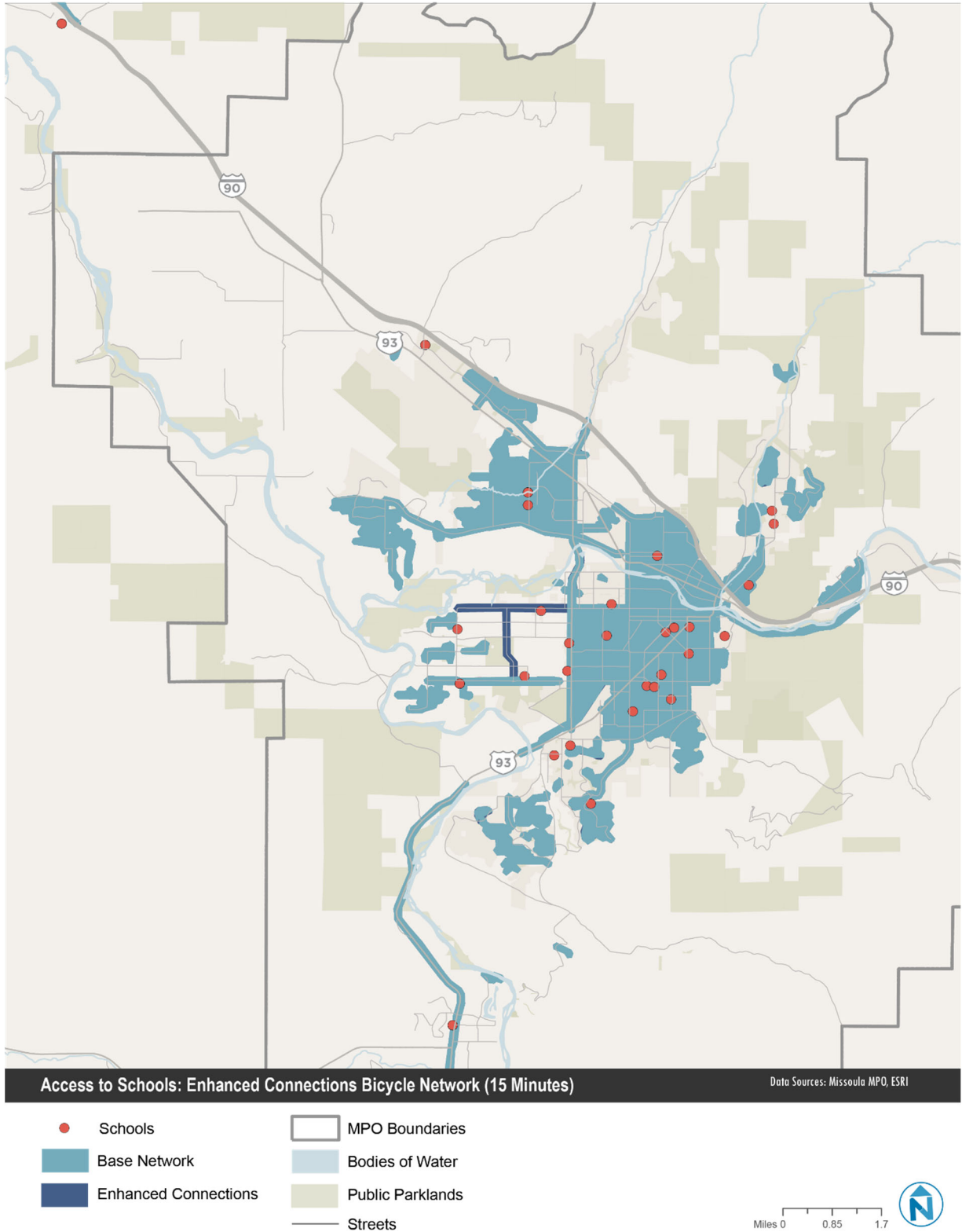
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 31 Biking Access to Schools (15 mins) – New Connections



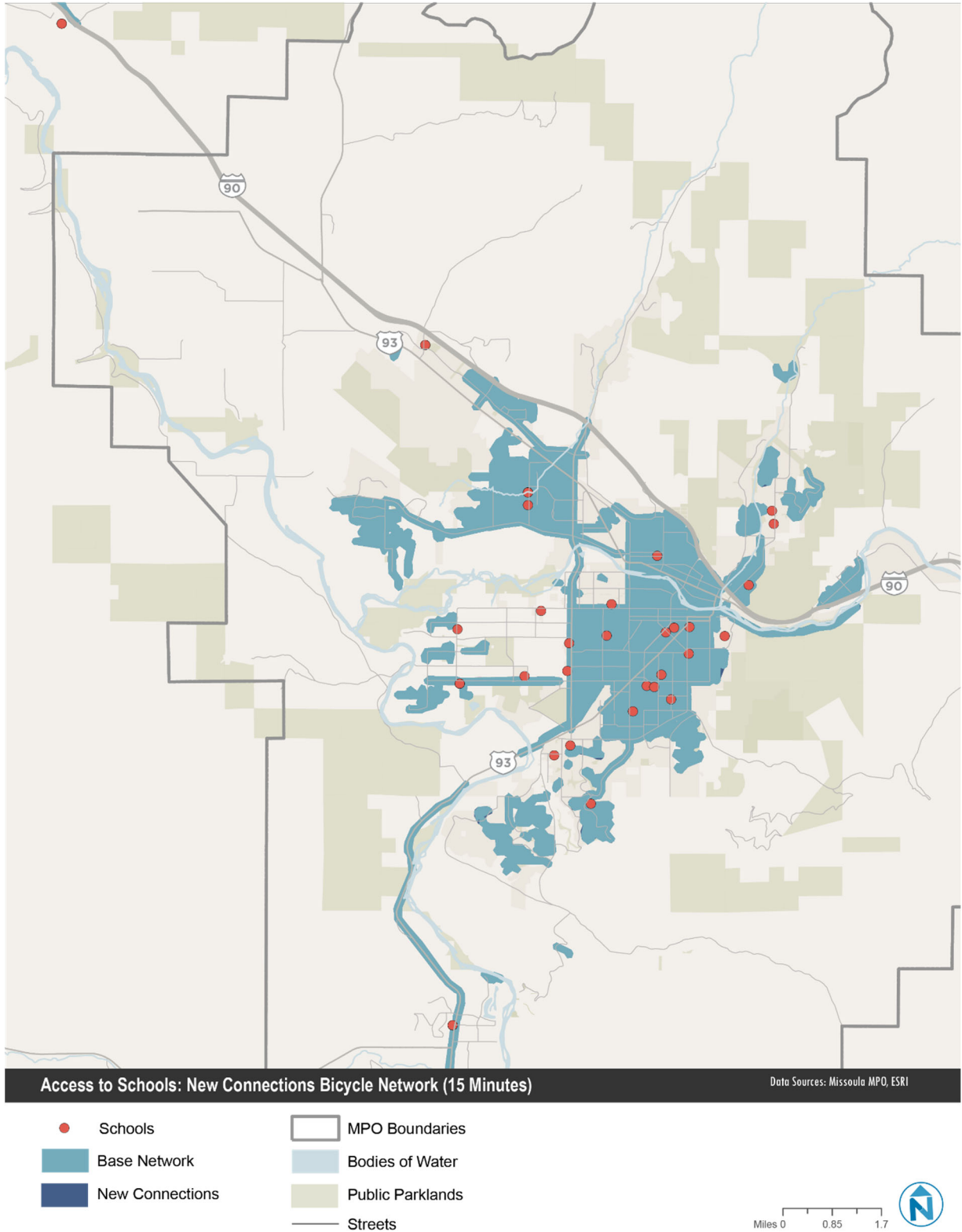
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 32 Biking Access to Schools (15 mins) – Enhanced Connections



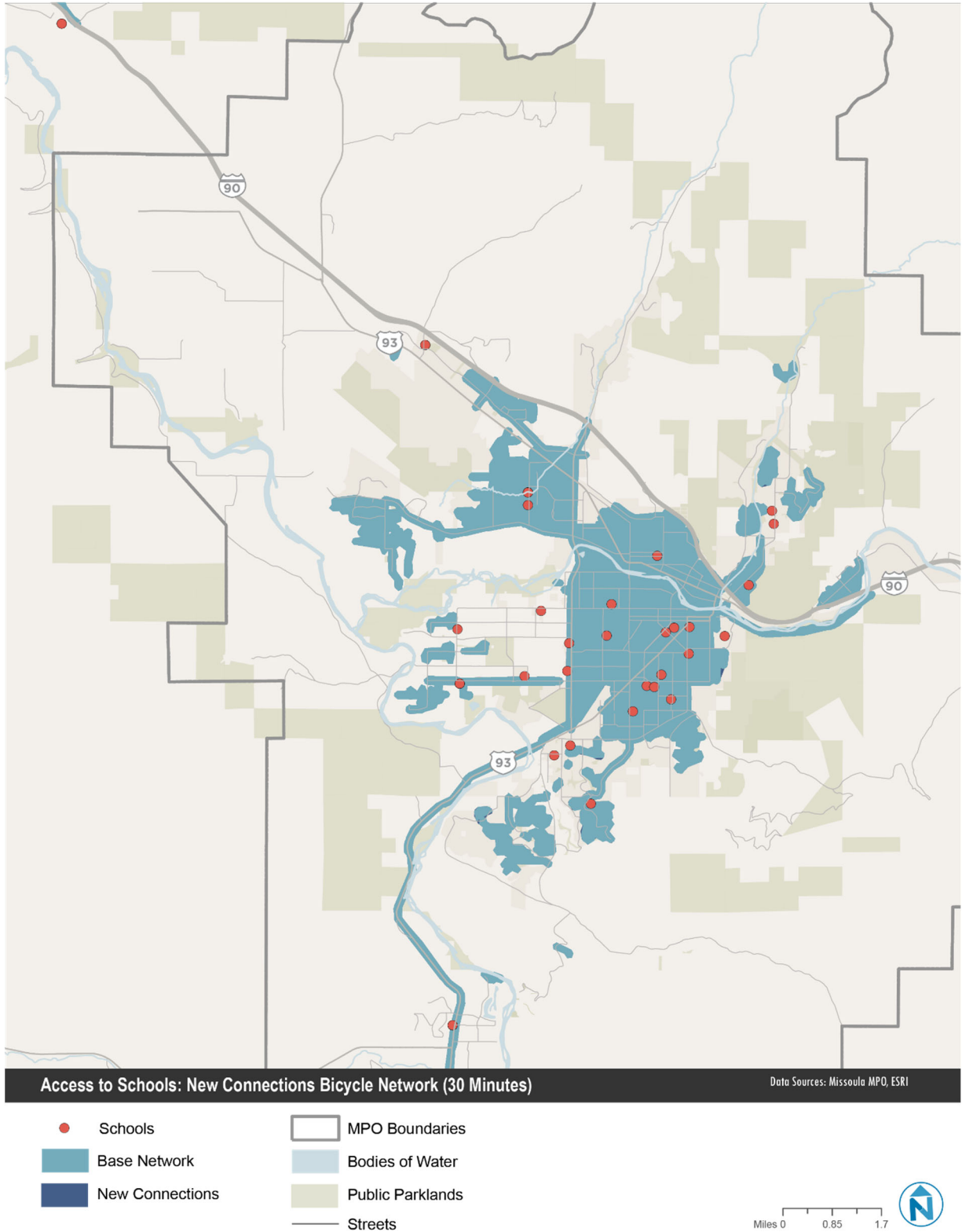
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 33 Biking Access to Schools (15 mins) – Regional Equity



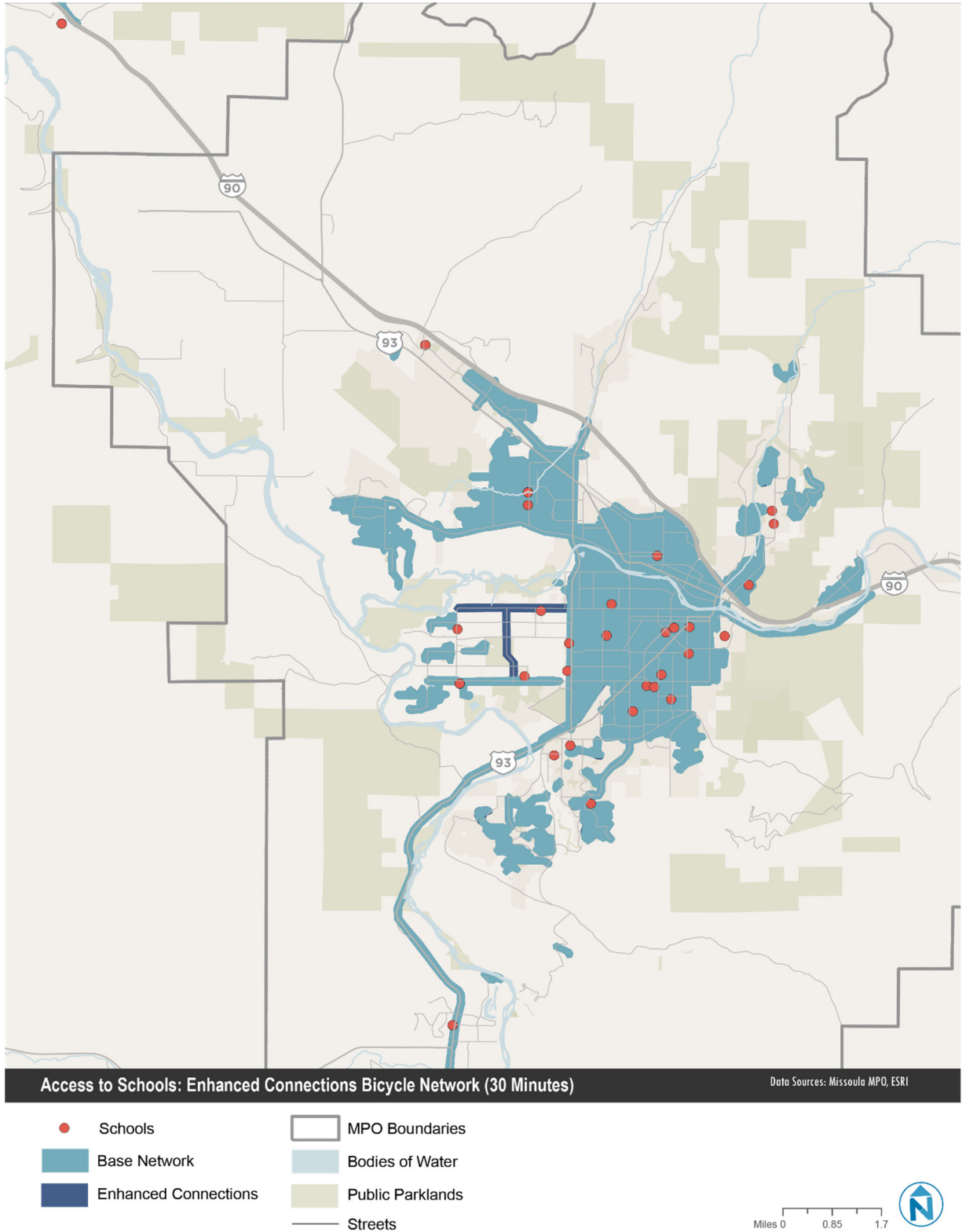
SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 34 Biking Access to Schools (30 mins) – New Connections



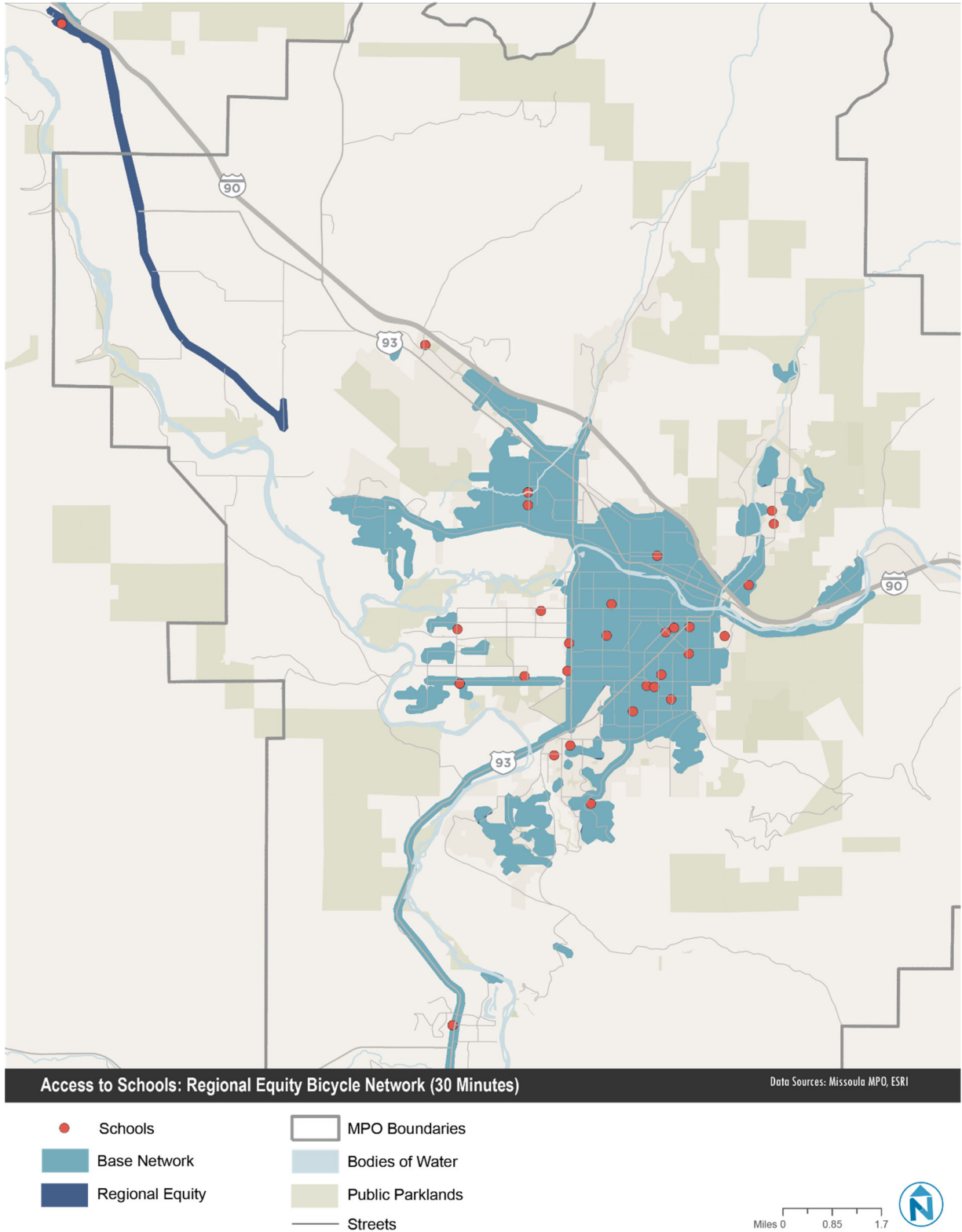
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Figure 35 Biking Access to Schools (30 mins) – Enhanced Connections



SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Figure 36 Biking Access to Schools (30 mins) – Regional Equity



SOCIAL SERVICES ACCESSIBILITY

Increased access to social services is an indicator that the transportation network is supportive of enhanced equity, access to opportunity, and improved public health outcomes. This analysis reveals how each transportation network scenario provides accessibility to social service providers within a 15- and 30-minute walk or bicycle ride under both Business as Usual and Strategic Growth scenarios in 2050.

As with schools, maps were created by calculating the extent to which someone walking or riding a bicycle could reach social services by using the active transportation facilities provided by each transportation network (Base, New Connections, Enhanced Connections, and Regional Equity). The network for walking includes sidewalks and streets with LTS 1. The network for biking includes on-street bicycle facilities, commuter trails, and LTS 1 streets.

To estimate access, the coverage of each network was overlaid with the point location of social service facilities in the region. For this analysis, social service facilities include healthcare clinics, senior centers, substance and mental health facilities, emergency food and housing, veterans' associations, and family or children's services.

Figure 37 through Figure 48 provide maps indicating overall changes in walking and biking access to social services by transportation network scenario. Key findings are as follows:

- Most social service facilities are accessible via the existing pedestrian network within a 15-minute walk, with all but the Watson's Children's Shelter accessible within a 30-minute walk.
- All three transportation network scenarios improve bicycle access to social service facilities that are served by the base transportation network, particularly those located in the central core and the Riverfront area.
- However, the transportation network scenarios do not provide access to those few social services facilities that are not currently served by the base transportation network.

Table 8 and Table 9 show the change in the number of future (2050) households with walking and biking access to social services for one transportation network scenario compared to the base network. For this calculation, we used the transportation network that showed the greatest increase in overall coverage from the base.

As with overall network coverage, there would be little to no increase in households with access to social services by walking or biking in any of the transportation scenarios. The greatest impact to access comes from the Strategic Growth scenario (compared to Business as Usual). Concentrating more households in the core of the region increases the number of households with access to social services, which are largely located in the central part of Missoula.

