South North Transit Corridor Study

Downtown Portland

South Entry Station Access Study

Final Draft Report

October 7, 1997

Downtown Portland South Entry Station Access Study
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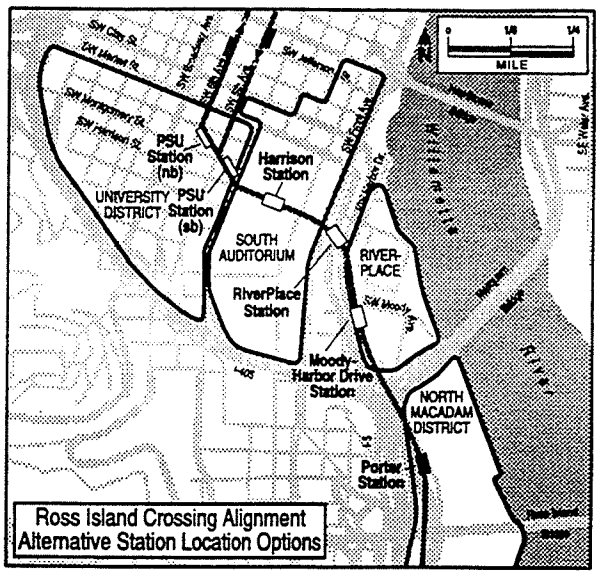
Study Summary

South Entry Station Access Study Summary

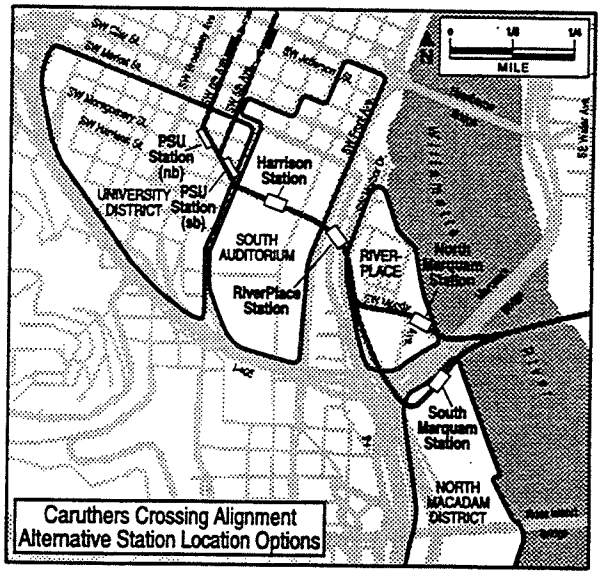
The purpose of this Station Access Study is to inform decisions about proposed LRT station locations within the South Entry portion of the South/North LRT Corridor. The South Entry study area encompasses parts of the North Macadam District, RiverPlace, South Auditorium, and Portland State University. The study evaluates six possible station sites and nine combinations of station sites using criteria adopted by the Downtown Oversight Committee.



Station Sites in the South Entry to Downtown Portland

Six station sites were studied which are located along three different alignment alternatives being studied in the DEIS. The alignments alternatives, illustrated by the adjacent maps, are:

- Ross Island Crossing Alternative
- Caruthers Crossing Alternative with the North Marquam Design Option
- Caruthers Crossing Alternative with the South Marquam Design Option



Study Summary (cont.)

A. Evaluation of Station Sites

Six station locations were evaluated independently using the following qualitative criteria:

- pedestrian access
- property impacts
- potential integration with development
- intermodal connections (between LRT, bus, car)
- vehicular access and circulation.

Table S.1 Evaluation of South Entry Station Sites

Note: The fuller the circle, the more the criteria is met.

	Pedestrian Access	Property Impacts	Integrate Development	Intermodal Connections	Vehicular Access
PSU Station	●	◑	●	●	◑
Harrison Street Station	◕	◑	●	◑	●
Riverplace (Elevated) Station	◔	●	◑	◔	●
Moody-Harbor Drive Station	◑	◕	◑	◕	●
North Marquam	●	◔	◕	◑	◑
South Marquam	◑	◑	◑	◔	●

Study Summary (cont.)

B. Evaluation of Station Combination Options

Nine combinations of station sites in the South Entry area were evaluated using the following quantitative criteria:

- access to jobs within a 5 minute walk of a LRT Station
- access to housing units within a 5 minute walk of a LRT Station
- overall travel time
- ridership
- capital costs

The nine station combination options, which are listed below in Table S.2., includes three options from the DEIS, and six additional options developed during the South Entry Station Access Study.

Table S.2 Station Combination Options

Station Combination Option	Alignment Alternative	Stations
1 (DEIS)	Ross Island	Riverplace, PSU
2	Ross Island	Moody-Harbor Drive, PSU
3	Ross Island	Harrison St., Moody-Harbor Drive, PSU
4 (DEIS)	Caruthers-North Marquam (Moody)	North Marquam, PSU
5	Caruthers-North Marquam (Moody)	North Marquam, Riverplace, PSU
6	Caruthers-North Marquam (Moody)	North Marquam, Harrison St., PSU
7 (DEIS)	Caruthers-South Marquam	South Marquam, PSU
8	Caruthers-South Marquam	South Marquam, Riverplace, PSU
9	Caruthers-South Marquam	South Marquam, Harrison St., PSU

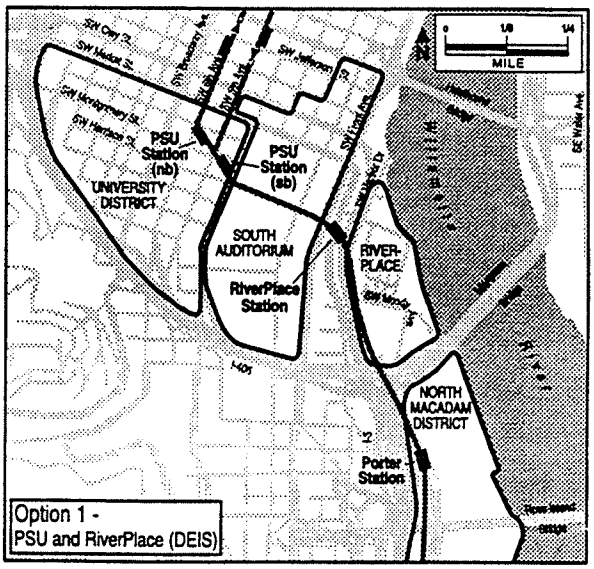
Study Summary (cont.)

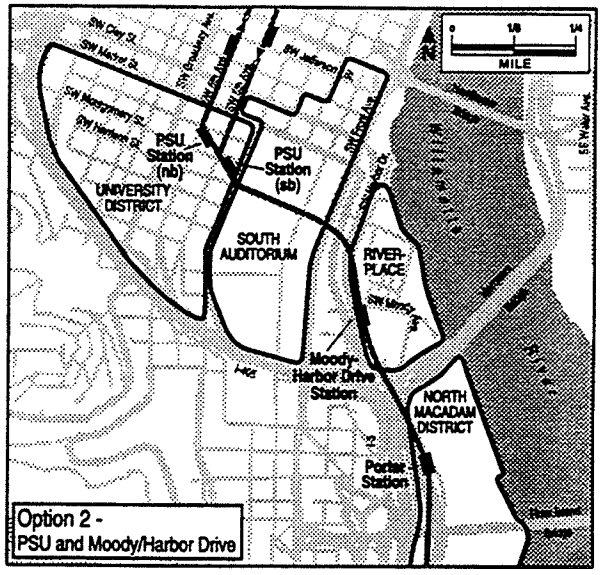
C. Evaluation of Station Combination Options using the Ross Island Crossing Alternative (Options 1,2,3):

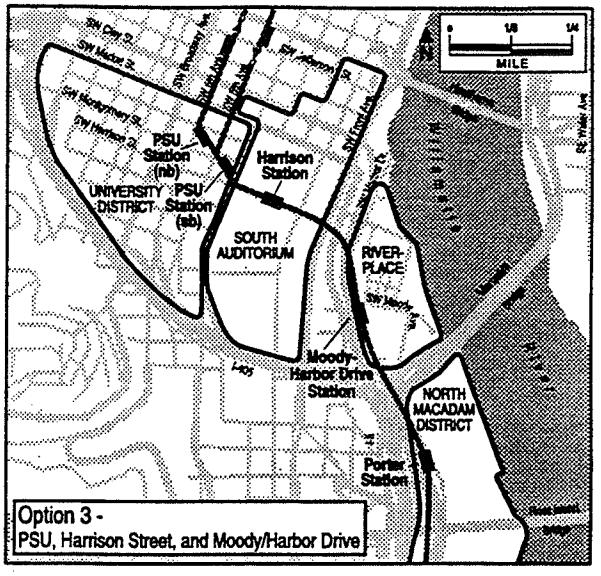
- The DEIS option (Option 1), which proposes an elevated RiverPlace Station above Harbor Drive, is projected in 2015 to provide access to 17,700 jobs and 2200 housing units within a 5-minute walk of the RiverPlace Station and to produce 4350 daily riders.

- Moving the RiverPlace Station from its elevated location above Harbor Drive to an at-grade location at Moody Street and Harbor Drive (Option 2), potentially reduces access to jobs (-2600 jobs), increases access to housing units (+300 units), reduces daily ridership (-450 riders) and reduces costs (-$0.6m) over the DEIS option.

- Adding a station at Harrison Street in addition to a station at Moody Street and Harbor Drive (Option 3), potentially increases access to jobs (+2700 jobs), increases access to housing units (+800), adds 24 seconds to travel time, increases daily ridership (+600 riders), and increases costs (+$1.5m) over the DEIS option.







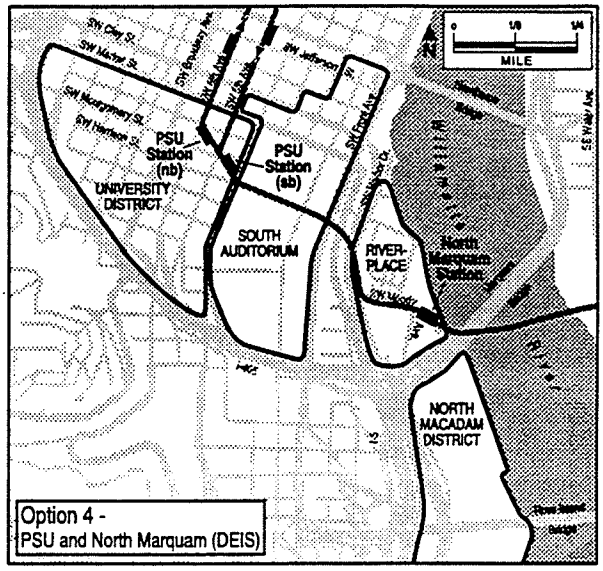
Study Summary (cont.)

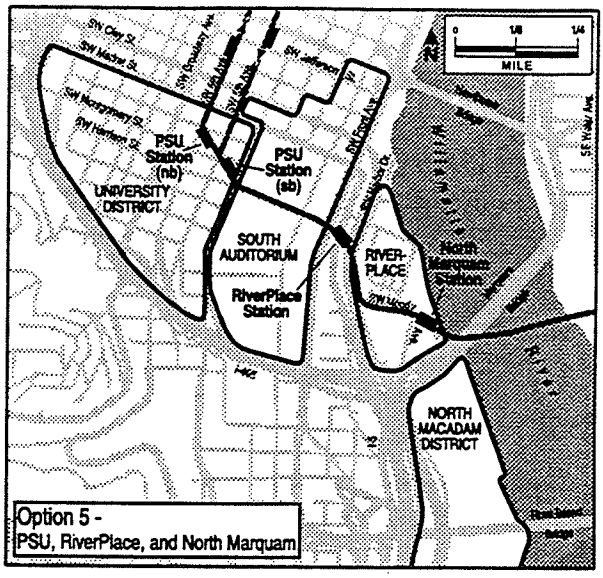
D. Evaluation of Station Combination Options using the Caruthers Crossing Alternative-Moody Option (Options 4,5,6)

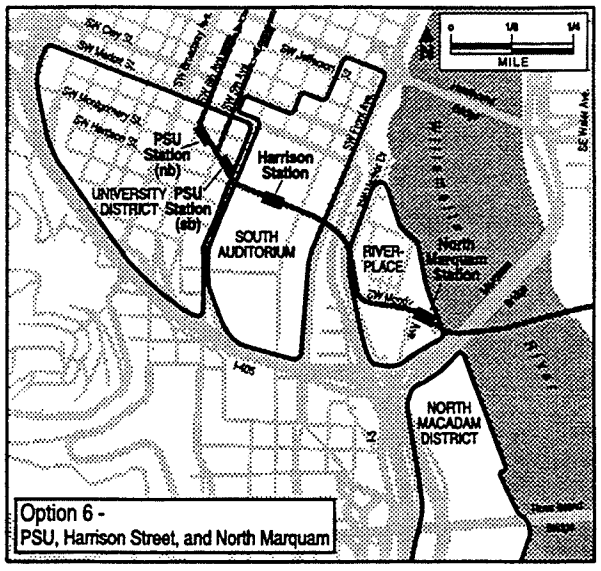
- The DEIS option (Option 4), which proposes an at-grade station on Moody St. (North Marquam Station), is projected in 2015 to provide access to 15,700 jobs and 2700 housing units within a 5-minute walk of the station and to produce 4100 daily riders.