SUMMARY OF SCENARIO ANALYSIS FINDINGS
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Table 8 Household Walking Access to Social Services in Regional Equity Scenario – 2050

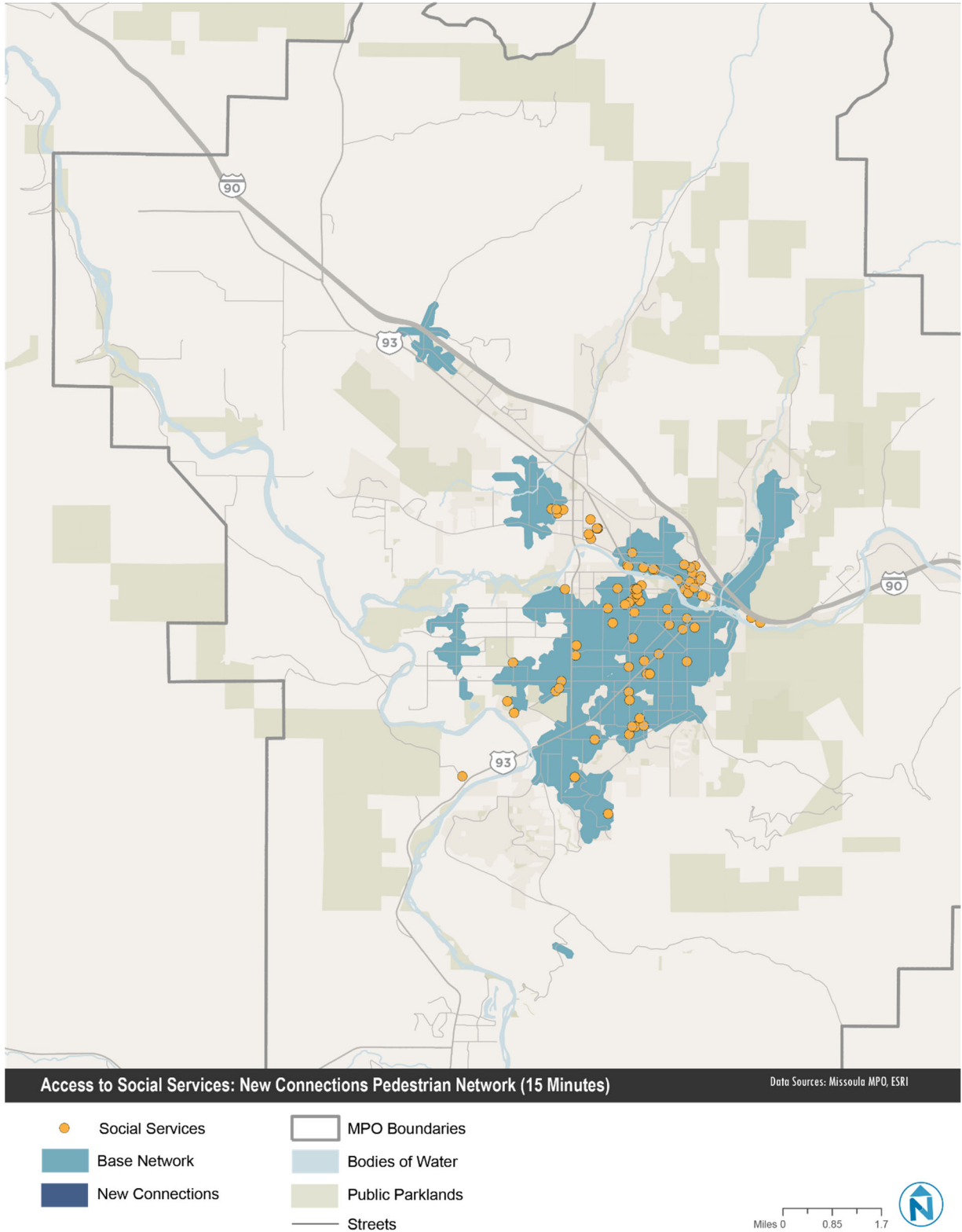
Growth Scenario	Commute Time	Base	Regional Equity	Change from Base
Business as Usual	15 min	27,526	27,526	0%
	30 min	36,775	36,778	0%
Strategic Growth	15 min	29,027	29,030	0%
	30 min	39,176	39,176	0%

Table 9 Household Biking Access to Social Services in Enhanced Connections Scenario – 2050

Growth Scenario	Commute Time	Base	Enhanced Connections	Change from Base
Business as Usual	15 min	31,959	31,960	0%
	30 min	32,370	32,370	0%
Strategic Growth	15 min	34,742	34,749	0%
	30 min	35,156	35,156	0%

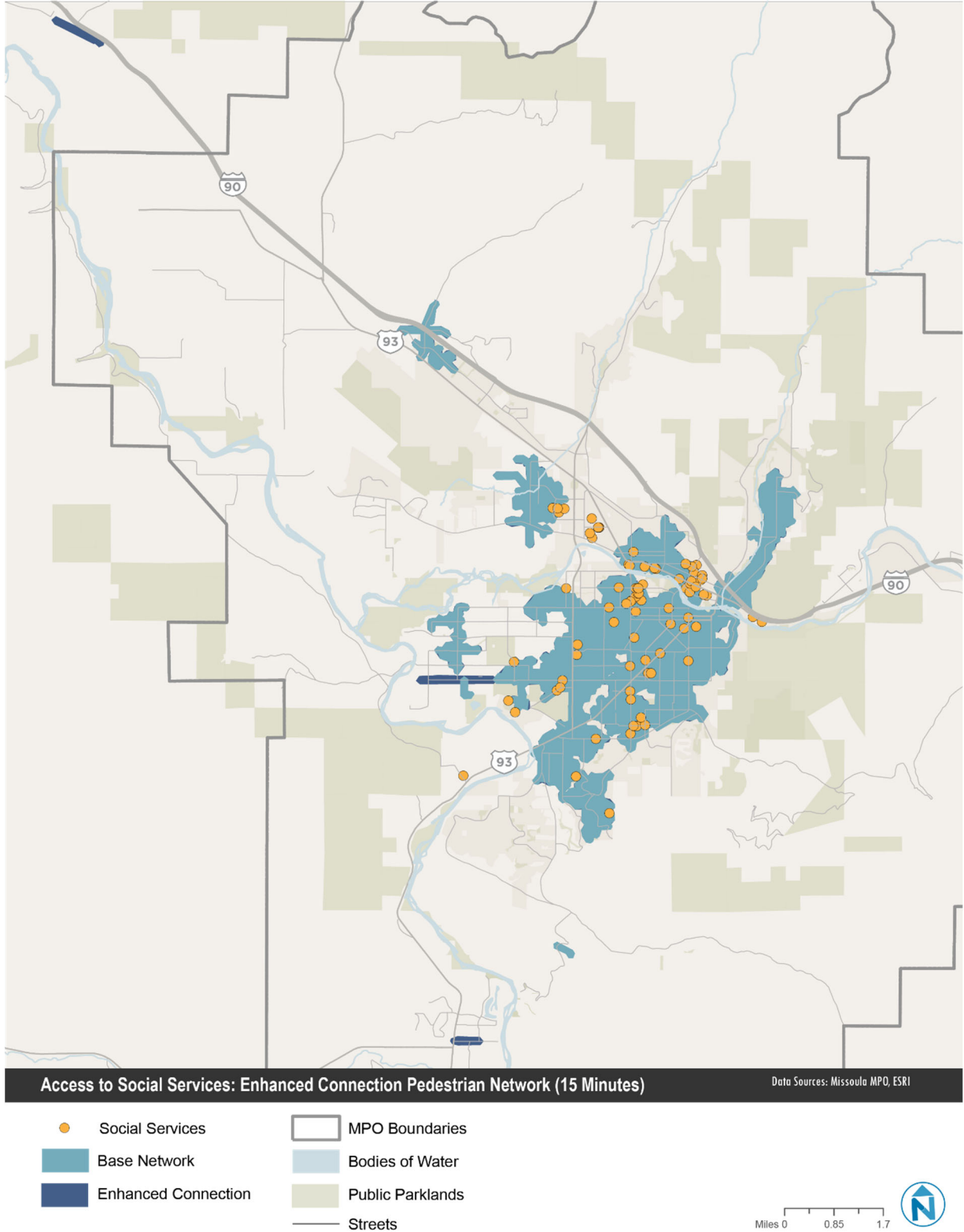
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 37 Walking Access to Social Services (15 mins) – New Connections



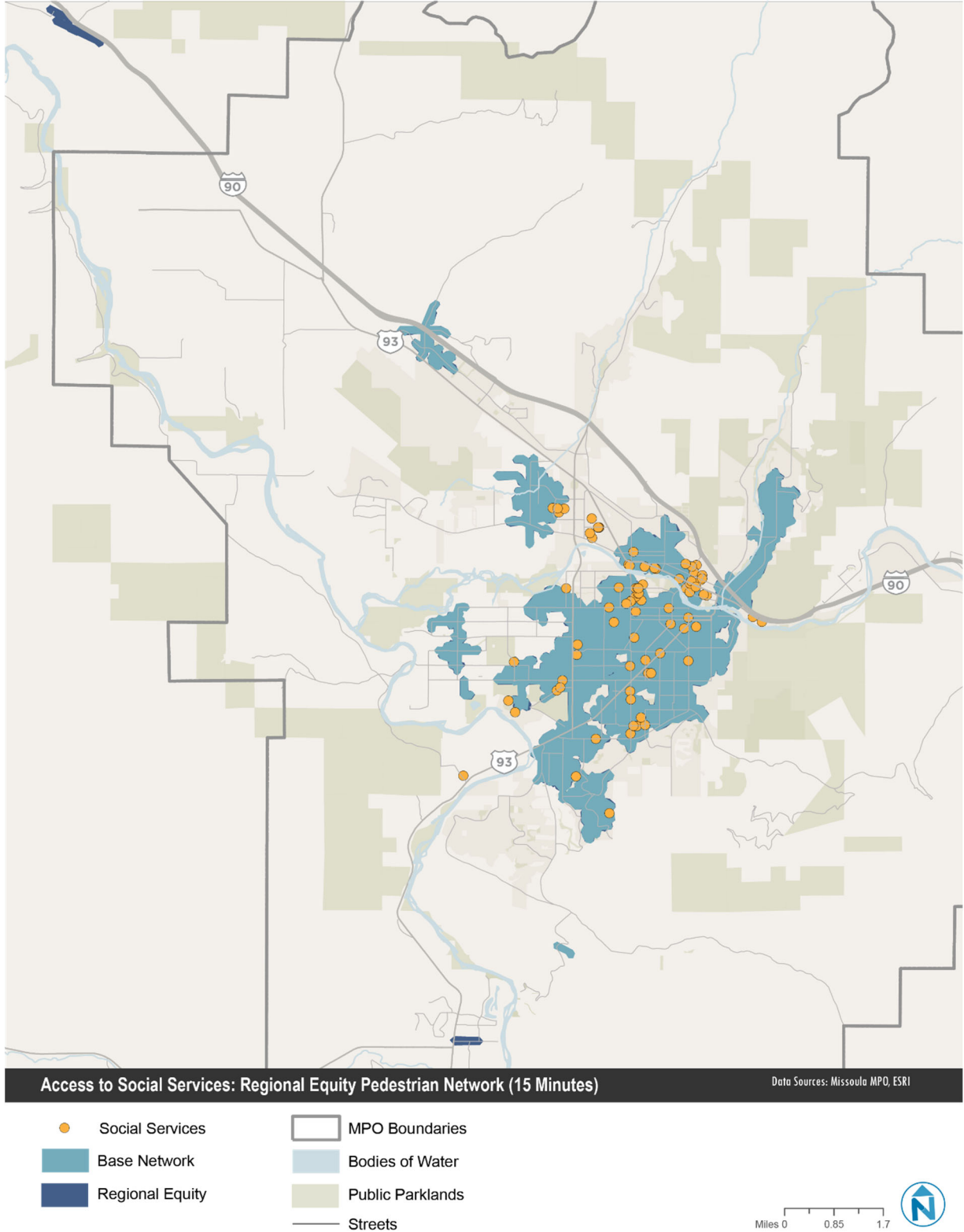
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 38 Walking Access to Social Services (15 mins) – Enhanced Connections



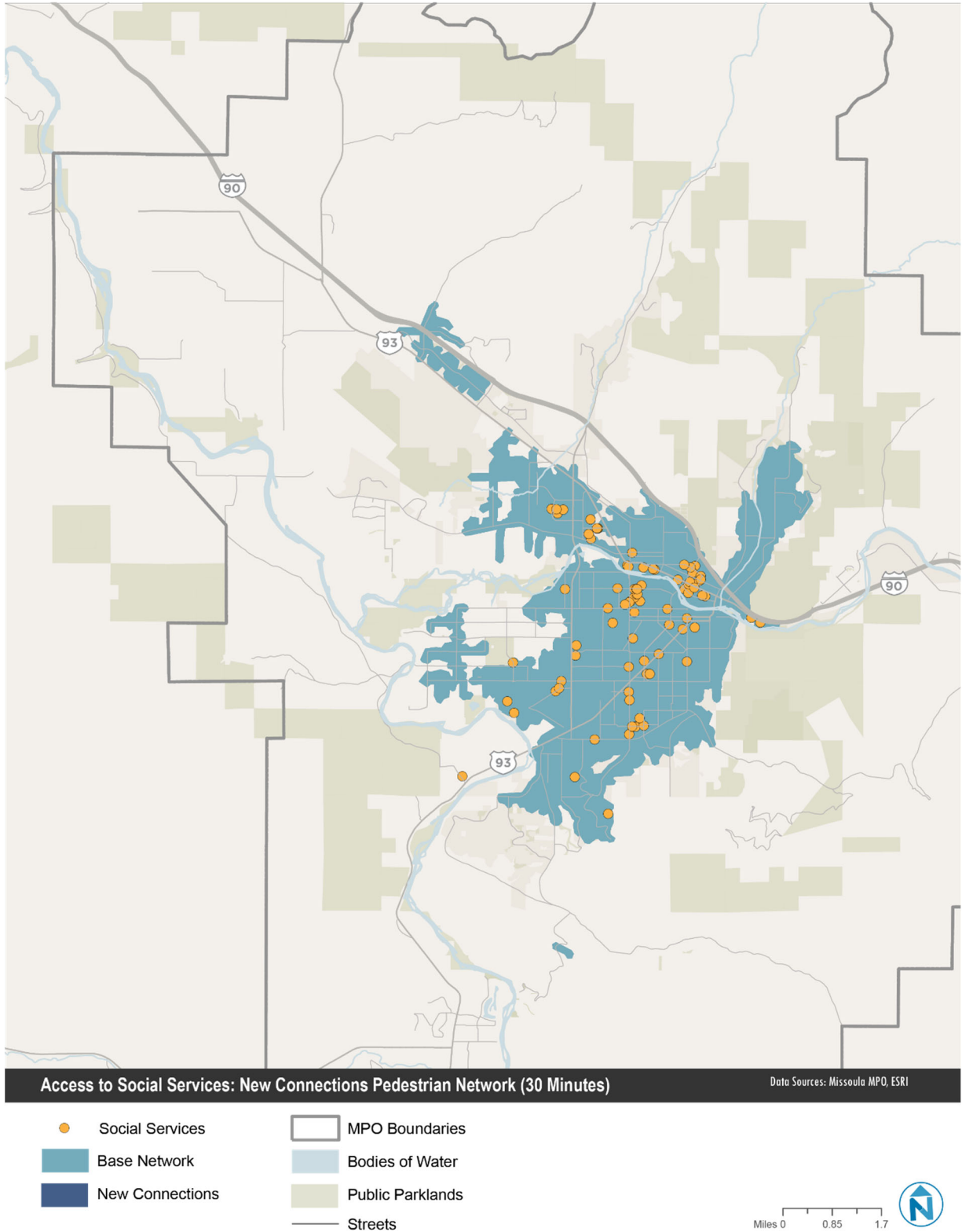
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 39 Walking Access to Social Services (15 mins) – Regional Equity



SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

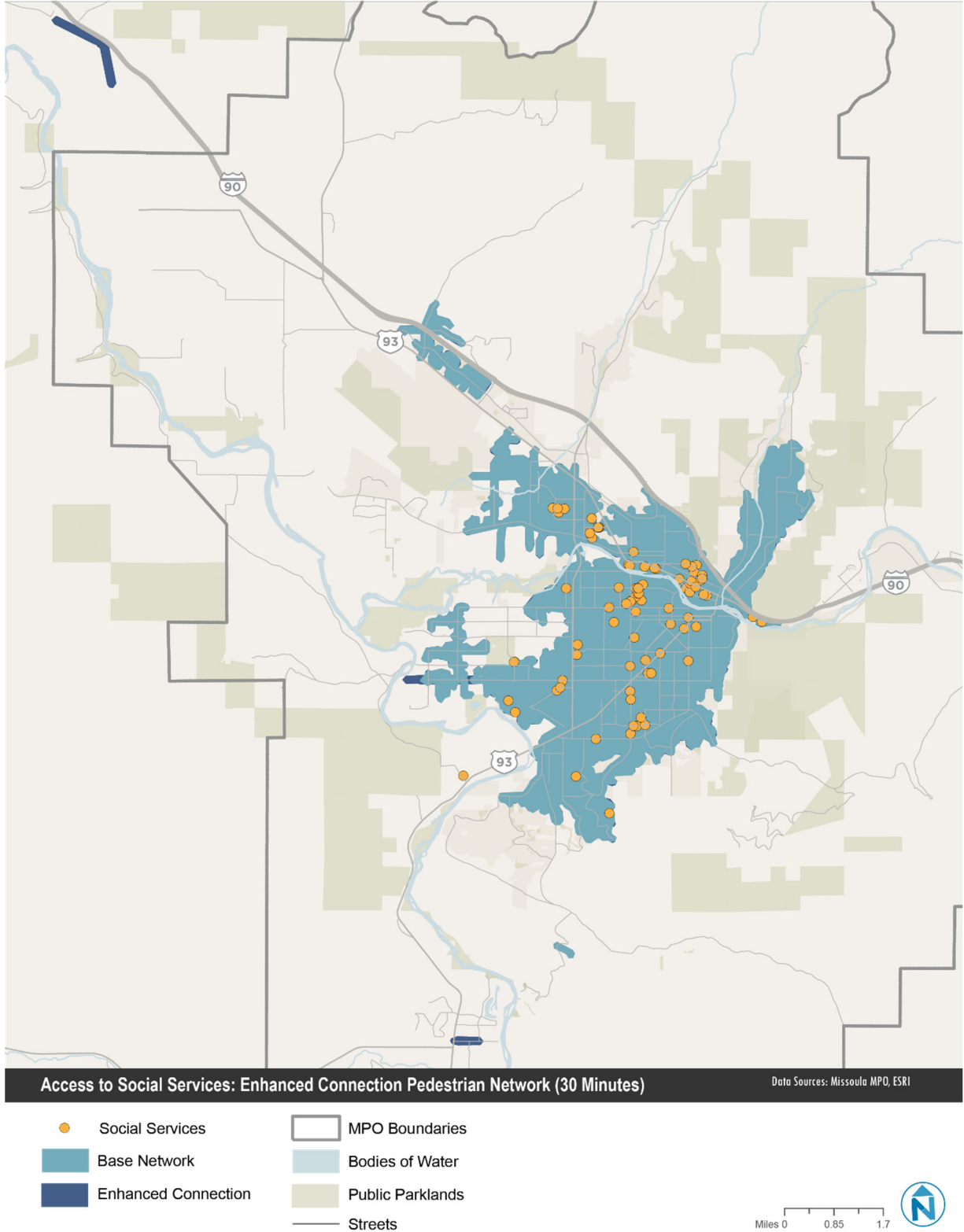
Figure 40 **Walking Access to Social Services (30 mins) – New Connections**



SUMMARY OF SCENARIO ANALYSIS FINDINGS

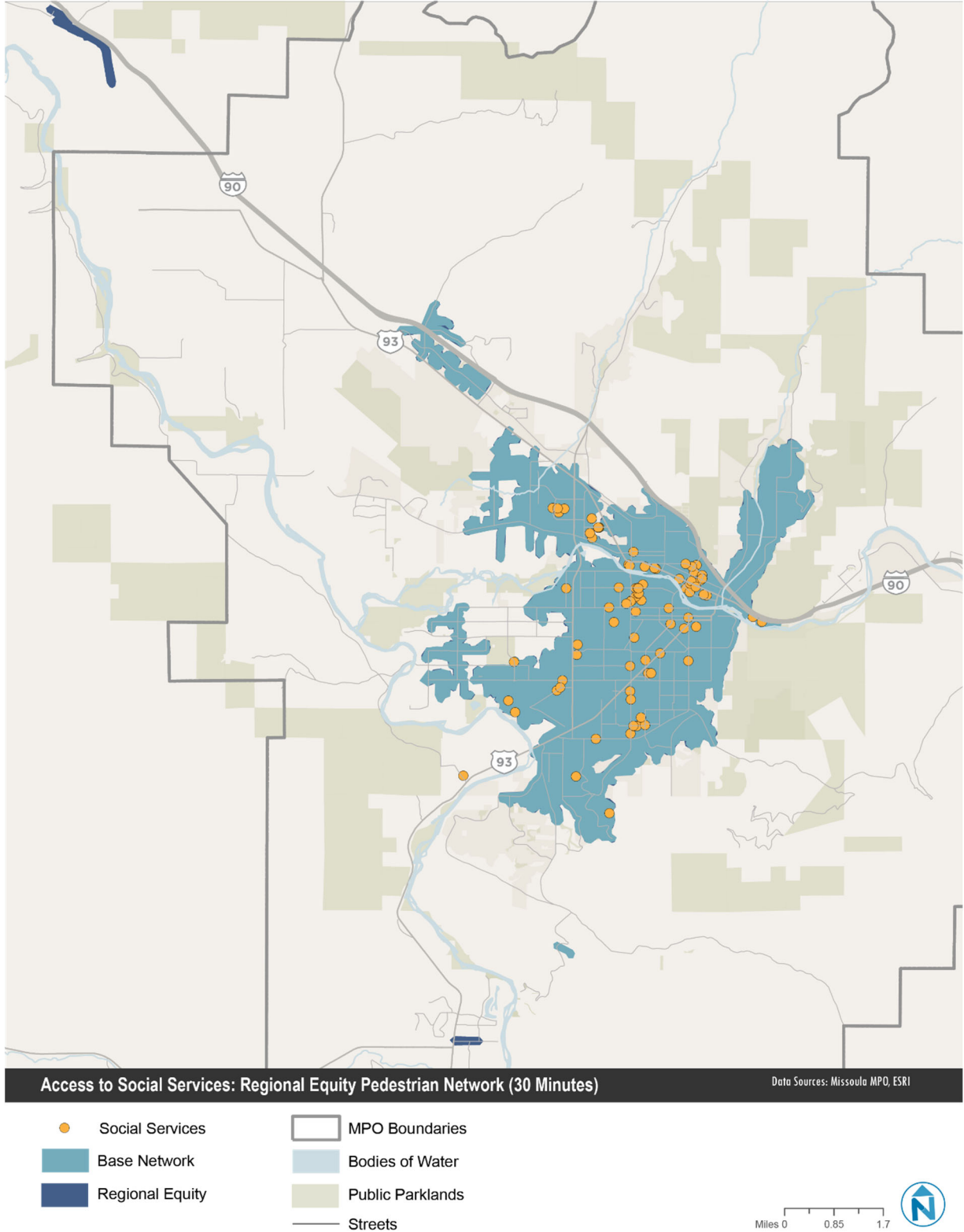
Missoula Connect

Figure 41 Walking Access to Social Services (30 mins) – Enhanced Connections



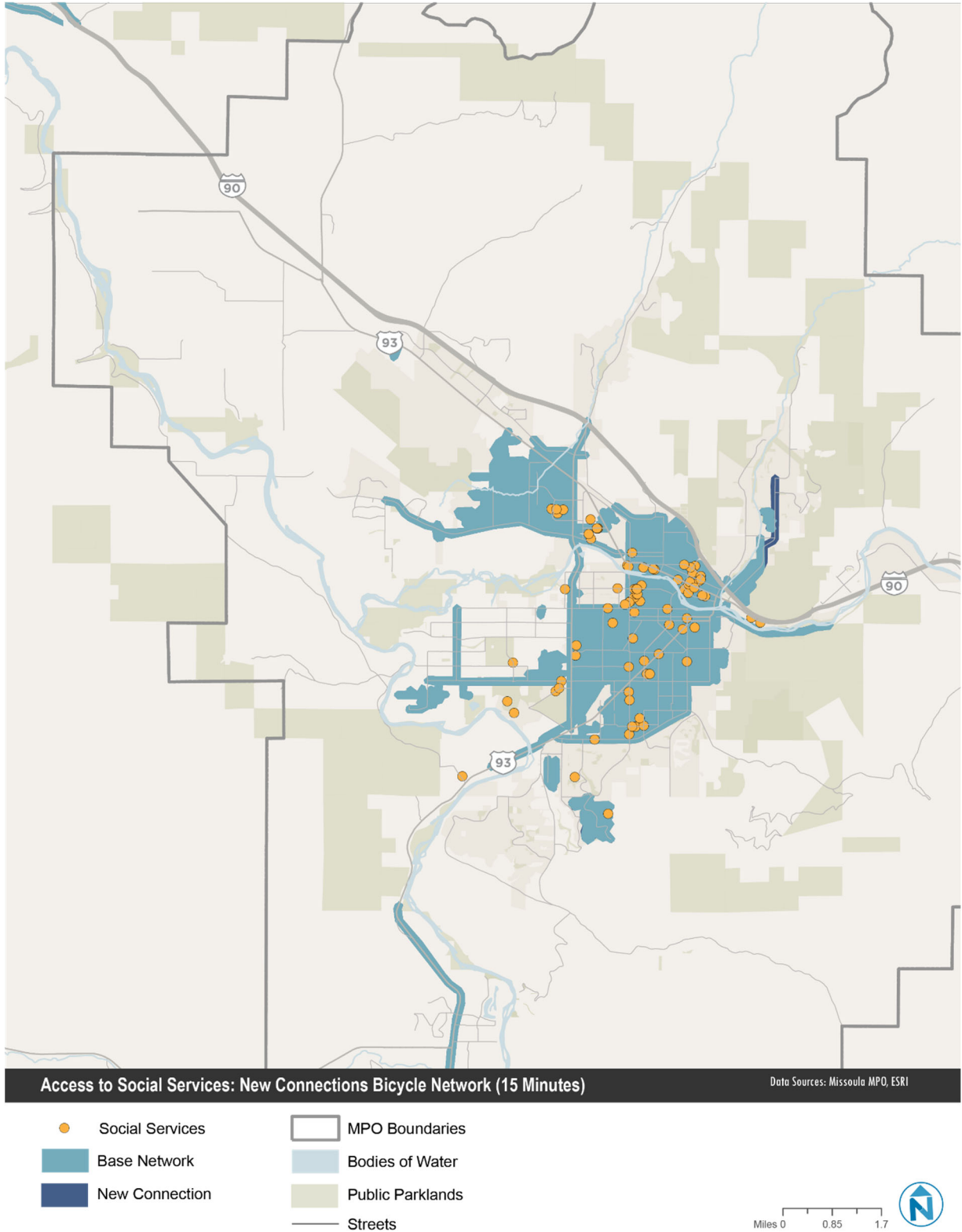
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 42 Walking Access to Social Services (30 mins) – Regional Equity



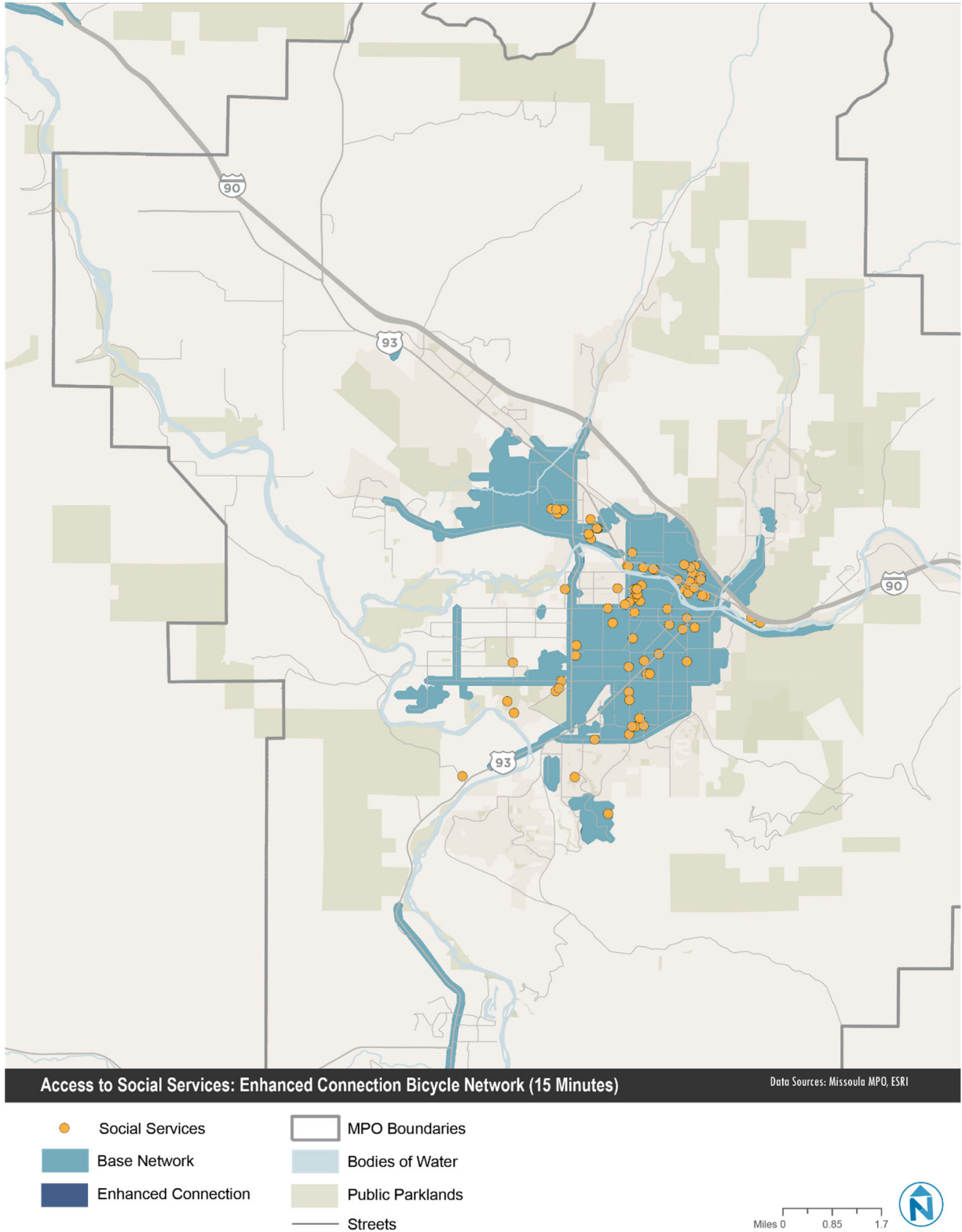
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 43 Biking Access to Social Services (15 mins) – New Connections



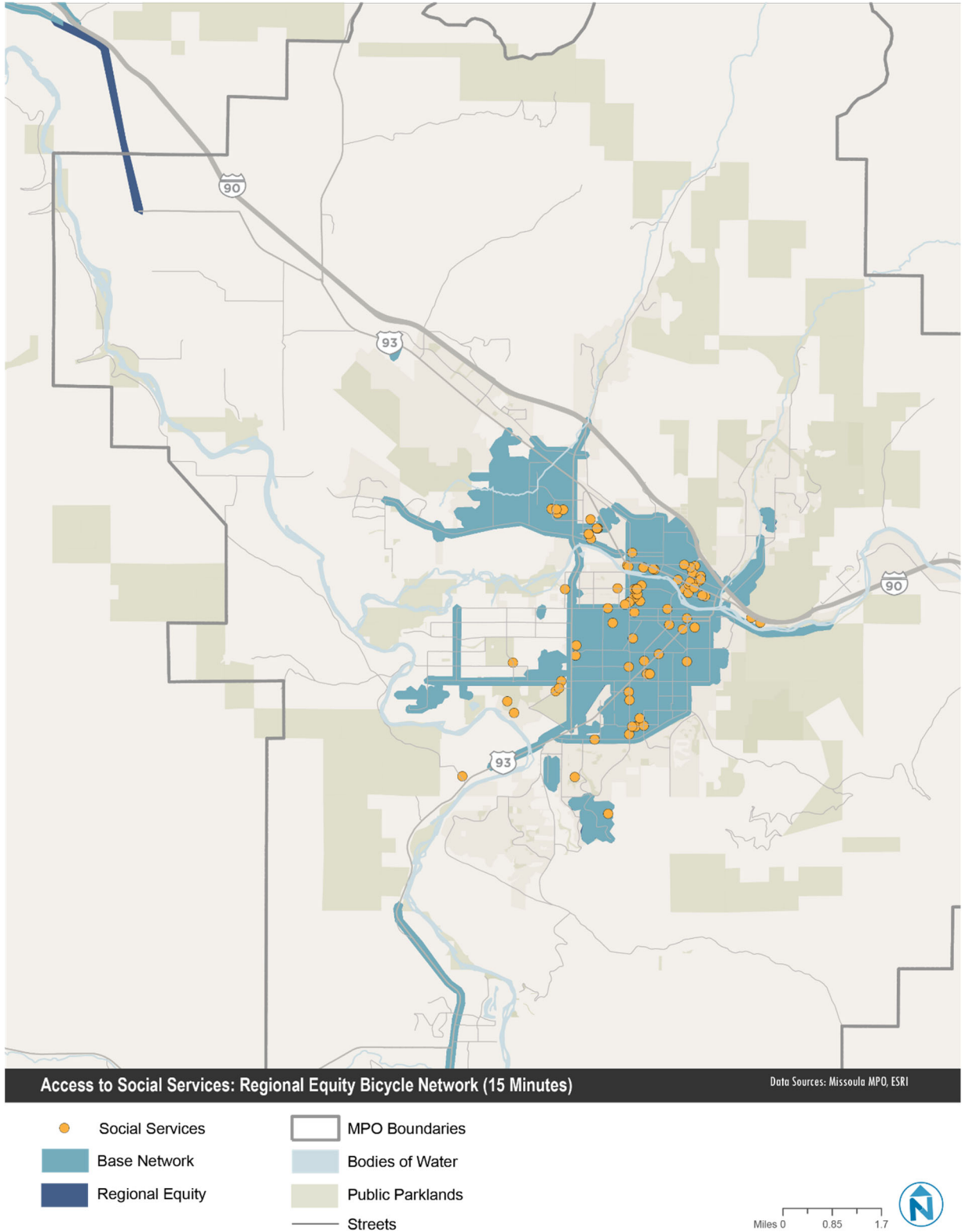
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 44 Biking Access to Social Services (15 mins) – Enhanced Connections



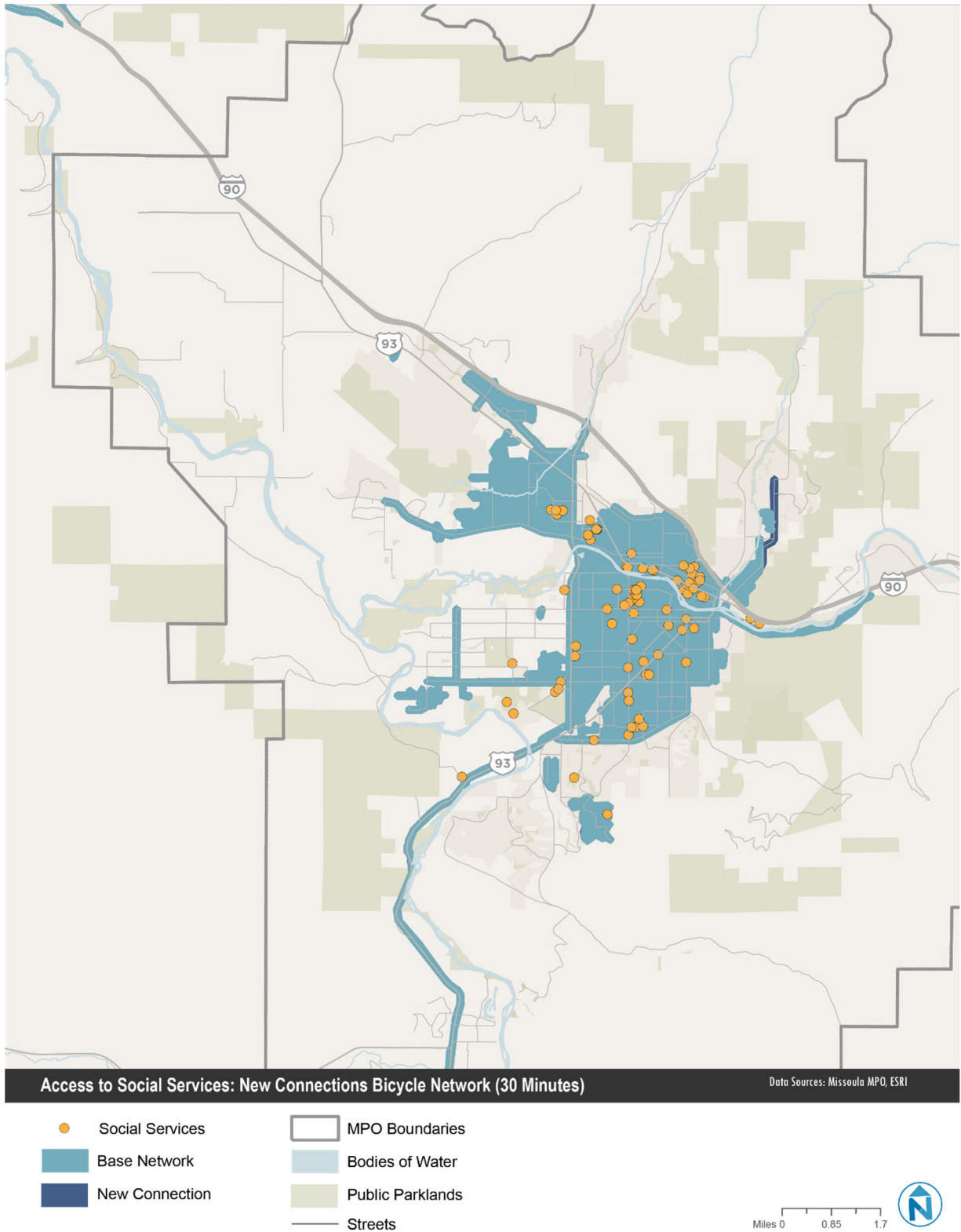
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 45 Biking Access to Social Services (15 mins) – Regional Equity



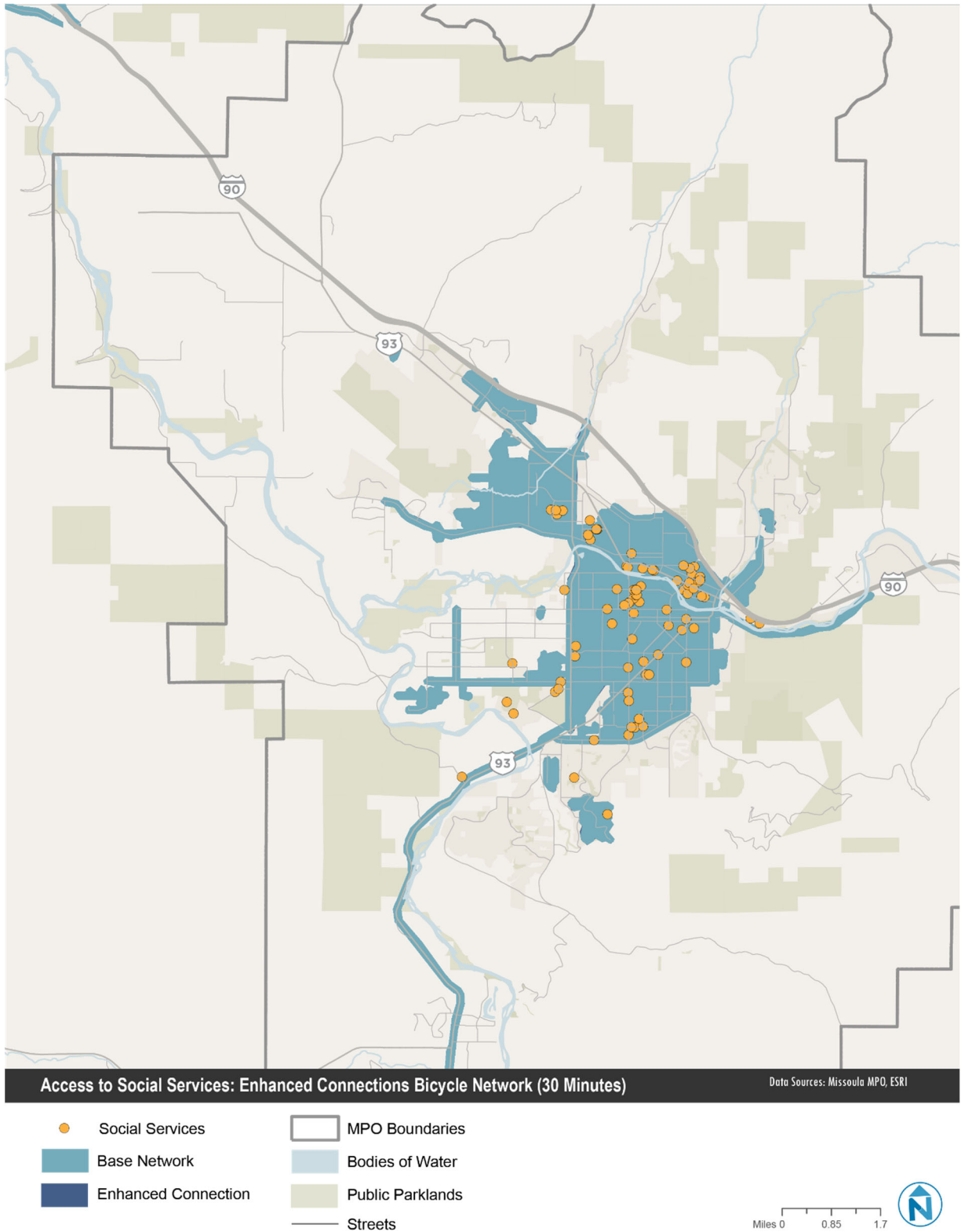
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 46 Biking Access to Social Services (30 mins) – New Connections



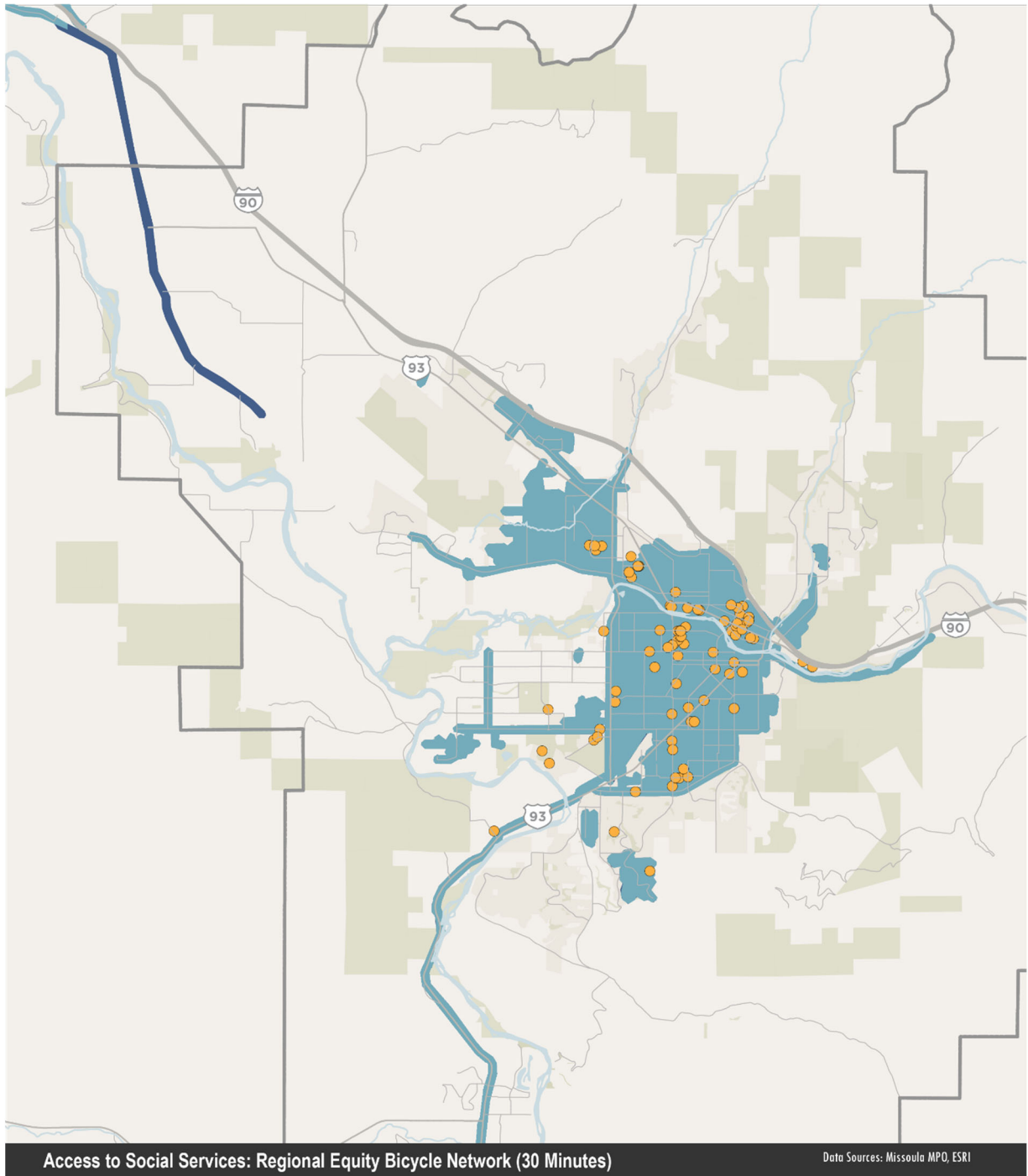
SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 47 Biking Access to Social Services (30 mins) – Enhanced Connections

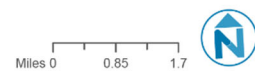


SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Figure 48 Biking Access to Social Services (30 mins) – Regional Equity



- Social Services
- Base Network
- Regional Equity
- MPO Boundaries
- Bodies of Water
- Public Parklands
- Streets



BICYCLE CONNECTIVITY

For a bicycling network to attract as many people as possible, it is critical to improve low-stress connectivity. This means providing routes that allow people riding bicycles to use connections that are within their tolerance for traffic stress and that avoid undue detours.