- Adding the elevated RiverPlace Station, in addition to the North Marquam Station (Option 5), potentially increase access to jobs (+5000 jobs), increases access to housing units (+500), adds 32 seconds to travel time, increases daily ridership (1000 riders) and increases costs (+$3.3m).

- Adding the Harrison Street Station, in addition to the North Marquam Station, potentially increase access to jobs (+5300 jobs), increases access to housing units (+500), adds 29 seconds to travel time, and increases daily ridership (1050 riders) and increases costs (+$2.1m).







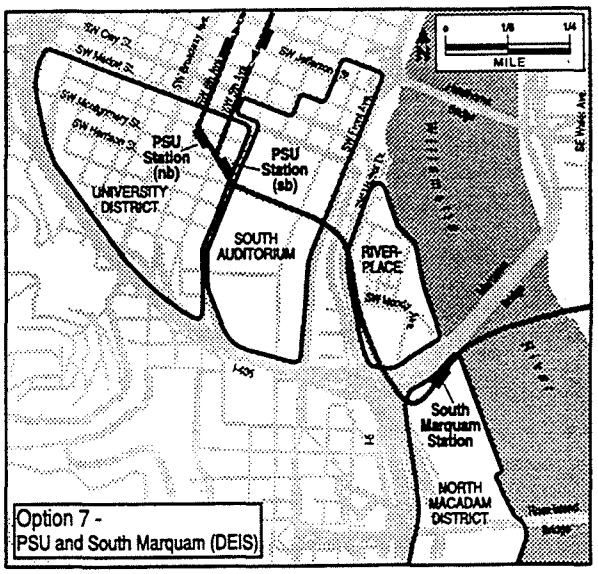
Study Summary (cont.)

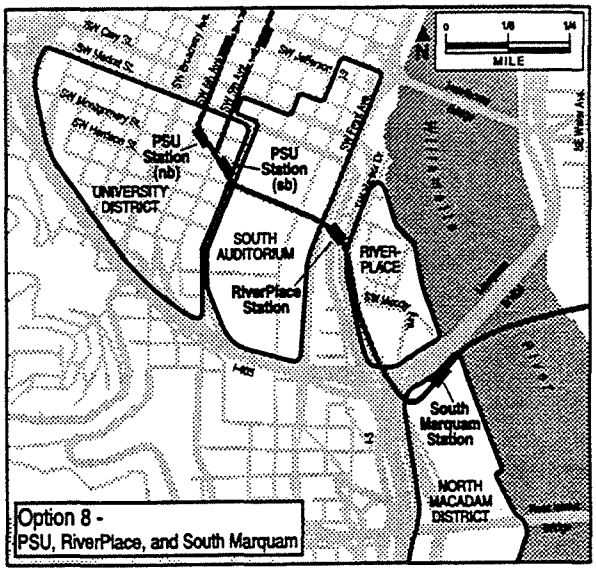
E. Evaluation of Station Combination Options using the Caruthers Crossing Alternative via South Marquam Station (Options 7,8,9)

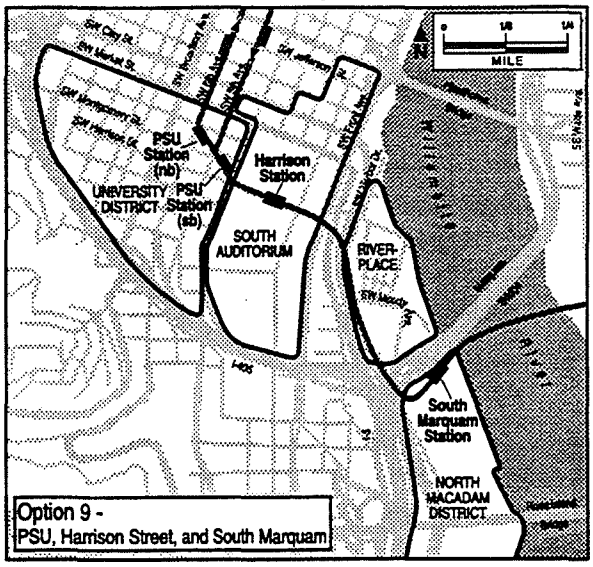
- The DEIS option (Option 7), which proposes an elevated station under the Marquam Bridge (North Marquam Station), is projected in 2015 to provide access to 17,100 jobs and 2600 housing units within a 5-minute walk of the station and to produce 4350 daily riders.

- Adding the elevated RiverPlace Station, in addition to the South Marquam Station, potentially increase access to jobs (+5100 jobs), increases access to housing units (+700), adds 34 seconds to travel time, increases daily ridership (1050 riders) and increases costs (+$3.5m).

- Adding the Harrison Street Station, in addition to the North Marquam Station, potentially increase access to jobs (+5300 jobs), increases access to housing units (+500), adds 29 seconds to travel time, increases daily ridership (1050 riders) and increases costs (+$2.1m).







1. Introduction

1.1 Origin of Study

The South Entry Station Access Study originated as a recommendation of the Downtown Portland Tier I Report, adopted by Metro Council in December, 1995. The report stated that "possible access to South/North light rail for residents and workers in the South Auditorium area and RiverPlace/South Waterfront would be studied further during the EIS process". The study began in early 1996.

The original scope of the study focused on the access needs of the South Auditorium area and RiverPlace with particular attention to whether an additional station on Harrison Street was warranted. As part of the cost cutting measures developed following the November 1996 election, additional station site options were added to the Caruthers Crossing Alternative (as a result of a lowered river crossing) with potential to serve RiverPlace and the North Macadam District. The scope of the Station Access was expanded to include these new Caruthers station. The expanded study scope now considers station location options designed to serve residents, workers and visitors of the University District (PSU), South Auditorium, RiverPlace, and the North Macadam district.