For this analysis, bicycle improvement projects from each transportation network scenario were overlaid with existing commuter trails and roadways categorized in the 2016 Bicycle Facilities Master Plan as Level of Traffic Stress 1 (LOTS 1). Level of Traffic Stress was determined based on factors such as posted speed limit, traffic volume, street width, and the presence or character of bicycle lanes. LOTS 1 roadways are generally low stress and suitable for all ages and abilities. Clusters of connected roadways and facilities were symbolized with different colors.

To compare scenarios, we also calculated the miles of bicycle projects from each transportation network that would be added to existing on-street facilities that have an LOTS higher than 1. This helps to explain the full scope of the bicycle network that might feel comfortable to a more experienced bicyclist (Table 10).

Figure 49 to Figure 52 depict connected clusters of streets and bicycle facilities within the Missoula region that are suitable for all ages and abilities. In general, existing roadways that are considered comfortable do not provide access between different parts of the region or between neighborhoods. Rather, clusters are fragmented and often “break” at major roadways. Future bicycle improvements that are included in the Enhanced Connections and Regional Equity scenarios—such as protected bike facilities, new crossing improvements, neighborhood greenways, and shared-use paths—would link many of the existing clusters and could increase the percentage of residents who feel comfortable bicycling.

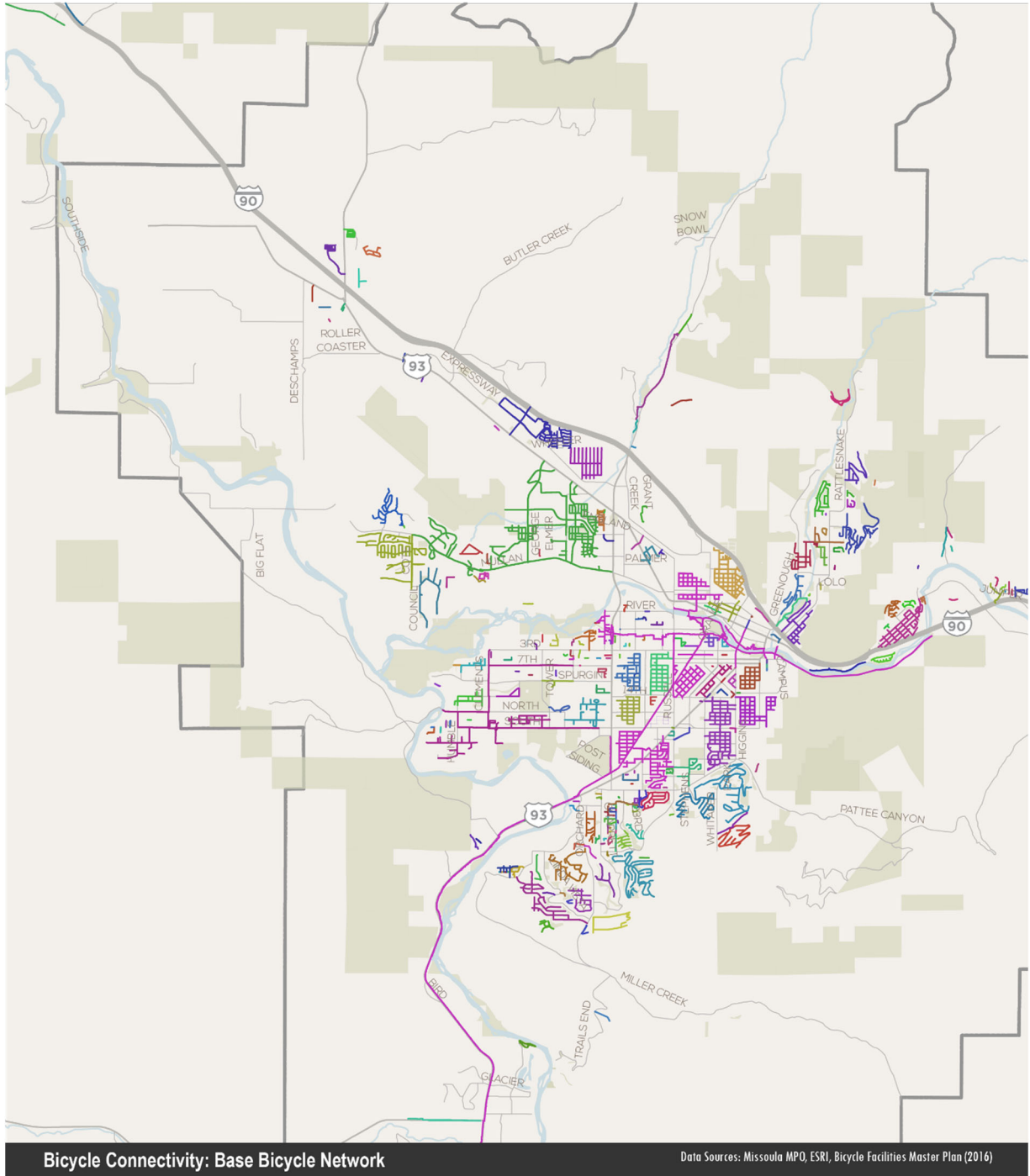
Table 10 Miles of Connected Low-Stress Facilities

Network Scenario	Level of Traffic Stress 1 (LOTS 1) & Commuter Trails	LOTS 1, Commuter Trails, & Existing Bicycle Facilities
Base	50	160
New Connections	74	168
Enhanced Connections	160	210
Regional Equity	175	226

SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

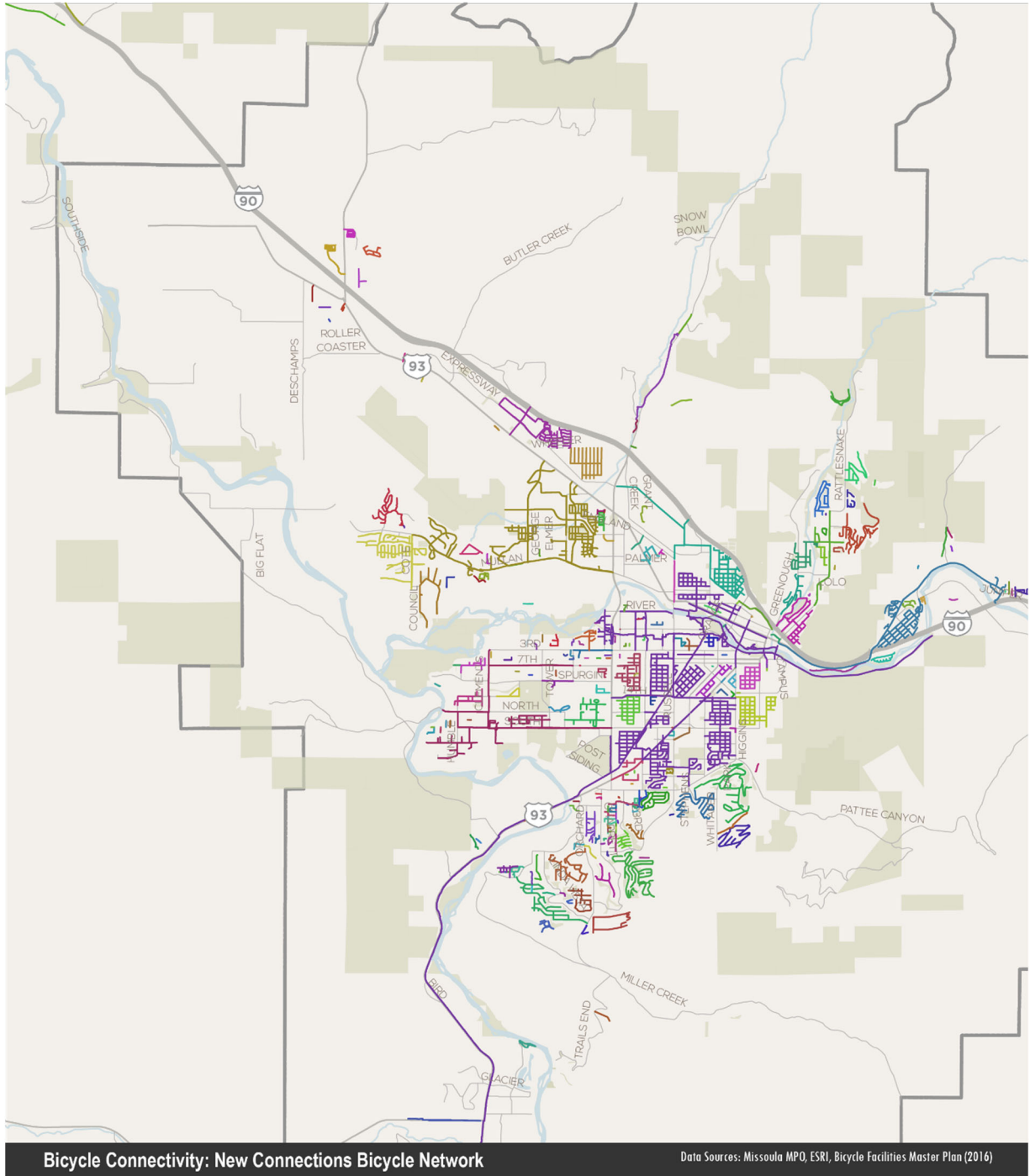
Figure 49 Bicycle Connectivity – Base Network



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 50 Bicycle Connectivity – New Connections



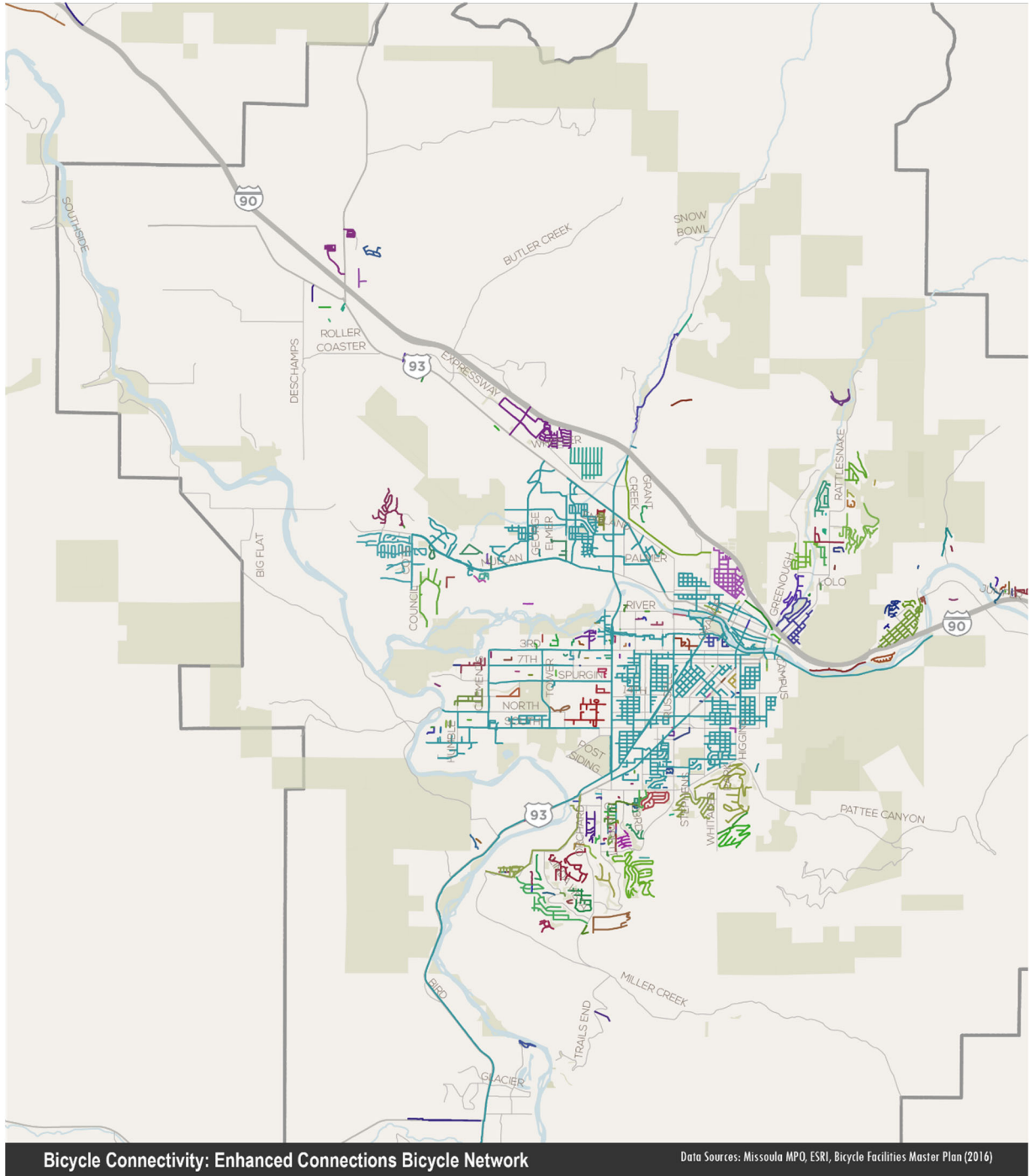
The mapped clusters depict continuous connectivity for people riding bicycles on roadways classified as suitable for all ages and abilities. These include existing paved shared use paths, on-street bicycle facilities, LTS 1 roadways, and proposed transportation network scenarios. Clusters isolated from each other are identified through different colors, indicating a discontinuation of low stress facilities between points.

- MPO Boundary
- Bodies of Water
- Public Parklands
- Streets

SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 51 Bicycle Connectivity – Enhanced Connections



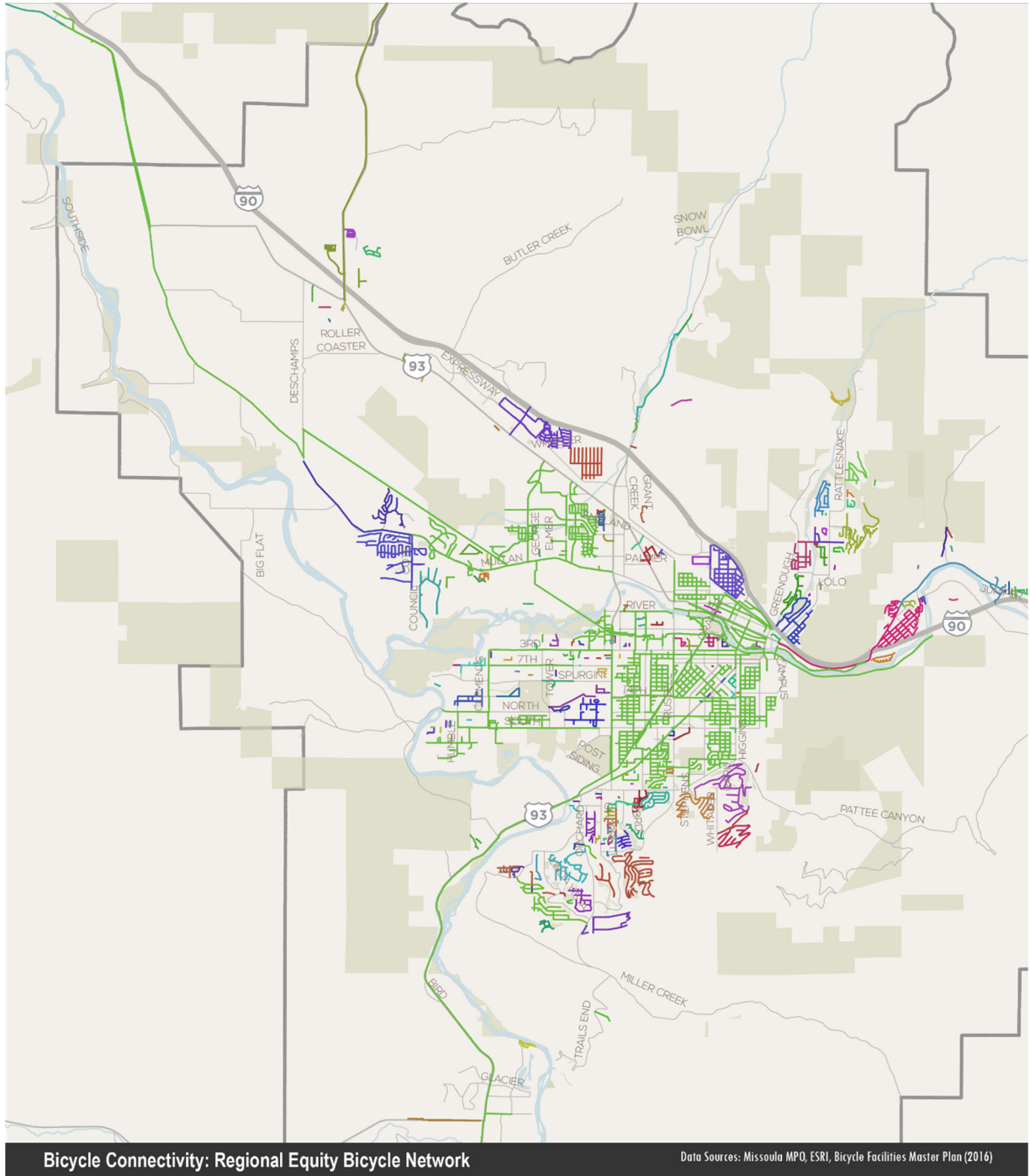
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- MPO Boundary
- Bodies of Water
- Public Parklands
- Streets

SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 52 Bicycle Connectivity – Regional Equity



The mapped clusters depict continuous connectivity for people riding bicycles on roadways classified as suitable for all ages and abilities. These include existing paved shared use paths, on-street bicycle facilities, LTS 1 roadways, and proposed transportation network scenarios. Clusters isolated from each other are identified through different colors, indicating a discontinuation of low stress facilities between points.

- MPO Boundary
- Bodies of Water
- Public Parklands
- Streets

AFFORDABILITY

Improving access to affordable housing is part of creating a more equitable region and can help to lower household transportation costs.

For this analysis, each transportation network scenario was overlaid with the point locations of affordable housing facilities in the region. We then calculated the number of sites that would be within 200 meters of a transportation project in each proposed scenario. We defined affordable housing to include all existing (2018 data) housing developments that receive Low-Income Housing Tax Credit (LIHTC), US Department of Housing and Urban Development (HUD), or Section 8 funding, as well as mobile home courts.

Table 11 shows the total number of affordable housing locations served by the projects in each transportation scenario. The maps in Figure 53 through Figure 55 show the location of affordable housing relative to the projects in each scenario. Key findings are as follows:

- Projects in the Regional Equity scenario serve the most affordable housing facilities (both mobile home courts and multi-family complexes) followed by Enhanced Connections.
- All three scenarios include projects that provide access to affordable housing sites in the Franklin to the Fort and River Road neighborhoods.
- New Connections and Regional Equity outperform Enhanced Connections in connecting to affordable housing options in East Missoula.

Table 11 Affordable Housing Locations Served by Transportation Network Scenario

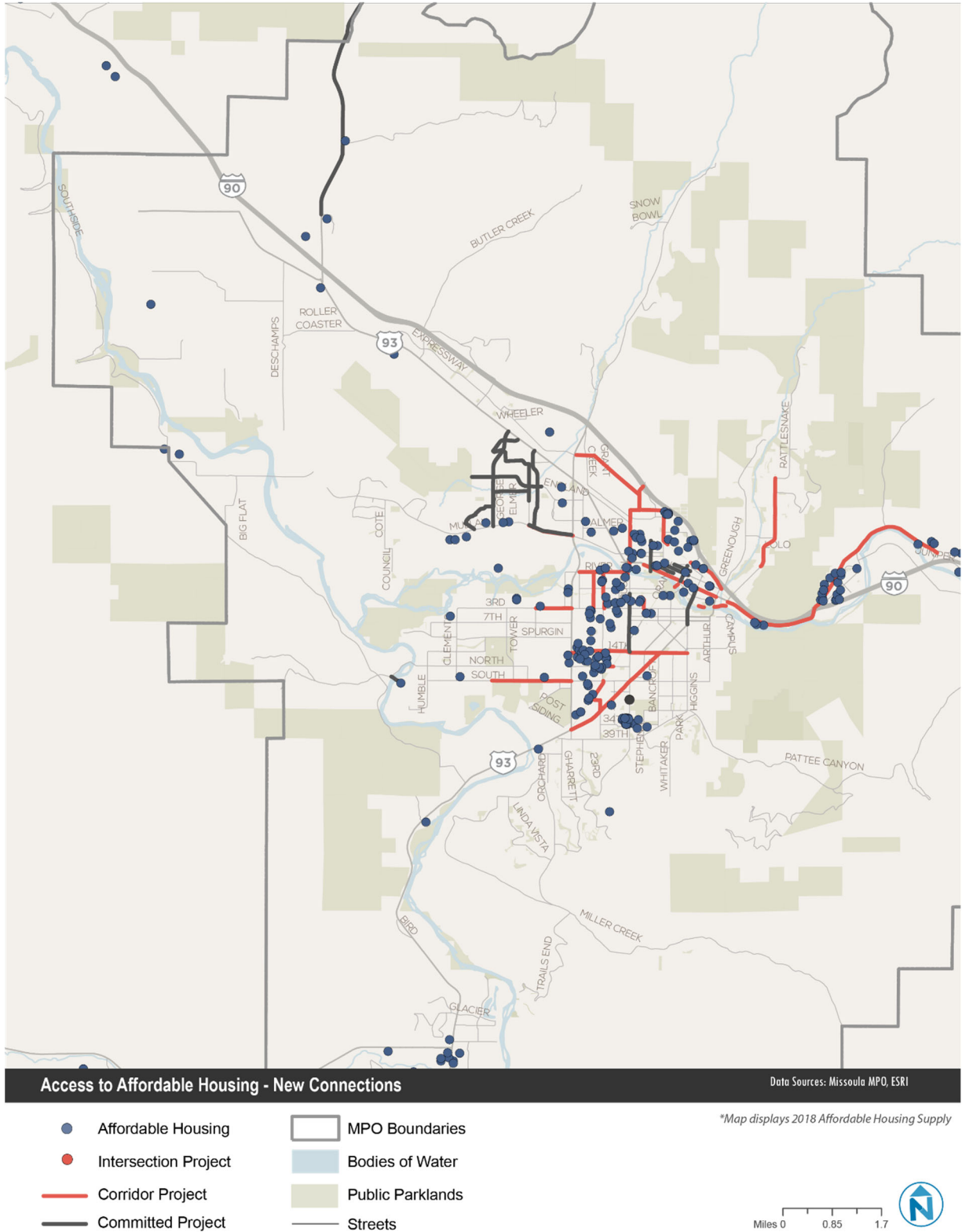
Housing Type	New Connections	Enhanced Connections	Regional Equity
Mobile Home Court	50	74	82
Affordable Housing Complex	27	39	46
Total	77	113	128

Source: Montana Department of Revenue (2018)

SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

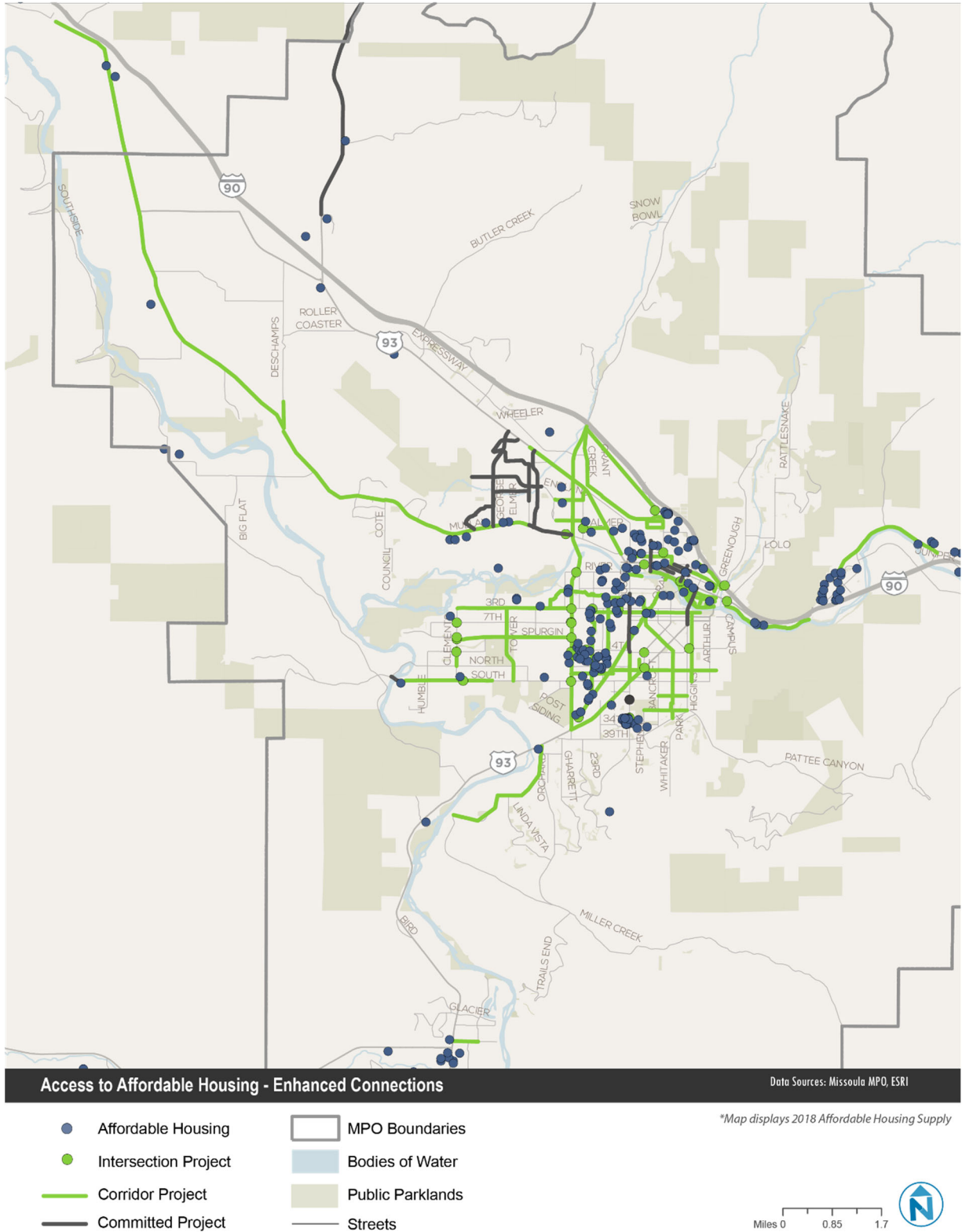
Figure 53 New Connections and Affordable Housing



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

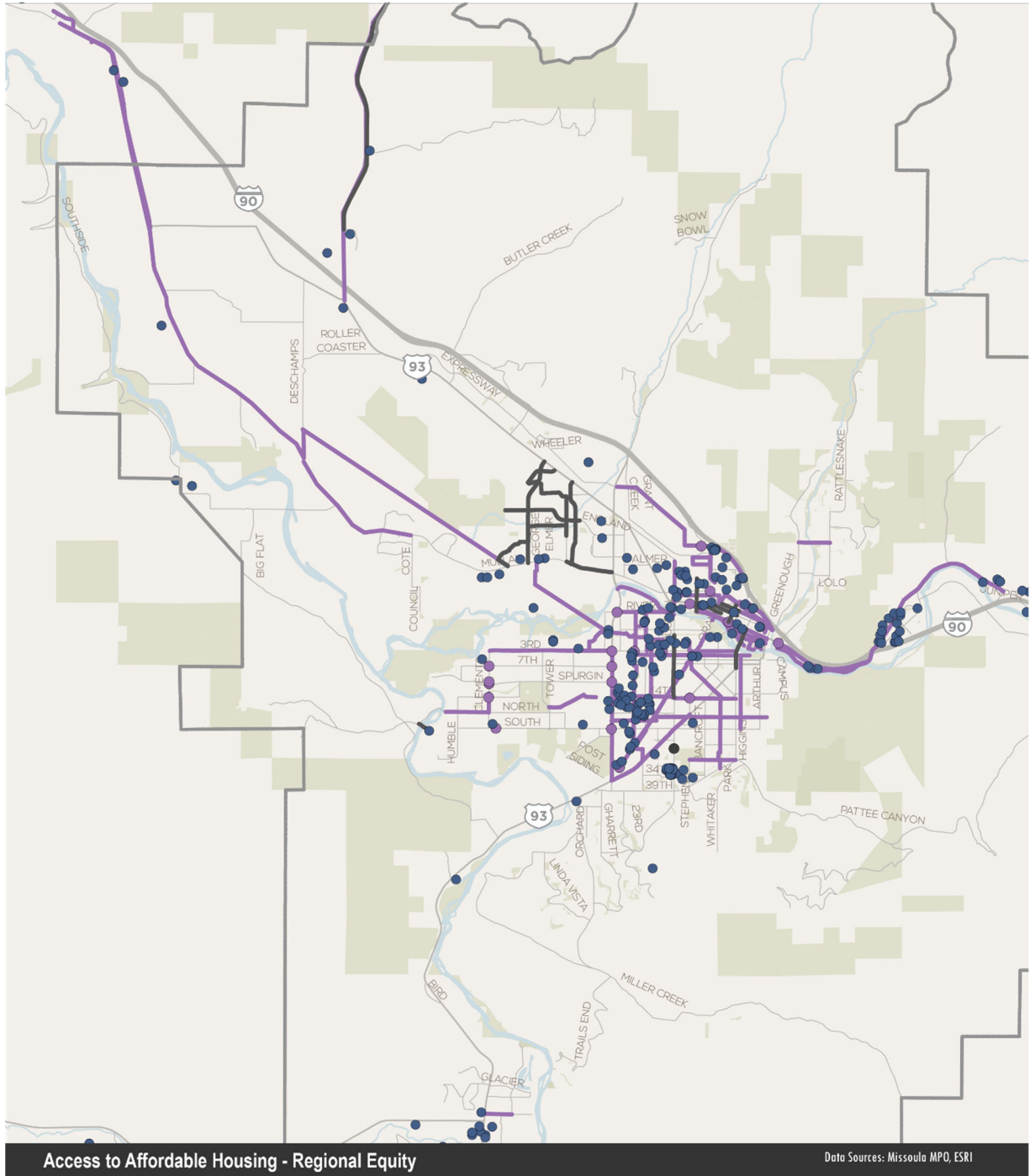
Figure 54 **Enhanced Connections and Affordable Housing**



SUMMARY OF SCENARIO ANALYSIS FINDINGS

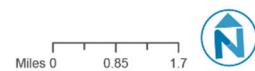
Missoula Connect

Figure 55 **Regional Equity and Affordable Housing**



- Affordable Housing
- Intersection Project
- Corridor Project
- Committed Project
- MPO Boundaries
- Bodies of Water
- Public Parklands
- Streets

*Map displays 2018 Affordable Housing Supply



SAFETY

Improving safety at intersections and providing enhanced levels of comfort and separation between modes is key to achieving desired Missoula Connect outcomes, including the elimination of traffic-related fatalities and serious injuries. While we cannot predict the degree to which each transportation network scenario might reduce collisions, all projects recommended by Missoula Connect will incorporate best practice safety countermeasures. Projects will be designed to eliminate modal conflicts and reduce the likelihood and severity of collisions.

Although predictive analysis is not possible, we can use historical collision data to assess whether the transportation scenarios include projects in locations that have previously experienced a high number of collisions. This indicates an opportunity to improve safety at those locations as projects are designed and implemented.

For this analysis, we overlaid each transportation network scenario with the density of bicycle- and pedestrian-involved collisions based on number of crashes from 2007-2018. Crash data is from the Missoula Community Transportation Safety Plan. The dataset includes all crashes that resulted in injury or property damage over \$1,500.

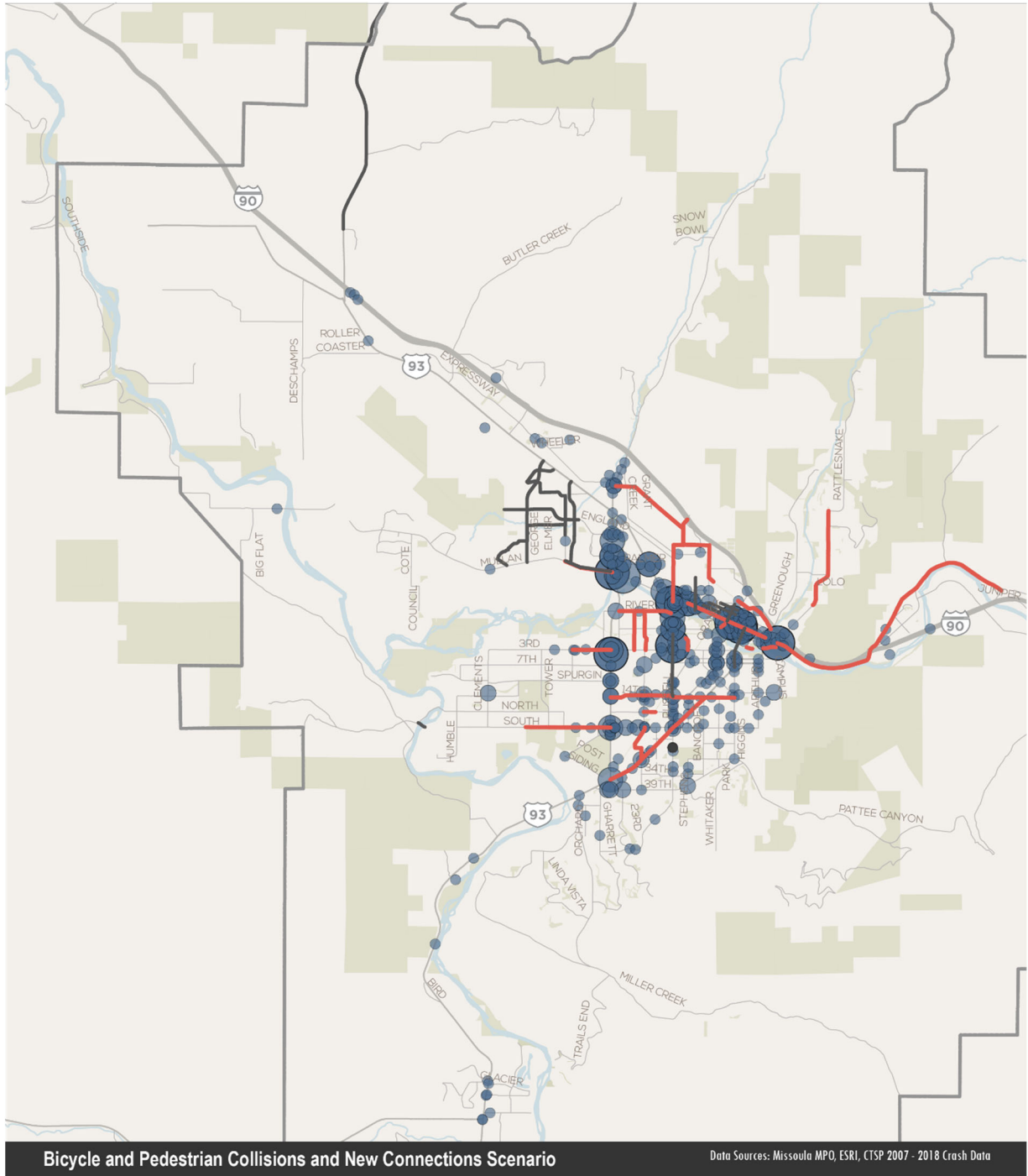
The maps in Figure 56 through Figure 58 show the density of previous bicycle and pedestrian collisions relative to the projects in each transportation network scenario. The maps in Figure 59 through Figure 61 show the density of all previous crashes (between 2007 and 2018) relative to the projects in each transportation network scenario. Key findings are as follows:

- Projects in the Enhanced Connections scenario touch the highest number of previous pedestrian- and bicycle-involved collision locations (202), followed by Regional Equity (188), and New Connections (134).
- Enhanced Connections includes 14 intersection improvement projects at locations that had multiple crashes (or clusters) between 2007 and 2018.
- Projects in the Enhanced Connections scenario cover the largest number of previous collision locations along Reserve Street, which has a high total number of collisions relative to other corridors in the region.

SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 56 New Connections and Bicycle/Pedestrian Collision Density

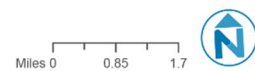


- Committed Project
- Corridor Project
- Intersection Project

- MPO Boundary
- Bodies of Water
- Public Parklands

Number of Collisions

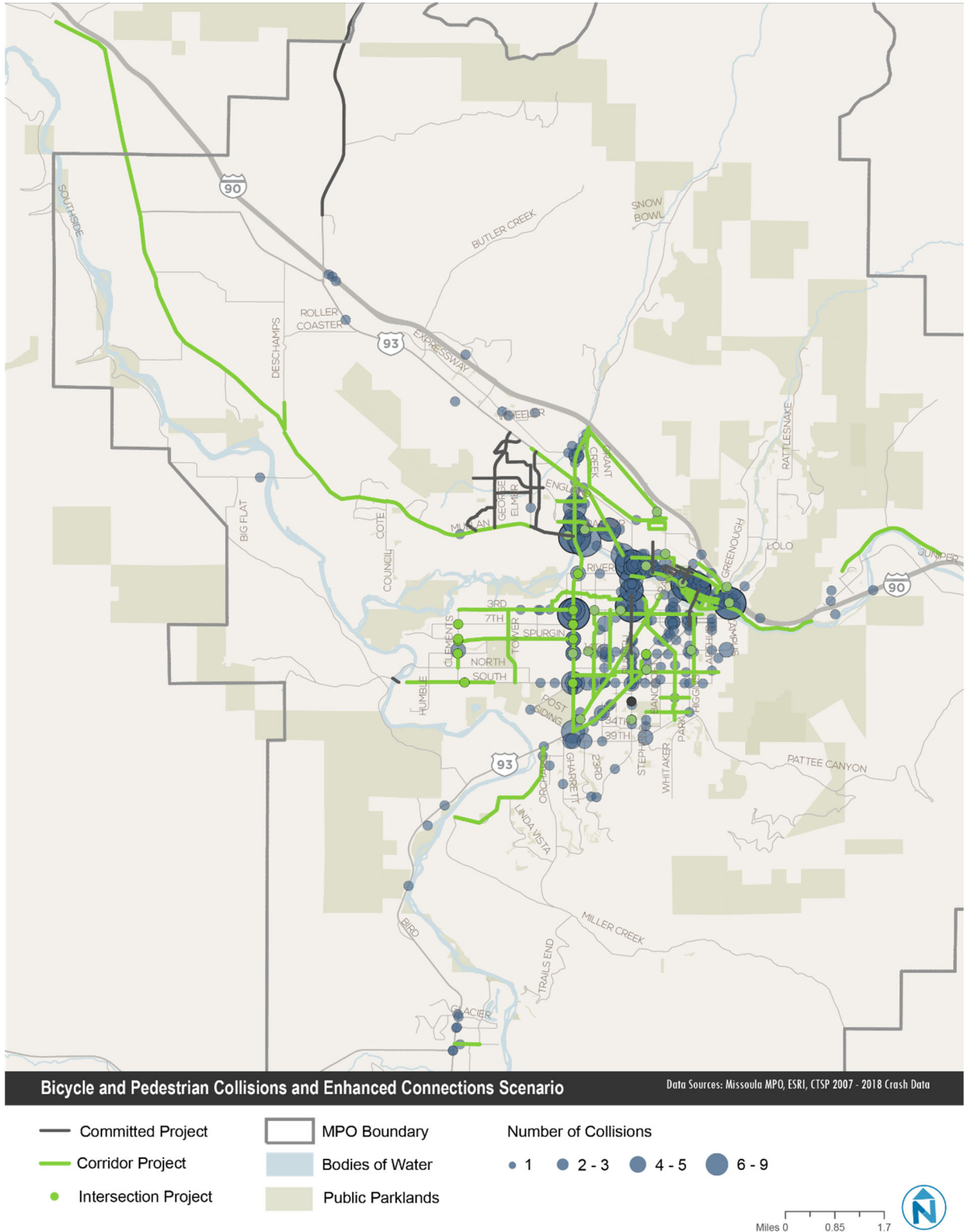
- 1
- 2 - 3
- 4 - 5
- 6 - 9



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

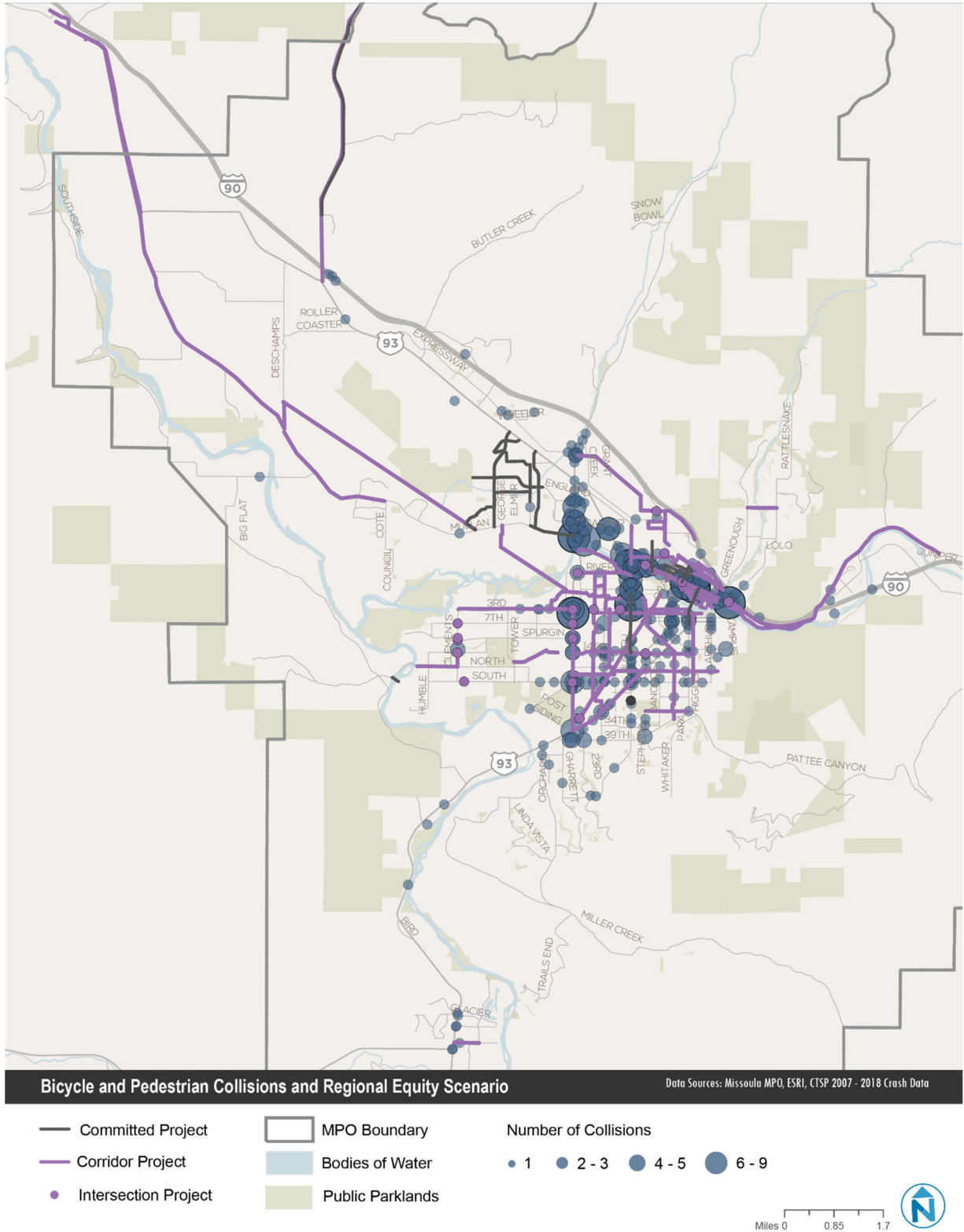
Figure 57 Enhanced Connections and Bicycle/Pedestrian Collision Density