1.2 Study Purpose

The purpose of the South Entry Station Access Study has, however, remained unchanged: to develop information to help inform decisions on the optimal locations of station sites. The report does not present recommendation or conclusions. It does however, evaluate and compare options to assist in the reader in reaching their own conclusions.

1.3 Study Participants

A sub-TAC to the South/North Downtown TAC was formed to guide the South Entry Station Access Study including preparation of study elements. Those people as study contributors are gratefully acknowledged below:

***Michael Fisher, Tri-Met**, Station Access Study Co-Project Manager, report preparation.*
***John Cullerton, Metro**, Station Access Study Co-Project Manager, ridership analysis.*
***Sharon Kelly, Metro**, EIS coordination.*
***Steve Iwata, PDOT**, policy analysis.*
***Heather Coleman, PDOT**, 2015 population and employment data.*
***Mike Eidlin, Tri-Met**, station and track engineering.*
***Jennifer Ryan, Tri-Met**, station and track engineering, capital cost analysis,*

***Ben Hufford, ZGF**, walk isochrons and station concept graphics*
***Charles Kelley, ZGF**, walk isochrons and station concept graphics*

1.4 Study Approach

Using criteria adopted by the Downtown Oversight Committee (DOC), the study followed a two step approach:

- First, individual station sites were evaluated using qualitative criteria from the DOC list. These criteria included: impacts to property, pedestrian access to the station, potential to integrate the station with existing or future development, and impact to vehicular access and circulation. This part of the study was only focused on the suitability of a given site as a possible location for a LRT station.

- Second, various combinations of station sites were evaluated using the quantitative criteria from the DOC list. These criteria included: access to future jobs and housing units within a 5 minute walk of a LRT station, changes to travel time, increases or decreases in ridership, and capital costs. Three station combination options found in the DEIS were compared to six new station combination options identified through the study.

2. Evaluation of Station Sites

2.1 DEIS Alignment Alternatives Studied

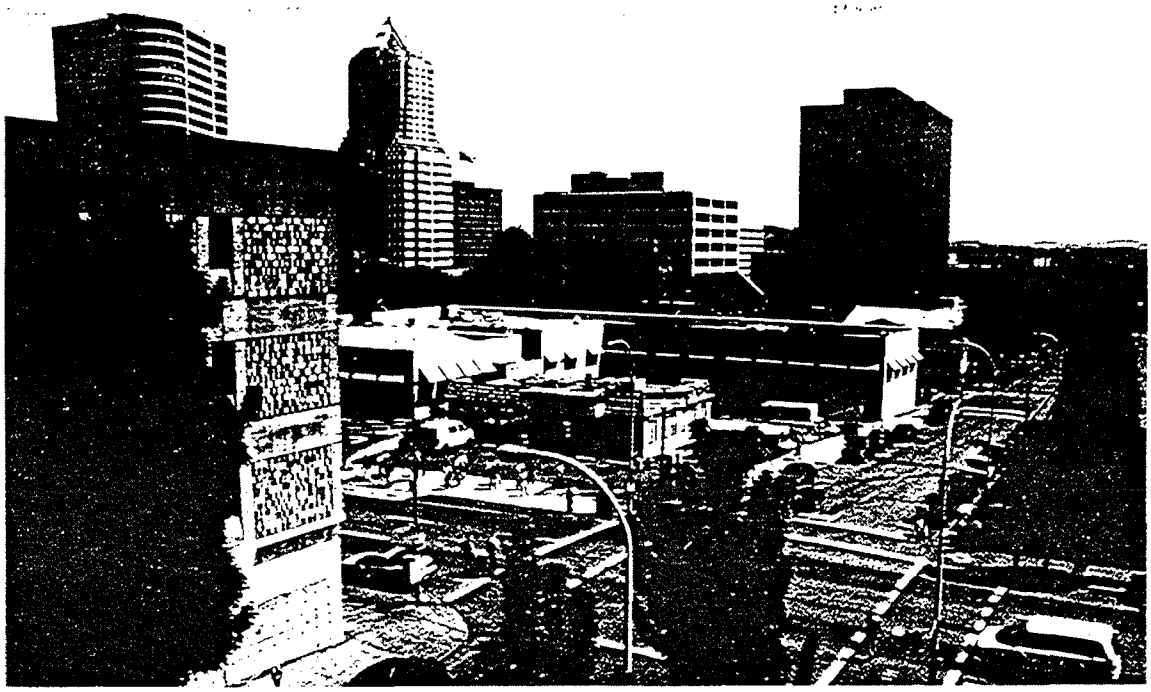
There are three alignment choices in DEIS for the South Entry portion of the South/North LRT Corridor:

- Ross Island Crossing Alignment Alternative, which generally follows an alignment along the west side of Moody Ave., crosses above Harbor Drive near the RiverPlace Athletic Club, and heads west toward PSU via Harrison Street.
- Caruthers Crossing Alignment Alternative via the North Marquam Station, which crosses the river at OMSI, lands on the west bank of the river at an at-grade station in front of the PGT Building, heads west on Moody Ave., crosses above Harbor Drive on a structure, and then heads west toward PSU via Harrison Street.
- Caruthers Crossing Alignment Alternative via the South Marquam Station, which crosses the river at OMSI, lands at an elevated station on the west side of the river just south of the Marquam Bridge, heads west to Harbor Drive, then crosses above Harbor Drive on a structure, and then heads west toward PSU via Harrison Street.

2.2 Alternative Station Sites

Six different station sites are located within the three alignment alternatives described above. The station sites studied include:

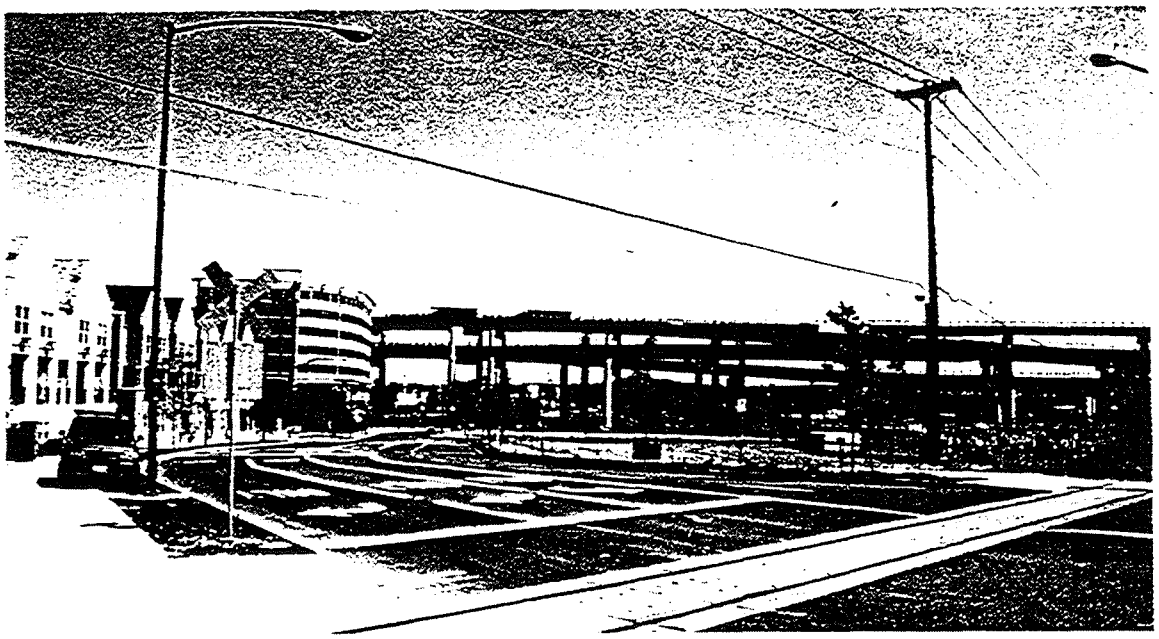
- PSU Station (in DEIS)
- Harrison Street Station
- RiverPlace Elevated Station (in DEIS)
- Moody-Harbor Drive Station
- North Marquam Station (in DEIS)
- South Marquam Station (in DEIS)



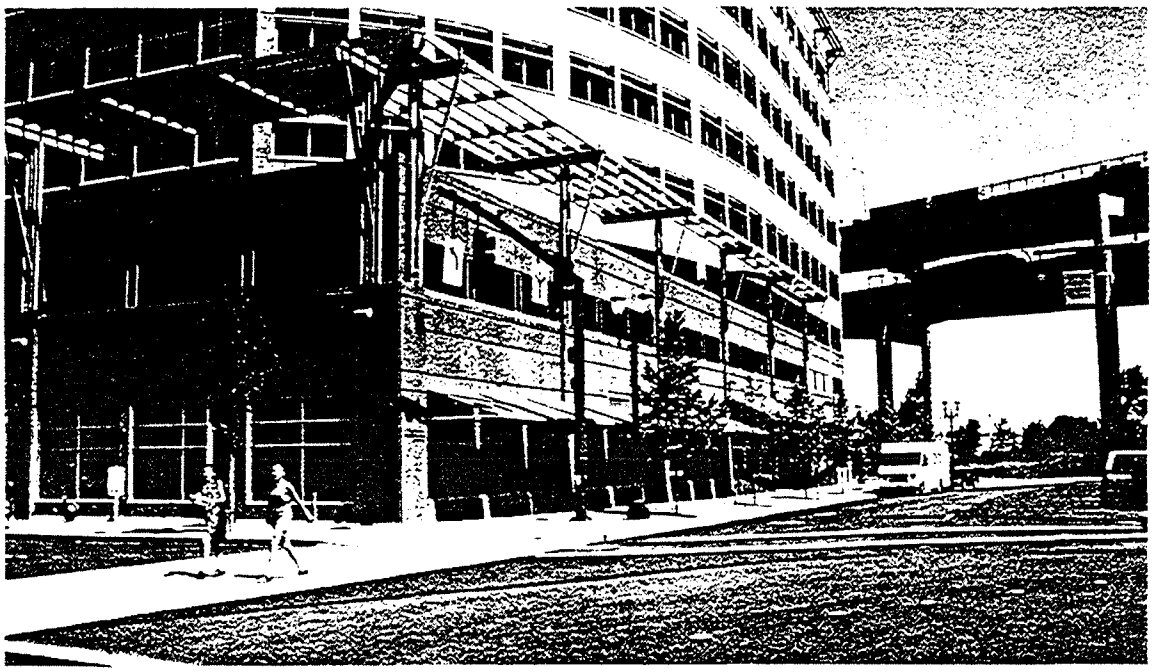
View of the site of the PSU Urban Center and proposed **PSU Station**. Montgomery Street would be closed to form a major public space. The northbound South/North LRT platform would extend diagonally across the block with direct pedestrian access to the plaza.

View of Harrison Street and site of the proposed **Harrison Street Station**. The platform would occur in the center median between the existing walkways which traverse the South Auditorium area.

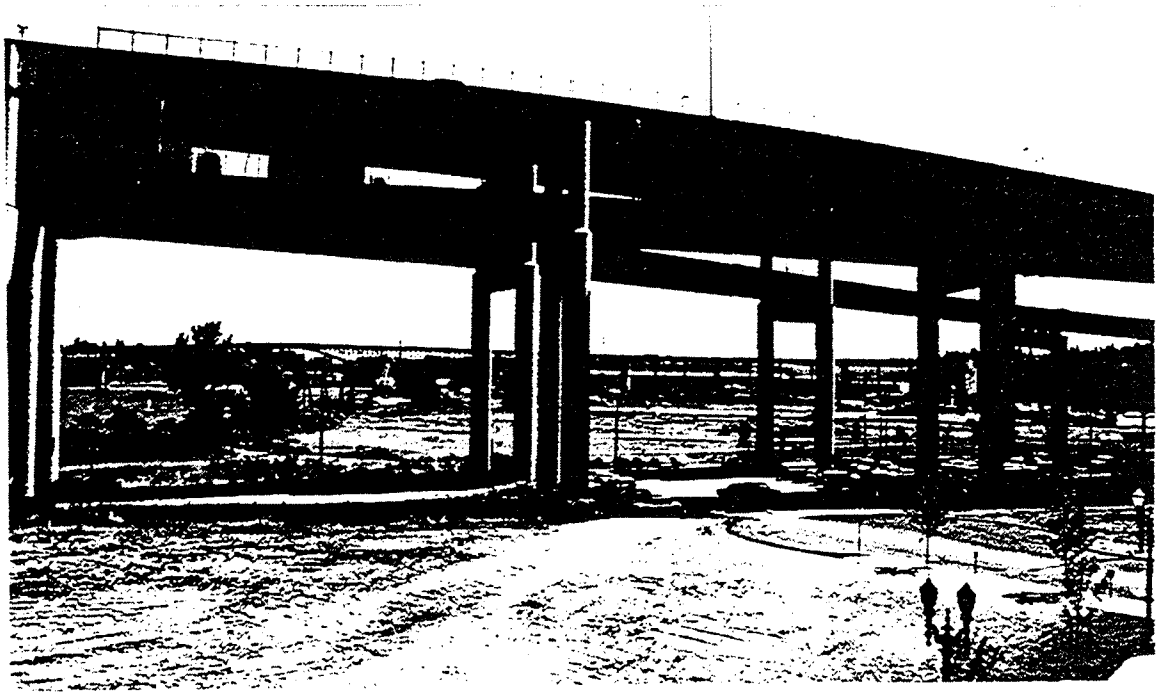
The elevated **RiverPlace Station** is proposed above Harbor Drive. In this view looking north, the station would occur above the four lanes of Harbor Drive.