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

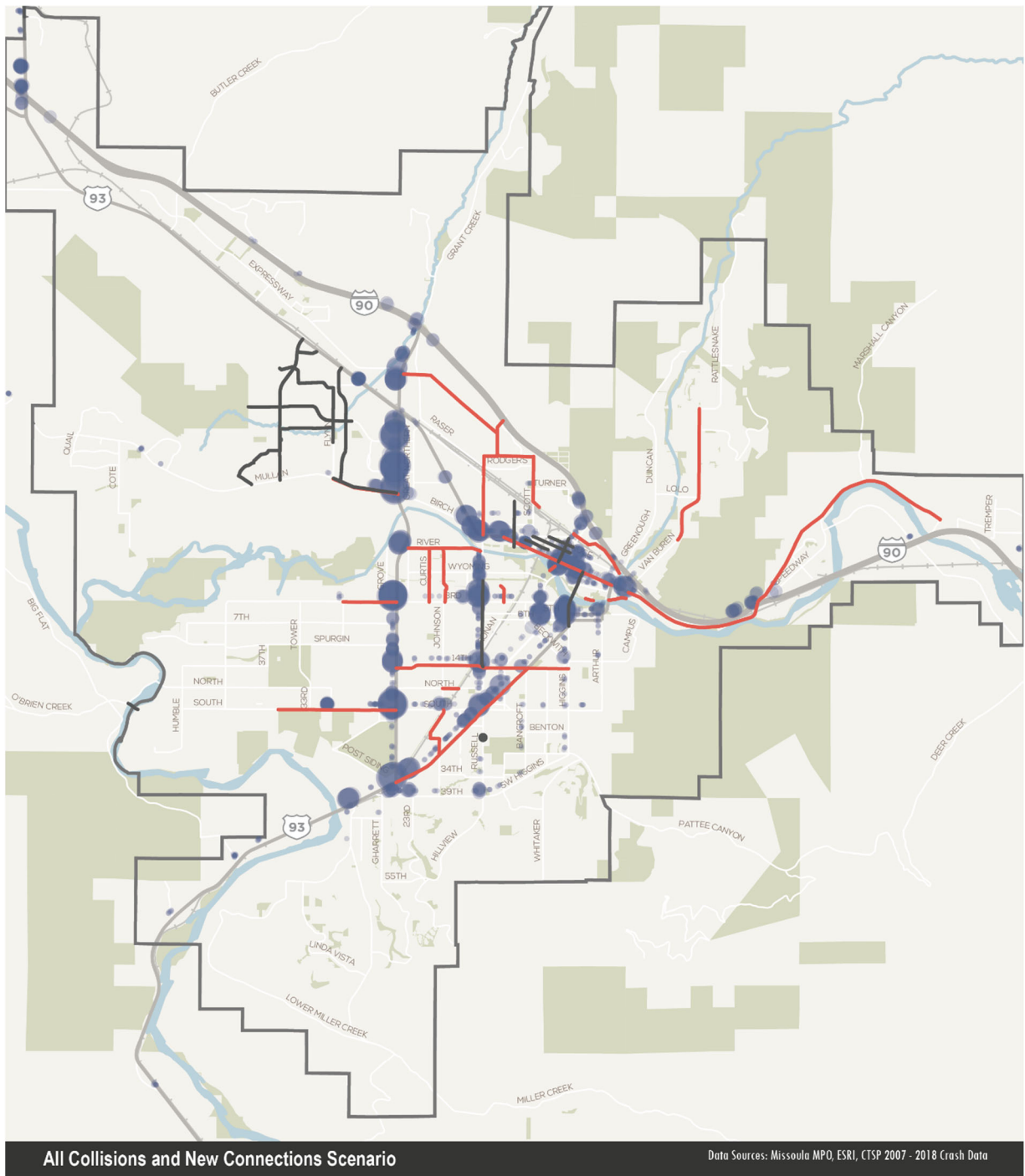
Figure 58 Regional Equity and Bicycle/Pedestrian Collision Density



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

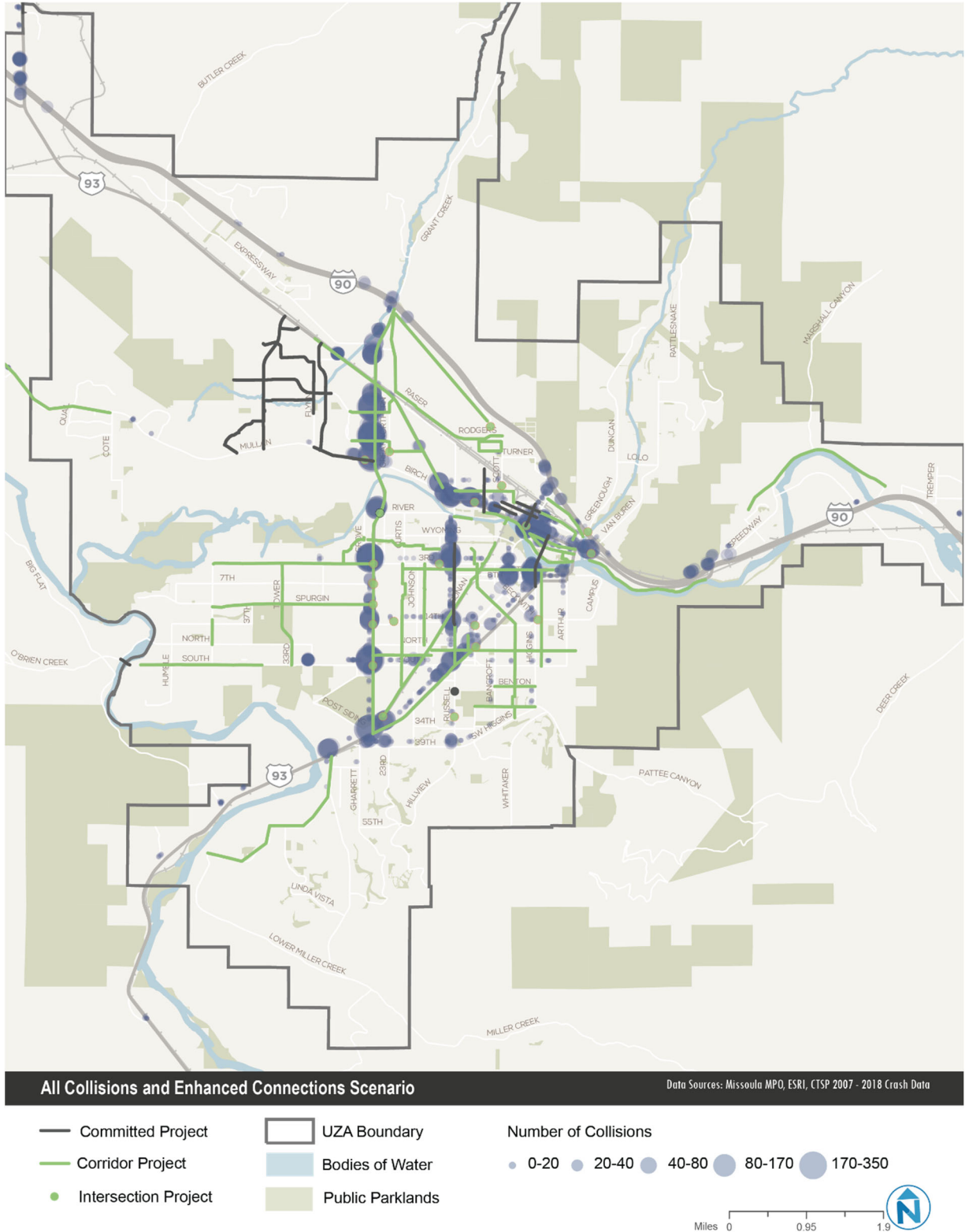
Figure 59 New Connections and All Collisions Density



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

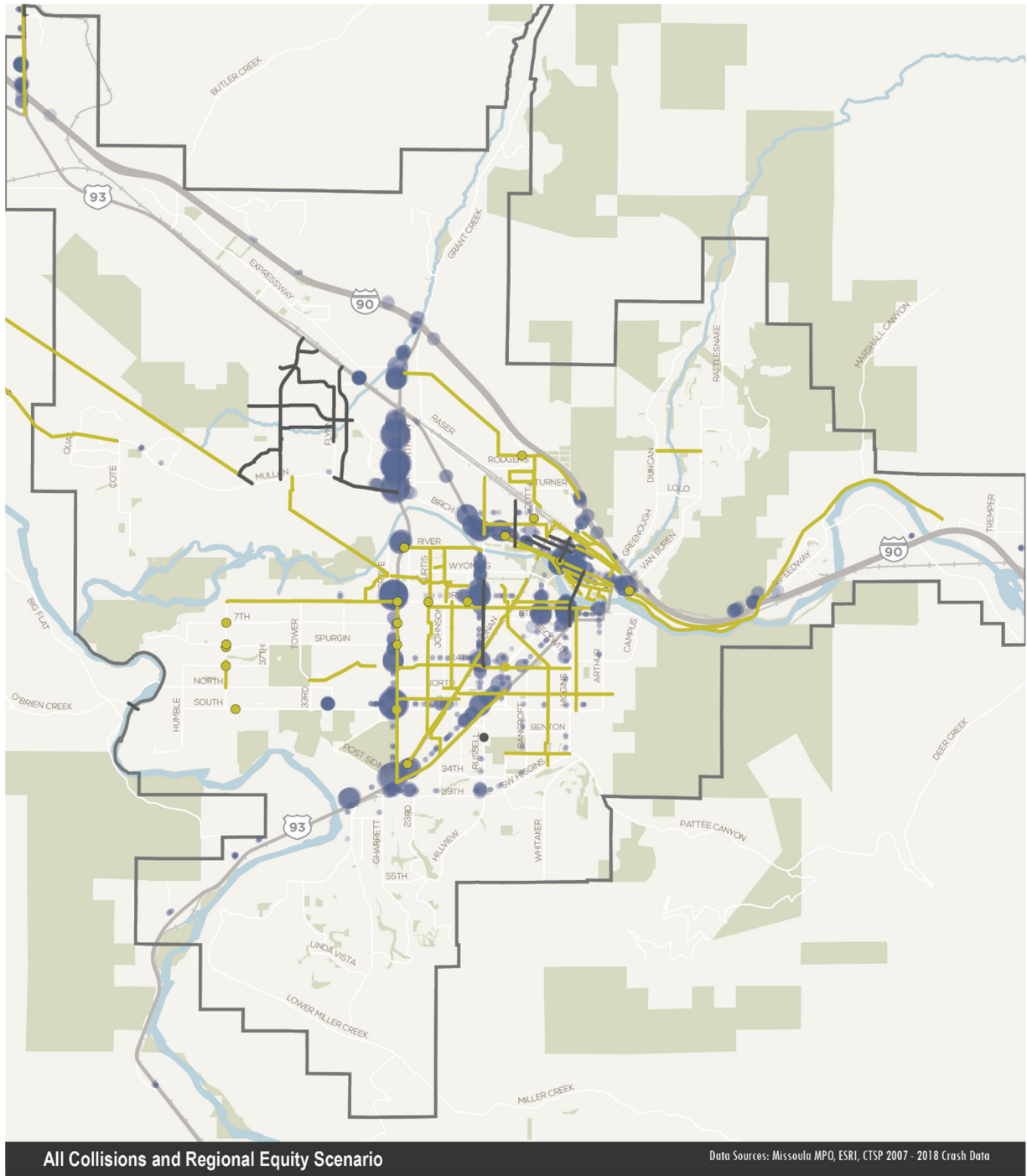
Figure 60 **Enhanced Connections and All Collisions Density**



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 61 Regional Equity and All Collisions Density



ABILITY TO SUPPORT GROWTH

This analysis considers how the proposed transportation scenarios serve areas with the highest estimated density of housing in the future (2050). These areas may support future inward growth that could accommodate more residents in the core of the region, providing greater access to destinations through non-drive alone modes.

This analysis maps the region's future housing density (dwelling units per square mile) at the TAZ level under the Strategic Growth scenario and overlays that with each transportation network scenario. TAZs that fall within the highest quintile of dwelling units per square mile were designated as areas with the highest housing density. This quintile includes TAZs with an estimated future density of housing between 1,526 and 95,779 dwelling units per square mile.

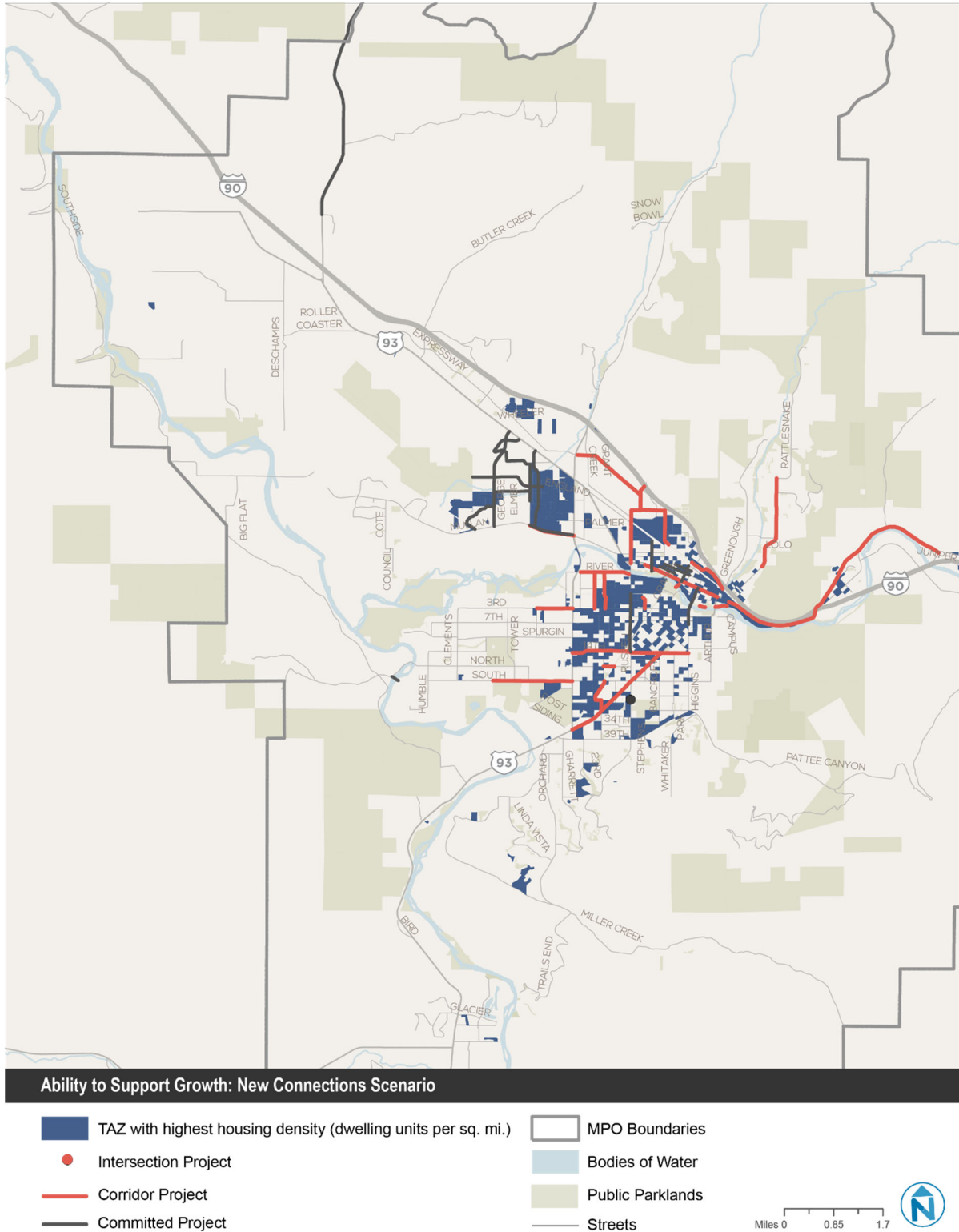
The maps in Figure 62 through Figure 64 show areas of density in 2050 that would be served by the projects in each transportation network scenario. Key findings are as follows:

- Enhanced Connections and Regional Equity include more projects and provide better coverage than New Connections to higher density housing areas in the core of the region, both north and south of the Clark Fork River.
- All three scenarios include projects supportive of the future Mullan Area Master Plan development.

SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

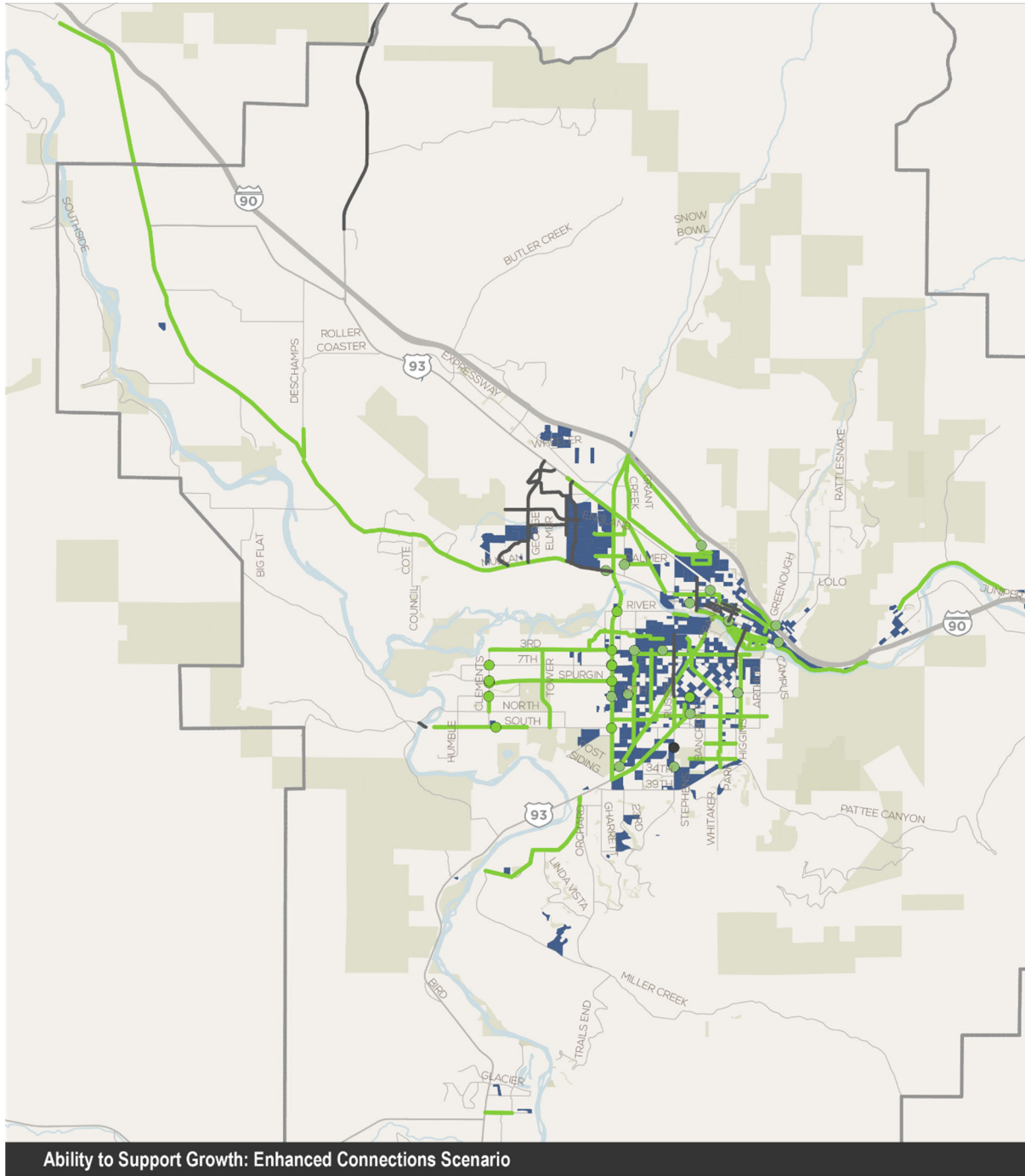
Figure 62 Ability to Support Growth – New Connections



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 63 Ability to Support Growth – Enhanced Connections



Ability to Support Growth: Enhanced Connections Scenario

- TAZ with highest housing density (dwelling units per sq. mi.)
- Intersection Project
- Corridor Project
- Committed Project
- MPO Boundaries
- Bodies of Water
- Public Parklands
- Streets

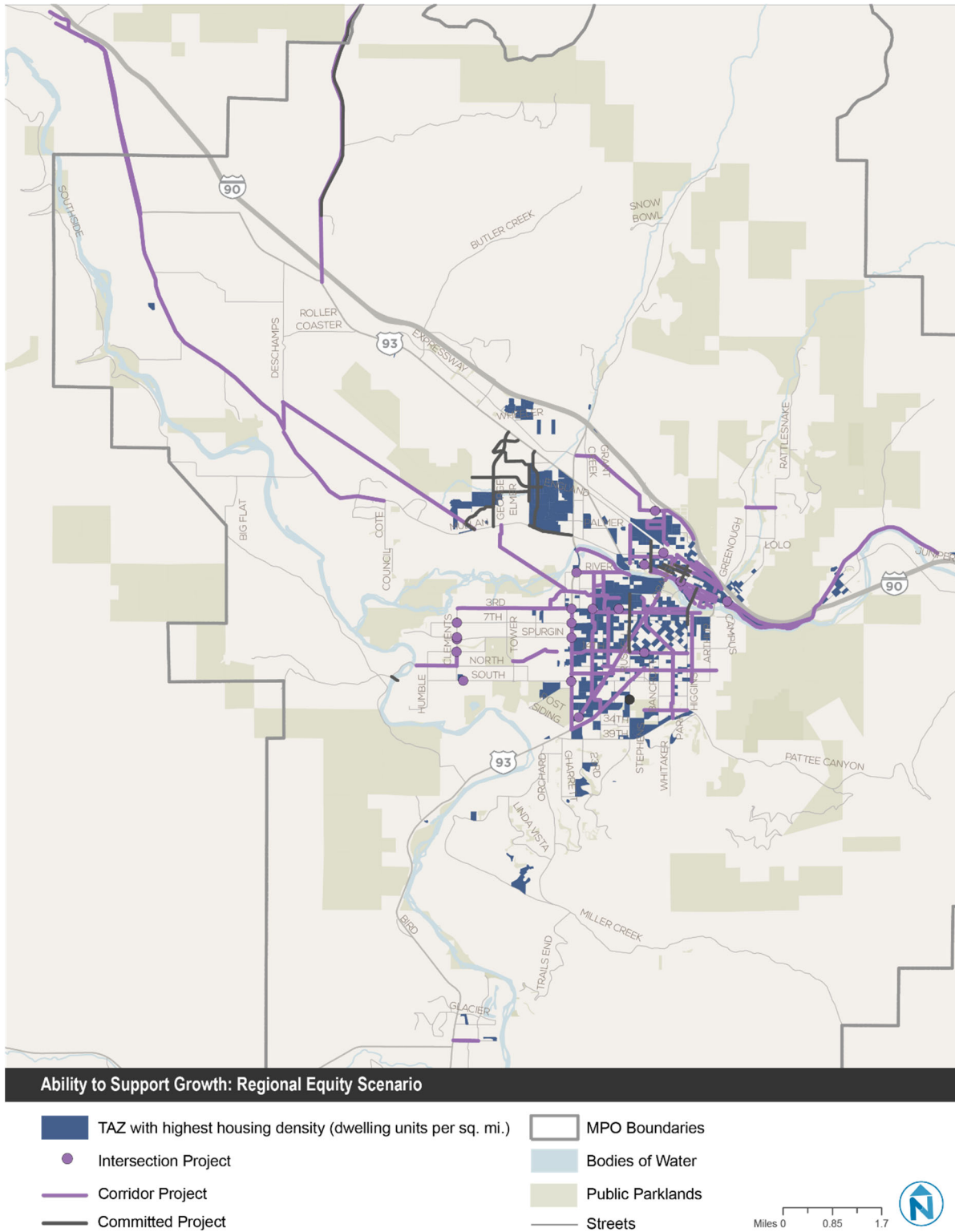
Miles 0 0.85 1.7



SUMMARY OF SCENARIO ANALYSIS FINDINGS

Missoula Connect

Figure 64 Ability to Support Growth – Regional Equity



GOOD REPAIR

Identifying projects that have the potential to bring existing infrastructure into a state of good repair supports the Missoula Connect goal of maintaining regional assets and investing strategically to make the best use of limited funds.

For this analysis, we identified the complete streets projects or projects that would involve repaving in each transportation network scenario and overlaid them with Pavement Condition Index (PCI) data covering non-State routes and roadways within the City of Missoula. This revealed the location and mileage of roadways in fair or poor condition that potentially could be improved by each transportation scenario. Intersection, bicycle and pedestrian bridge, off-street trail, and greenway projects were excluded, as those projects would not impact existing roadways or do not include project elements that would improve roadway maintenance conditions.

Table 12 shows the total mileage of roadways in fair or poor condition that could be improved by each scenario. In addition to these totals, up to 3 miles of roadway in fair or poor condition could be improved by committed projects. Key findings are as follows:

- Enhanced Connections includes the most projects with the potential to improve facilities with fair or poor pavement conditions.
- There are 6.1 miles of committed new roadway projects in each scenario that would be constructed, adding to future pavement preservation needs. The New Connections scenario increases this total to 9.6 miles with an additional 3.5 miles of new roadway projects.
- Regional Equity contains more projects off the roadway network, such as trail connections, and thus covers the fewest miles of roadway with facilities in fair or poor condition.

Table 12 Miles of Roadway Potentially Improved

Pavement Condition	Committed Projects	New Connections	Enhanced Connections	Regional Equity
Poor	2.2	9.6	9.9	8.3
Fair	0.8	7.4	10.8	6.2
Total (miles)	3.0	17.0	20.7	14.5

EQUITY

Connecting and strengthening the community to create a more equitable region is a core goal of Missoula Connect. More equitable transportation networks can increase affordability and lower household transportation costs, improve access to opportunities and services, reduce localized impacts from air pollution, and improve health outcomes for neighborhoods and people traditionally marginalized by planning decisions.

For this analysis, we calculated the density (persons or households per square mile) of the following populations:

- People with disabilities
- Youth (17 years and younger)
- Seniors (65 years and older)
- Non-English speaking households
- Zero-vehicle households
- People of color
- Households with median incomes that are at or below the federal poverty level at the block group level

From these socioeconomic factors, we created an index to identify the Census block groups with the highest prevalence of these populations. These “equity zones” were then overlayed with total person trips mapped at the TAZ level for each growth and transportation network scenario. In addition to mapping equity zones, Invest Health Neighborhoods, which focus on low-income neighborhoods and health equity, were also included as part of this analysis. Key findings are as follows:

- Areas that fall within equity zones when indexed for the socioeconomic factors above¹ include the western half of Downtown, Franklin to the Fort, Riverfront, Rose Park, Lewis and Clark, and the University District.
- The Enhanced Connections and Regional Equity networks result in a greater than 5% reduction in auto person trips in the equity zones under both growth scenarios.
- Regional Equity has the greatest potential to increase walking trips in the equity zones and Invest Health Neighborhoods in both growth scenarios, followed by Enhanced Connections.
- Enhanced Connections has the greatest potential to increase biking trips in the equity zones and Invest Health Neighborhoods in both growth scenarios, followed by Regional Equity.
- There are nearly twice as many biking trips and three times as many walking trips for TAZs within an equity zone compared to non-equity TAZs immediately adjacent to the equity zones under both growth scenarios.

Table 13 through Table 16 show the change in total person trips by mode from the base network for each transportation network scenario under Business as Usual and Strategic Growth.

¹ The index analysis assigned a score of 1 to 5 based on the density values of each socioeconomic characteristic, with a score of 5 representing the highest density. The sum of the scores for all socioeconomic characteristics determines the total score assigned to each TAZ. TAZs with the highest scores (determined using the Quantile function in GIS), are “equity zones.”

SUMMARY OF SCENARIO ANALYSIS FINDINGS
Missoula Connect

Table 13 Changes in Equity Zone Person Trips by Mode – Business as Usual 2050

Travel Mode	Base	New Connections	% Change from Base	Enhanced Connections	% Change from Base	Regional Equity	% Change from Base
Auto	39,538.34	38,537.90	-2.5%	37,162.90	-6.0%	37,236.89	-5.8%
Transit	6,807.83	6,377.13	-6.3%	6,418.86	-5.7%	6,376.21	-6.3%
Walk	22,902.88	23,797.38	3.9%	24,699.78	7.8%	24,938.45	8.9%
Bike	11,215.18	11,836.08	5.5%	12,486.05	11.3%	12,235.92	9.1%
Total	80,464.23	80,548.49	0.1%	80,767.59	0.4%	80,787.47	0.4%

Table 14 Changes in Equity Zone Person Trips by Mode – Strategic Growth 2050

Travel Mode	Base	New Connections	% Change from Base	Enhanced Connections	% Change from Base	Regional Equity	% Change from Base
Auto	41,364.39	40,312.85	-2.5%	38,906.09	-5.9%	39,043.75	-5.6%
Transit	6,938.95	6,498.79	-6.3%	6,539.11	-5.8%	6,497.85	-6.4%
Walk	24,081.81	25,023.00	3.9%	25,897.59	7.5%	26,119.43	8.5%
Bike	11,429.00	12,066.52	5.6%	12,785.64	11.9%	12,484.15	9.2%
Total	83,814.15	83,901.15	0.1%	84,128.43	0.4%	84,145.18	0.4%

Table 15 Changes in Invest Health Neighborhood Person Trips by Mode – Business as Usual 2050

Travel Mode	Base	New Connections	% Change from Base	Enhanced Connections	% Change from Base	Regional Equity	% Change from Base
Auto	72,832.00	72,049.45	-1.1%	70,071.58	-3.8%	70,531.93	-3.2%
Transit	5,485.55	5,119.14	-6.7%	5,178.45	-5.6%	5,118.29	-6.7%
Walk	11,179.51	11,607.16	3.8%	12,581.43	12.5%	12,900.05	15.4%
Bike	11,832.20	12,543.05	6.0%	13,487.71	14.0%	12,768.66	7.9%
Total	101,329.26	101,318.80	0.0%	101,319.17	0.0%	101,318.93	0.0%

Table 16 Changes in Invest Health Neighborhood Person Trips by Mode – Strategic Growth 2050

Travel Mode	Base	New Connections	% Change from Base	Enhanced Connections	% Change from Base	Regional Equity	% Change from Base
Auto	76,404.34	75,622.46	-1.0%	73,521.29	-3.8%	74,120.29	-3.0%
Transit	5,555.35	5,181.82	-6.7%	5,239.31	-5.7%	5,180.99	-6.7%
Walk	11,644.80	12,069.78	3.6%	13,043.80	12.0%	13,329.92	14.5%
Bike	12,093.04	12,823.00	6.0%	13,893.11	14.9%	13,066.11	8.0%
Total	105,697.53	105,697.06	0.0%	105,697.51	0.0%	105,697.31	0.0%

REGIONAL TRIP MAKING AND TRAVEL CONDITIONS

Following the initial runs of the MPO's regional travel demand model, the project team conducted additional post-processing in TransCAD to refine estimates of the impact that the growth and transportation scenarios could have on future travel behavior and regional trip making. By estimating how each scenario increases or decreases the number of trips made by mode from the base, we can better assess how the scenarios support the desired outcome of reducing the share of regional trips made by automobile and associated externalities like carbon emissions.

This analysis is based on mode choice models estimated from the American Community Survey (ACS) for work trip mode, and then extended to other trip types. We calculated non-auto mode choice based on equations for accessibility by mode. The accessibility equations are similar to the gravity models commonly used in travel demand models, in that destinations that can be reached more quickly are weighted more heavily than destinations further away, and there is no cut-off time.

Home-based work (HBW) trip mode share models were estimated using 2014-2018 5-year ACS data at the Census tract level. The coefficients from the HBW models were then adjusted to match the mode shares presented in the 2018 base year model summary report for other types of trips, such as Home-based school (HBS), Home-based university (HBU), Home-based other (HBO), Work-based other (WBO), and Other-based other (OBO).

Vehicle miles traveled (VMT) was estimated by running a script in TransCAD to calculate the average auto trip length by trip type and TAZ from the base model. Auto productions and attractions at each TAZ were compared between the base model and the post-processing model. TAZ-based VMT was then adjusted up or down in proportion to the difference in auto productions and attractions.

To estimate vehicle hours of delay (VHD), the post-processing model VMT was adjusted to the same range as the base model VMT using Strategic Growth as a reference scenario. Post-processing VHD was set to equal the base model VHD for Business as Usual. From this, a regression model was run to estimate VHD for each transportation network scenario. Because the Strategic Growth scenario has 2% more households within the MPO area than the Business as Usual scenario, VMT and VHD numbers for Strategic Growth were reduced by 2%.

Table 17 and Table 18 present the change from the base network for daily regional vehicle miles traveled, daily regional hours of congestion delay, and daily regional person trips by mode under the growth and transportation network scenarios as derived from the post-processing TransCAD analysis. Associated Level of Service (LOS) maps from the regional travel demand model (not the post-processing model) are provided in Figure 65 through Figure 72. Key findings are as follows:

- All three transportation scenarios are estimated to decrease regional VMT under both growth scenarios, with Enhanced Connections providing the highest reduction (1.8%) if development follows the Strategic Growth pattern.
- Enhanced Connections provides the greatest reduction in auto trips under both growth scenarios, reducing total auto mode share from 81.37% to 79.75% in the Strategic Growth scenario.
- Significant reductions in regional hours of congestion delay are achievable with the Regional Equity and Enhanced Connections scenarios, with Enhanced Connections providing a reduction of up to 21.7% under a Strategic Growth scenario.
- Regional Equity has the greatest potential to increase walking trips and mode share, whereas Enhanced Connections has the greatest potential to increase biking trips and mode share.

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- With the base network, the Strategic Growth scenario provides a 3.5% decrease in VMT and an increase in daily person trips for all modes but auto. This suggests that focusing future growth inward is an additional mechanism beyond transportation projects that can help decrease regional auto trips, congestion, and emissions.

Table 17 Regional Trip Making Summary – Business as Usual 2050

Daily Metric (MPO Level)	Base	New Connections	% Change from Base	Enhanced Connections	% Change from Base	Regional Equity	% Change from Base
VMT	3,351,389	3,344,599	-0.2%	3,308,304	-1.3%	3,313,143	-1.1%
VHD	16,817	16,481	-2.0%	14,681	-12.7%	14,921	-11.3%
Automobile – Person Trips	698,198	688,870	-1.3%	685,144	-1.9%	686,350	-1.7%
Transit – Person Trips	20,841	19,543	-6.2%	19,624	-5.8%	19,541	-6.2%
Walk – Person Trips	86,371	92,730	7.4%	93,060	7.7%	94,269	9.1%
Bike – Person Trips	44,416	48,682	9.6%	51,997	17.1%	49,666	11.8%
Automobile – Mode Share	82.16%	81.06%	-1.3%	80.62%	-1.9%	80.76%	-1.7%
Transit – Mode Share	2.45%	2.30%	-6.1%	2.31%	-5.7%	2.30%	-6.1%
Walk – Mode Share	10.16%	10.91%	7.4%	10.95%	7.8%	11.09%	9.2%
Bike – Mode Share	5.23%	5.73%	9.6%	6.12%	17.0%	5.84%	11.7%

Table 18 Regional Trip Making Summary – Strategic Growth 2050

Daily Metric (MPO Level)	Base	New Connections	% Change from Base	Enhanced Connections	% Change from Base	Regional Equity	% Change from Base
VMT	3,234,529	3,214,423	-0.6%	3,177,597	-1.8%	3,185,764	-1.5%
VHD	12,997	12,000	-7.7%	10,174	-21.7%	10,579	-18.6%
Automobile – Person Trips	692,680	683,209	-1.4%	678,898	-2.0%	680,868	-1.7%
Transit – Person Trips	21,175	19,848	-6.3%	19,924	-5.9%	19,846	-6.3%
Walk – Person Trips	91,837	98,373	7.1%	98,583	7.3%	99,712	8.6%
Bike – Person Trips	45,629	49,889	9.3%	53,914	18.2%	50,894	11.5%
Automobile – Mode Share	81.37%	80.25%	-1.1%	79.75%	-2.0%	79.98%	-1.7%
Transit – Mode Share	2.49%	2.33%	-0.2%	2.34%	-6.0%	2.33%	-6.4%
Walk – Mode Share	10.79%	11.56%	0.8%	11.58%	7.3%	11.71%	8.5%
Bike – Mode Share	5.36%	5.86%	9.3%	6.33%	18.1%	5.98%	11.6%

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Figure 65 Level of Service and Base Network – Business as Usual 2050

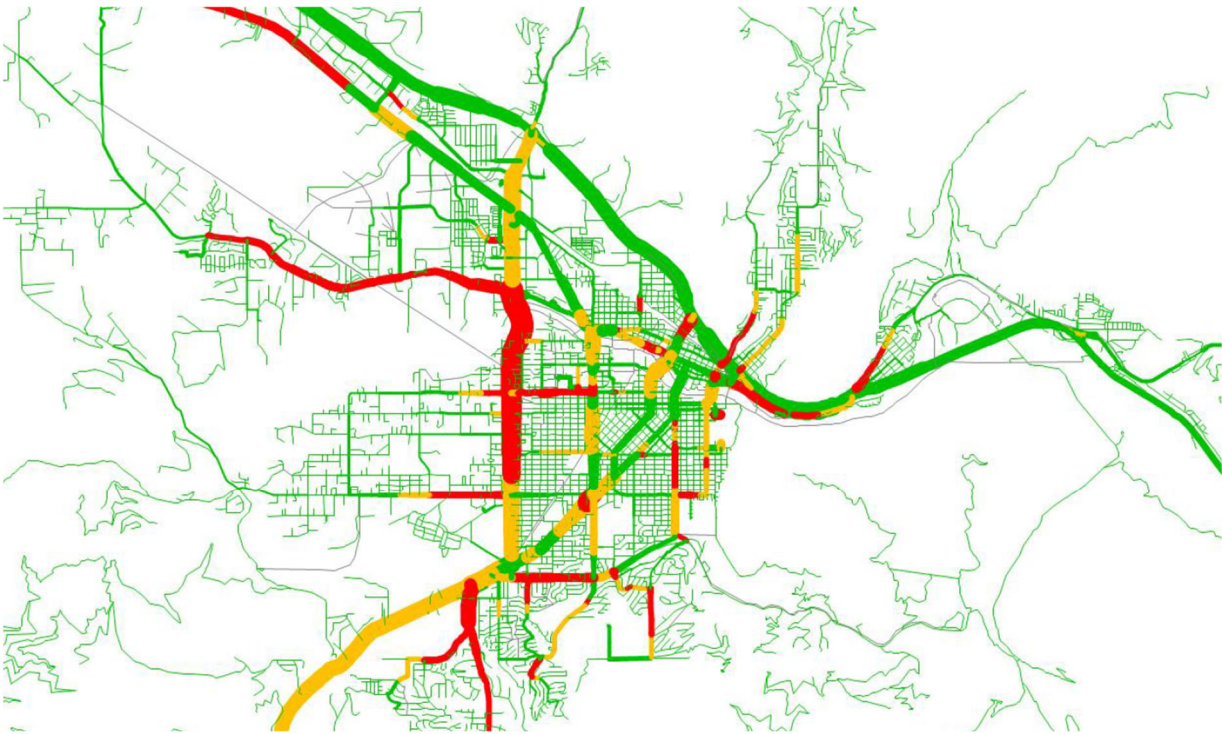
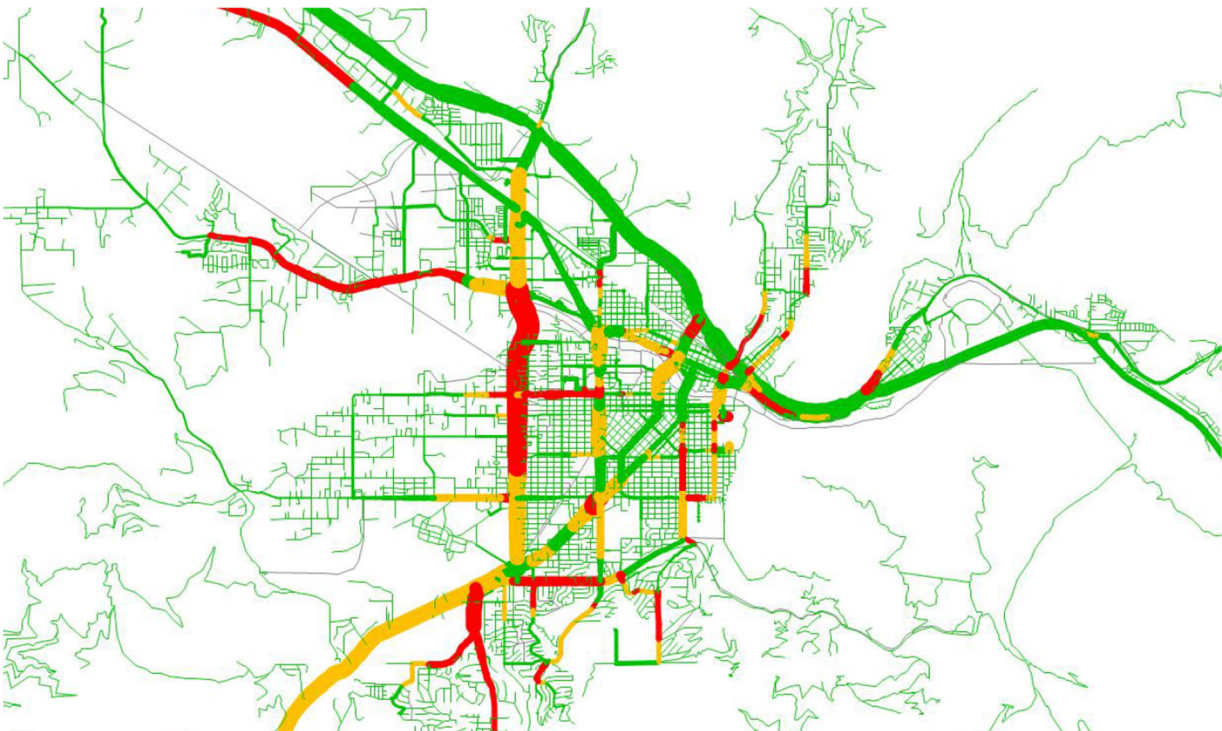
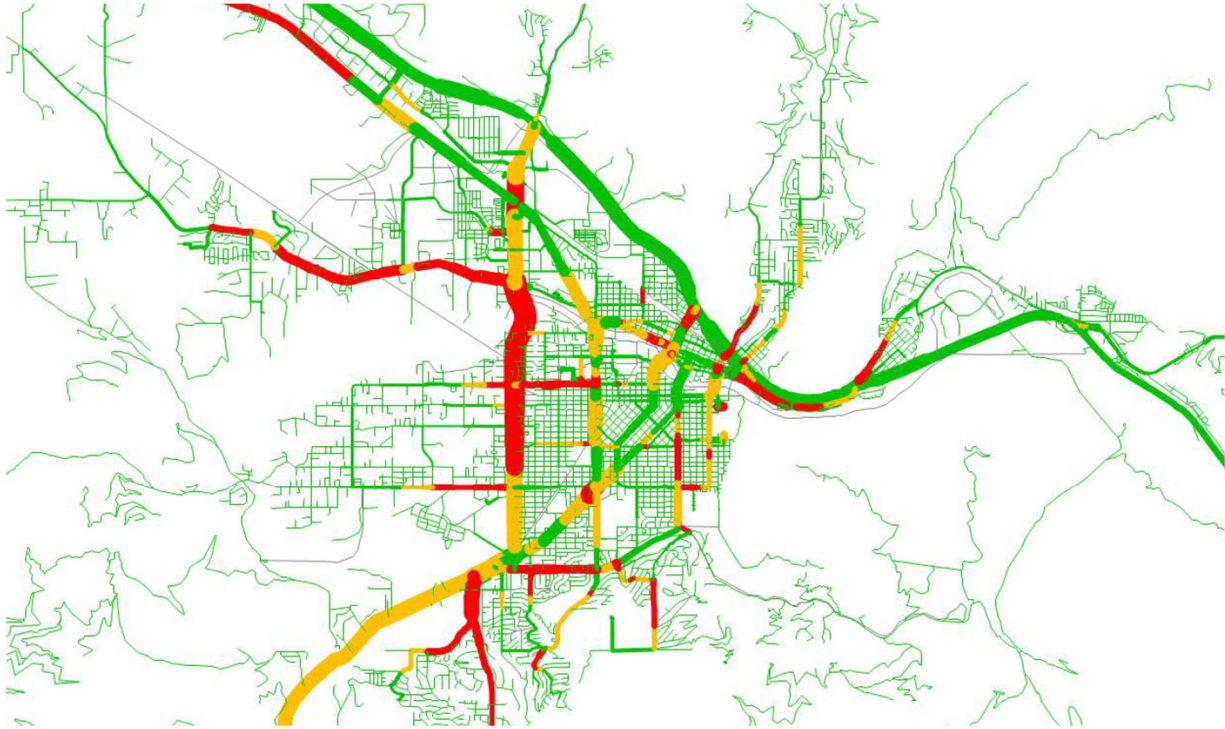