View of the **Moody-Harbor Drive Station** site looking southeast. The end of station platform would occur at a spot about where the telephone pole exists in the right half of the picture.



The **North Marquam Station** is proposed in front of the PGT Building. The entrance to the PGT building would remain in its present location and would face the northbound LRT platform.



The **South Marquam Station** is proposed on the south side of the Marquam Bridge. In this view looking south, the station would occur on the far side of the bridge columns and could be integrated with a mixed use development proposed by Schnitzer Properties.

2.3 Station Site Evaluation Criteria

The above station locations were evaluated independently using the following qualitative criteria:

- pedestrian access
- property impacts
- potential integration with development
- intermodal connections (between LRT, bus, car)
- vehicular access and circulation.

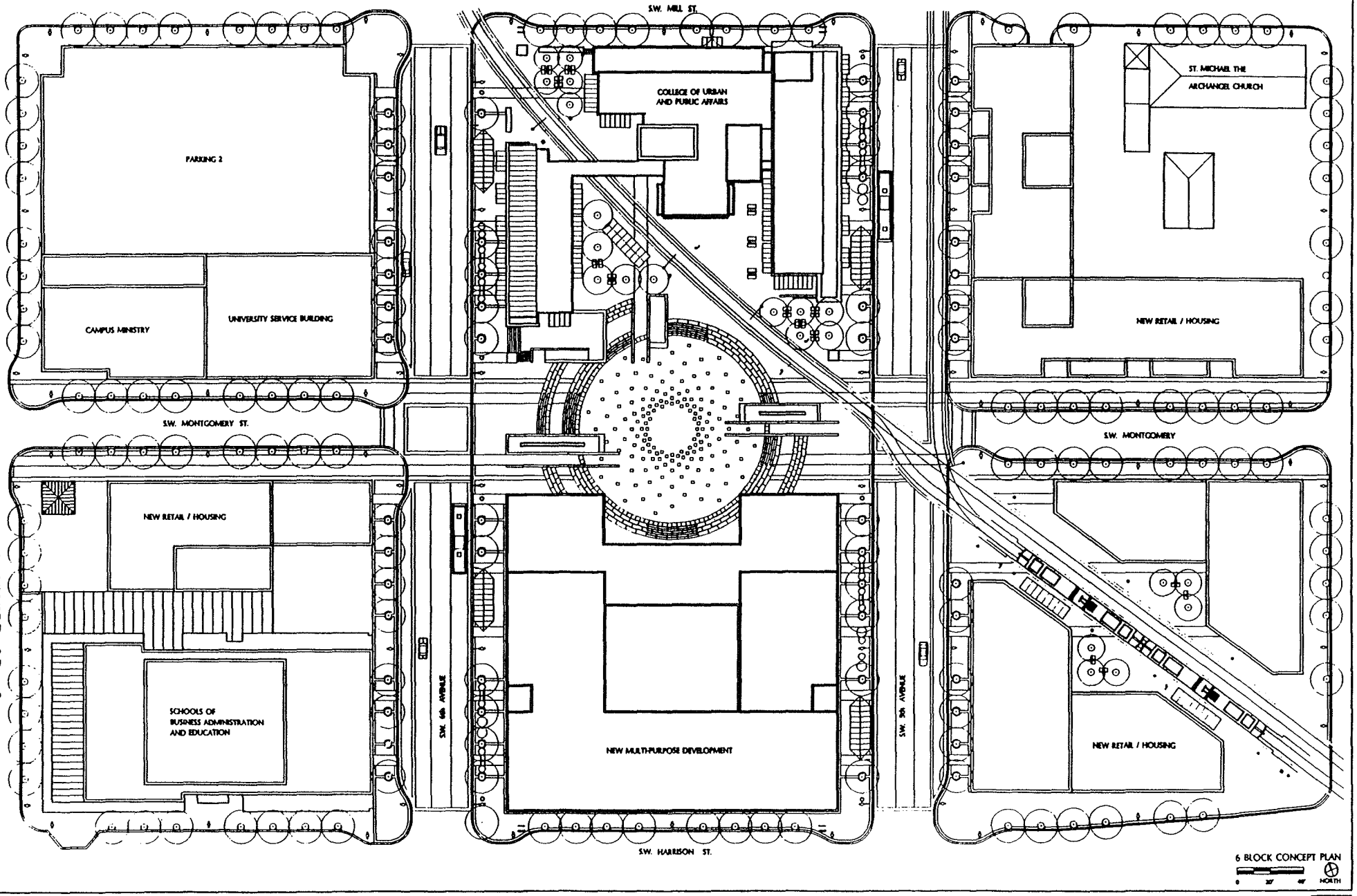
In the following section each station site is described, illustrated with a concept drawing, and evaluated using the above criteria. The section concludes with a table summarizing the evaluation of all six station sites.

2.4 PSU Station

The proposed PSU Station is designed to primarily serve the University District, an area bounded by I-405, Fourth Avenue, and Market Street. Portland State University is the main focus of activity within the University District. The station site would also serve the South Auditorium area, which adjoins the University District to the east.