Figure 66 Level of Service and New Connections – Business as Usual 2050



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Figure 67 **Level of Service and Enhanced Connections – Business as Usual 2050**



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Figure 68 Level of Service and Regional Equity – Business as Usual 2050

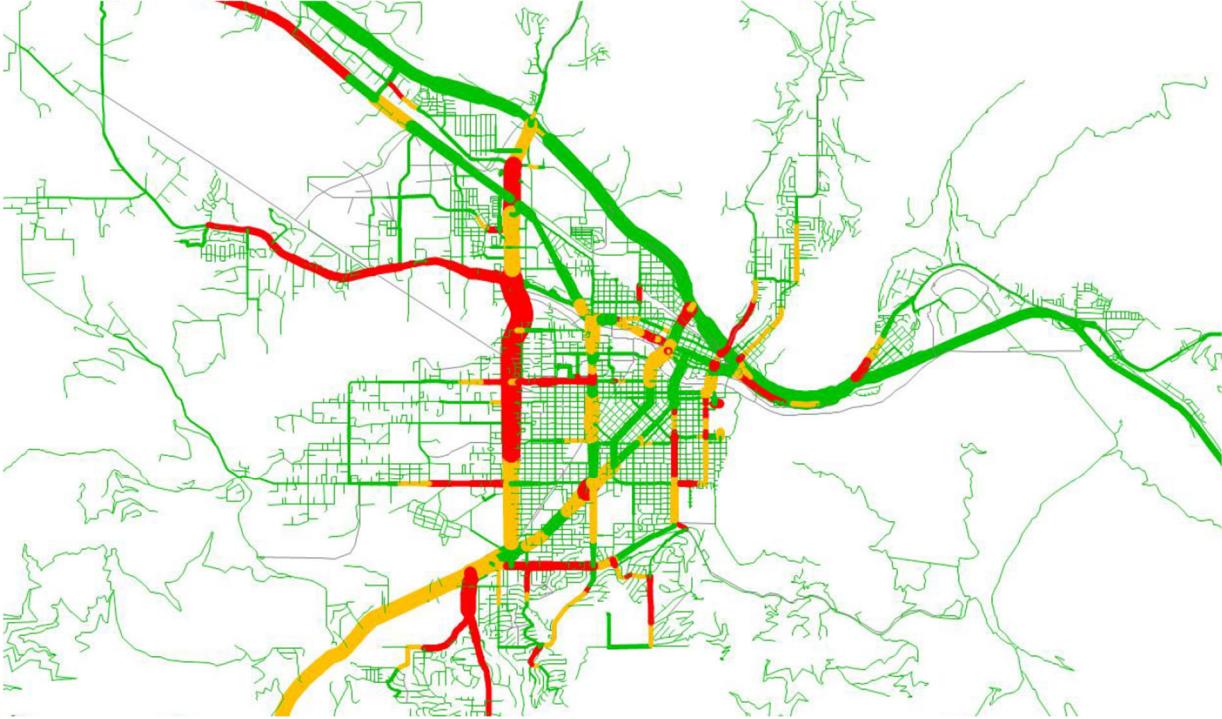
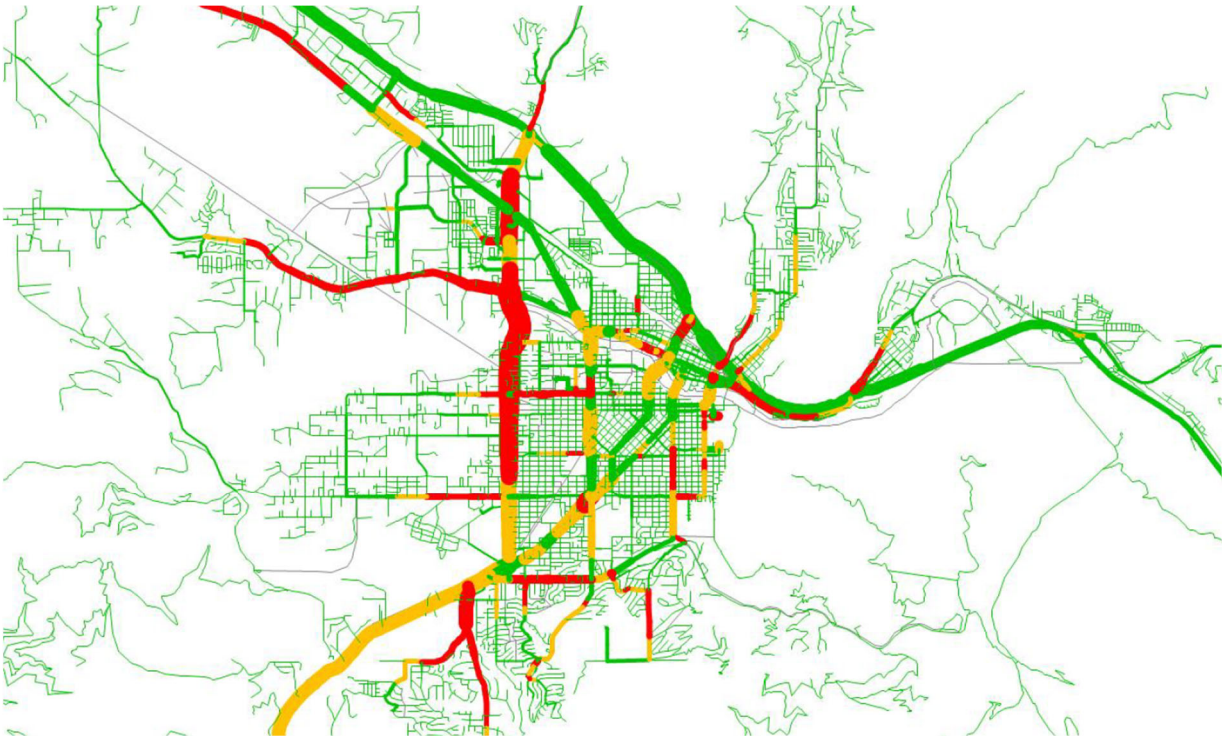


Figure 69 Level of Service and Base Network – Strategic Growth 2050



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Figure 70 **Level of Service and New Connections – Strategic Growth 2050**

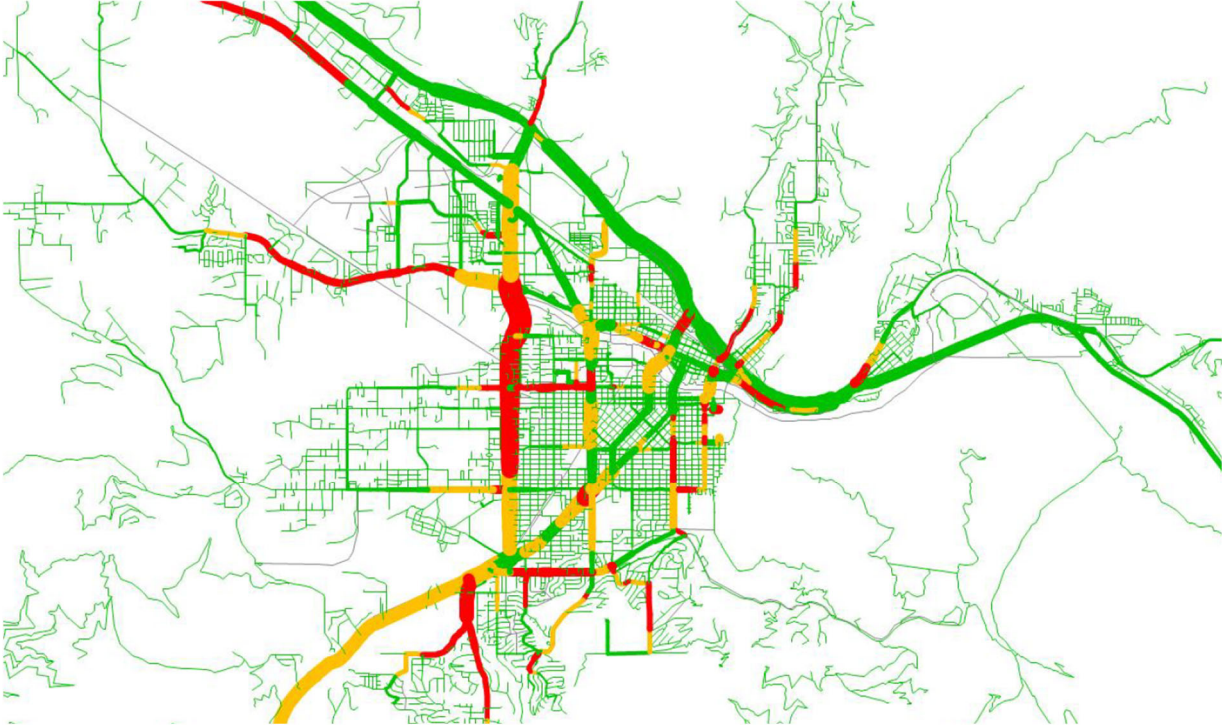
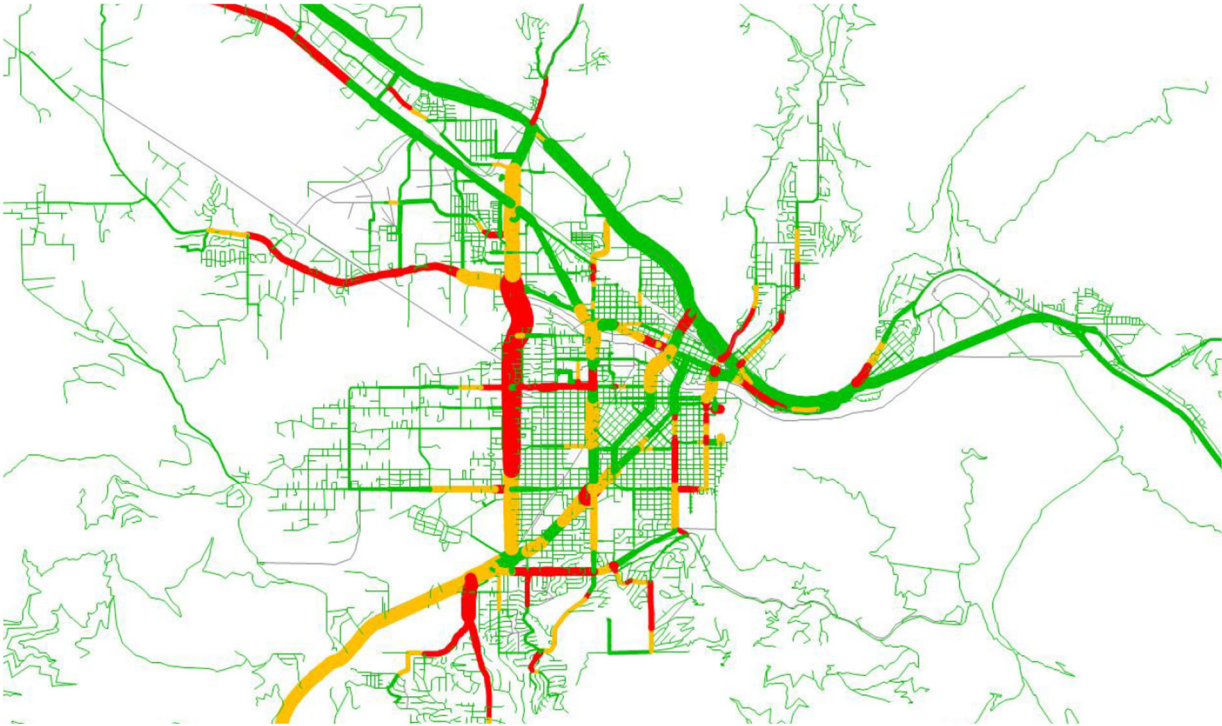
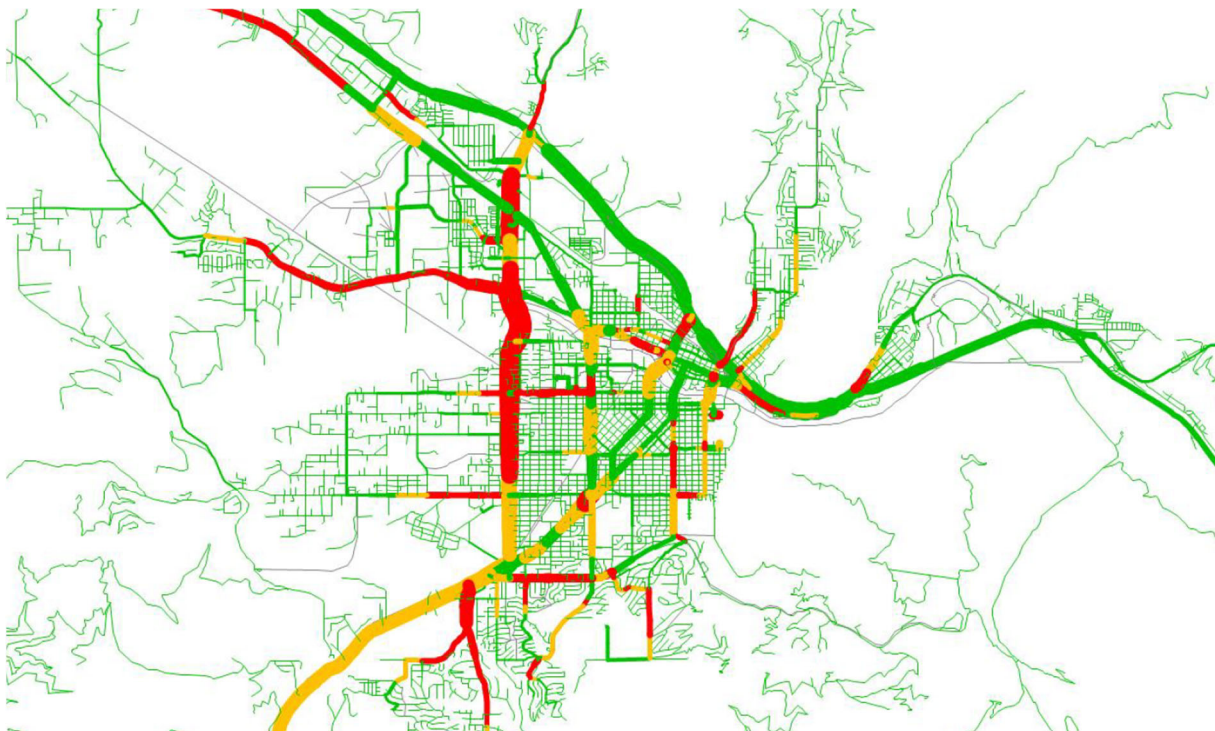


Figure 71 **Level of Service and Enhanced Connections – Strategic Growth 2050**



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Figure 72 **Level of Service and Regional Equity – Strategic Growth 2050**



CLIMATE

Advancing sustainability and addressing climate change are key goals for Missoula Connect. Reducing vehicle miles traveled (VMT) can reduce transportation-related greenhouse gas (GHG) emissions and advance the region toward the goal of carbon neutrality.

For this analysis, GHG emissions were calculated with the VMT numbers from model outputs, splitting VMT between congested and non-congested conditions. Journeys in congested conditions take more time, which increases the fuel used by the engine. To account for this, adjustment factors of 0.6 and 0.8 were applied to the fuel economy values for congestion on arterials and freeways, respectively.

Fuel economy (miles per gallon) also depends on the mix of vehicles on the road. Generally, larger and heavier vehicles will consume more fuel to travel a given mile. Since the summary outputs do not provide information on vehicle types, a split of 51% passenger cars and 49% light trucks was applied to the total VMT based on national projections from the U.S. Energy Information Administration (EIA).²

According to the EIA projections, the forecasted share of diesel vehicles by 2050 is less than 1% for the total fleet. This emissions assessment assumes that passenger cars and light trucks are powered by gasoline only. The EIA forecasts a fleet-wide fuel economy of 43.5 miles per gallon and 31.5 miles per gallon for passenger cars and light trucks, respectively.³ These are the values used in the assessment for non-congestion conditions.

The U.S. Environmental Protection Agency provides guidance on the factor emissions of mobile sources by fuel type. Gasoline has a factor emission of 8.78 kgCO₂/gallon, which is directly used in this assessment.⁴ Given the limited information on transit vehicles, this assessment does not include emissions from transit. However, their impact should be minor since this fleet accounts for a low share of the total vehicles.

The assessment does not make any assumptions regarding the electrification of passenger cars and light trucks. While this would affect the absolute emissions under each scenario (lower emissions), comparison across the scenarios is likely not affected if electrification rates are the same for all scenarios.

Estimated changes in CO₂ emissions for each scenario are shown in Table 19. Key findings are as follows:

- The New Connections transportation network scenario resulted in the greatest change from base network CO₂ emissions for both growth scenarios. This is likely a result of the greater amount of new roadway projects in the scenario reducing travel delay.
- The 1.1% difference between Business as Usual and Strategic Growth emissions in the base network indicates that land use policy may have a greater potential to reduce emissions than some transportation scenarios due to its ability to reduce VMT.

² Light-Duty Vehicle Stock by Technology Type. EIA Annual Energy Outlook 2020.
https://www.eia.gov/outlooks/aeo/supplement/excel/suptab_40.xlsx

³ Light-Duty Vehicle Miles per Gallon by Technology Type. EIA Annual Energy Outlook 2020.
https://www.eia.gov/outlooks/aeo/supplement/excel/suptab_40.xlsx

⁴ Emission Factors for Greenhouse Gas Inventories. U.S. EPA. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

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Table 19 Changes in Emissions (Tons of CO2)

Growth Scenario	Base	New Connections	% Change from Base	Enhanced Connections	%Change from Base	Regional Equity	%Change from Base
Business as Usual	816.5	802.6	-1.7%	816.2	0.0%	811.2	-0.7%
Strategic Growth	807.4	796.4	-1.4%	811.9	+0.6%	802.7	-0.6%