2.4.1 Description of PSU Station

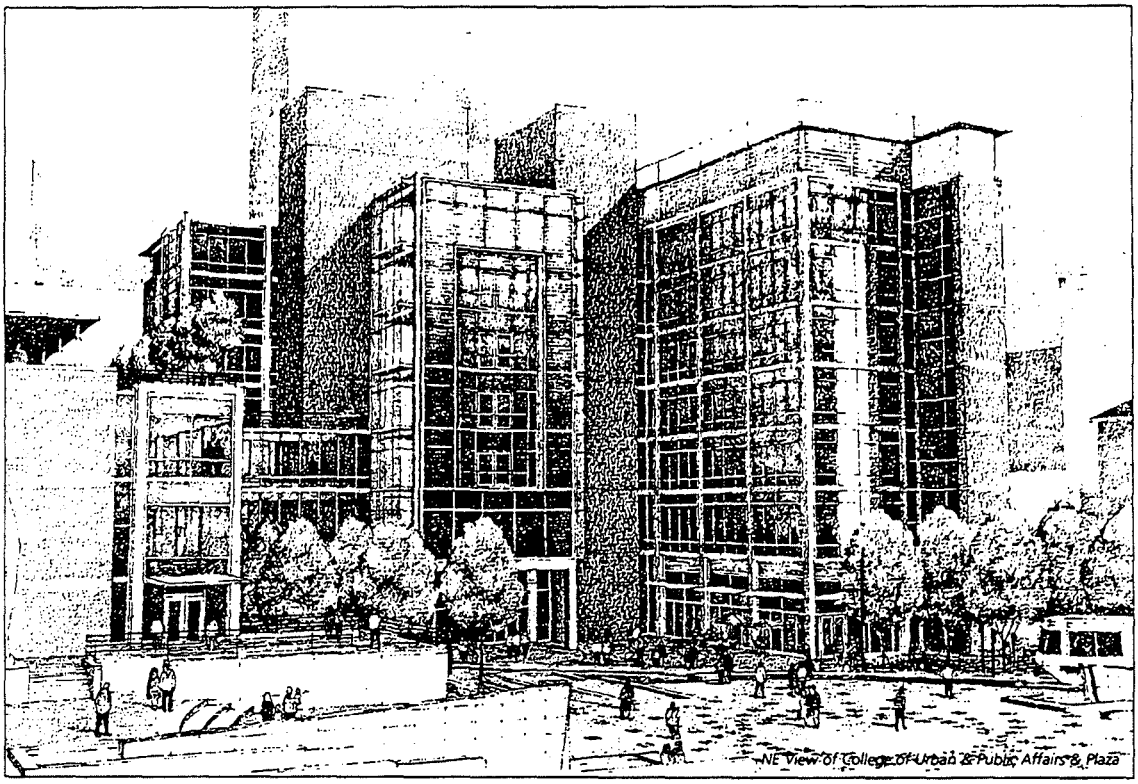
- The proposed PSU LRT Station is an integral part of the Urban Center Master Plan proposed by PSU. The plan proposes a mix of institutional, residential, retail and commercial uses within a six block area of the University District. The goal of Urban Center Plan is to create a vibrant urban place which functions as a gateway to Downtown Portland and an identifiable front door to PSU.
- The focal point of the Urban Center Master Plan is a major public plaza. Facing the plaza is the proposed College of Urban and Public Affairs.
- Montgomery Street is closed to vehicular traffic to create a plaza and to reinforce Montgomery Street as a major east-west pedestrian street linking PSU to the South Auditorium area and the river.
- The proposed northbound LRT station is located at the north edge of the plaza on a diagonal. Doors to trains could open to platforms on both sides allowing direct access to either the plaza or the College of Urban and Public Affairs.
- Shelter for northbound passengers is provided by an entry porch to the College of Urban and Public Affairs building and by a transit shelter on the south side of the tracks.
- The southbound platform is located on a diagonal within the block between Fifth and Fourth Avenue which is proposed by PSU as a future site for housing and ground floor commercial use.
- Shelter for southbound passengers is provided by shelters located on the south side of the tracks.
- A track crossover on Fifth Avenue allows southbound trains to be turned back at the PSU Station or facilitates the temporary operation on the Mall with a single track.



PORTLAND STATE UNIVERSITY
COLLEGE OF URBAN & PUBLIC AFFAIRS

URBAN CENTER PROJECT

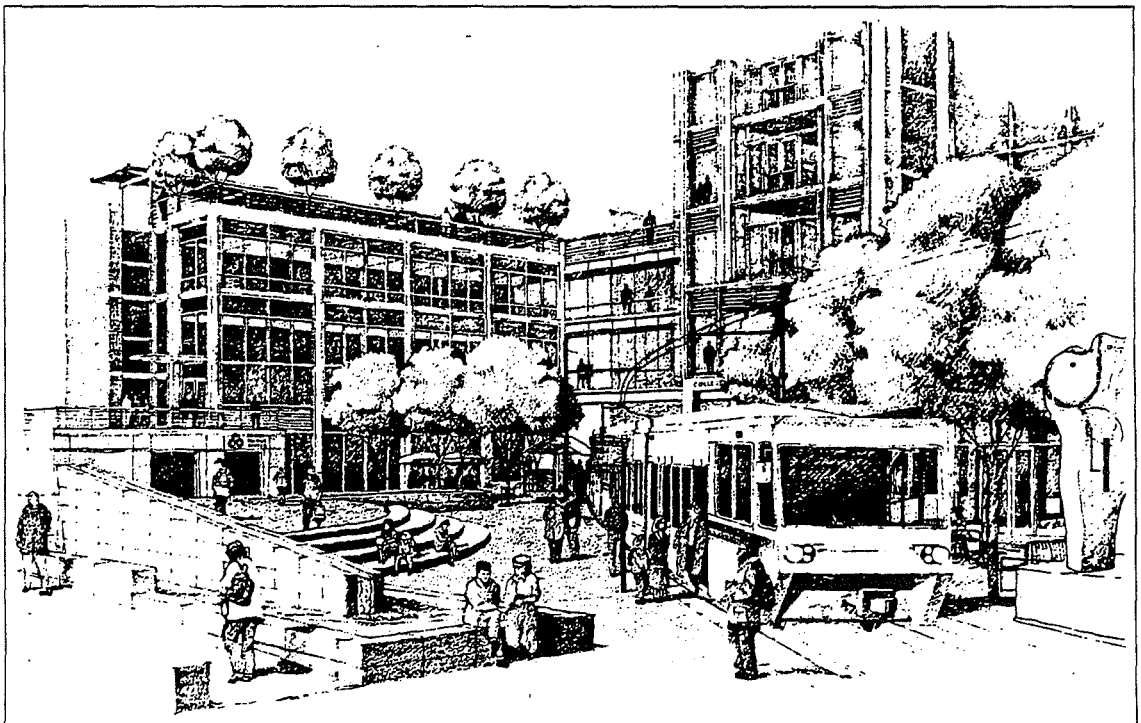
WALKER·MACY
THOMAS HACKER AND ASSOCIATES ARCHITECTS P.C.



NE View of College of Urban & Public Affairs & Plaza

COLLEGE OF URBAN & PUBLIC AFFAIRS
PORTLAND STATE UNIVERSITY

THOMAS HACKER AND ASSOCIATES ARCHITECTS P.C.



NW View of Urban center, Plaza and Light Rail

COLLEGE OF URBAN & PUBLIC AFFAIRS
PORTLAND STATE UNIVERSITY

THOMAS HACKER AND ASSOCIATES ARCHITECTS P.C.

2.4.2 Qualitative Evaluation of PSU Station

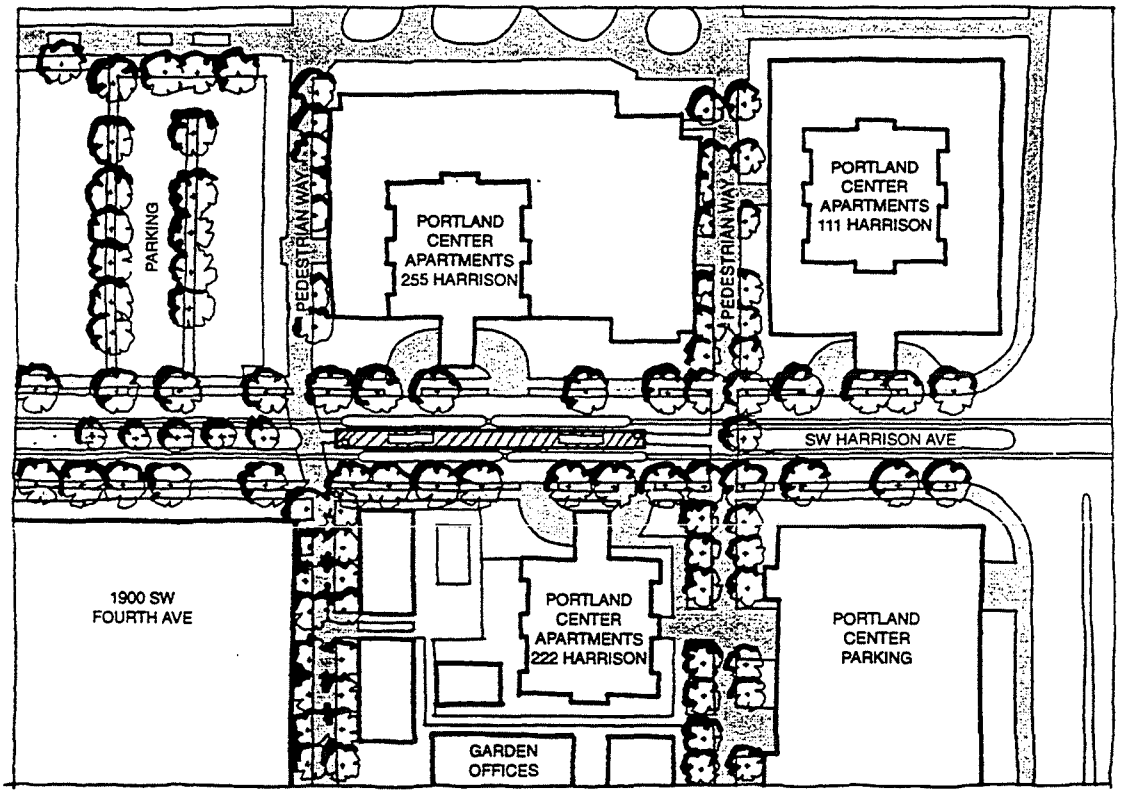
Criteria and Evaluation	Explanation
Pedestrian access Evaluation: ●	• Access to the northbound station occurs directly from pedestrian plaza. • Montgomery Street, designated a Central City Walkway in the CCTMP, connects station platforms to the heart of the PSU campus to the west, and to the South Auditorium neighborhood and the river to the east. • The proposed diagonal alignment creates a level walkway linking the main PSU campus to the new College of Engineering at Fourth and Harrison. • With the full implementation of PSU's Urban Center Plan, the pedestrian environment in the vicinity of the station is planned to be attractive. The plans propose retail in the ground floor of all buildings, and widened sidewalks paved with brick and lined with trees.
Property impacts Evaluation: ◑	• Acquisition of the Jasmine Tree Restaurant will be required in Block 153 (5th, Montgomery, 4th, Harrison) in addition to compensation to PSU for right-of-way in Block 162 (6th, Mill, 5th, Montgomery) and Block 153. • Because PSU's master plan incorporates future LRT stations and trackway, redevelopment of PSU-owned property can proceed without concern for future property impacts.
Potential to integrate station with existing or future development. Evaluation: ●	• The northbound station is fully integrated with the design of the College of Urban and Public Affairs building and the Urban Center Plaza. The activity of the station will help activate the plaza. • Although buildings in Block 153 (the location of southbound station) are not designed, preliminary studies indicate a high potential for joint development, possibly over the trackway and station platform.
Intermodal connections. Evaluation: ●	• The PSU Transit Center will be built on Fifth and Sixth Avenues for the 20 Tri-Met and C-Tran bus lines serving PSU. • Passengers transferring from the future northbound LRT station in the Urban Center Plaza to bus stops on Fifth and Sixth will not have to cross a street. • Passengers transferring from the future southbound LRT station in Block 133 to bus stops on Fifth and Sixth will need only to cross the street at Fifth and Montgomery.
Impact to vehicular access and circulation Evaluation: ◑	• Montgomery Street is closed to vehicular traffic. However, because Montgomery Street is used for local access, vehicular circulation patterns will not be significantly impacted. • The PSU Transit Center project will reduce the number of auto lanes from three to two lanes on Fifth and Sixth. The addition of LRT on the Mall retains two lanes for vehicular traffic. • Because both station platforms are located within the interiors of blocks, vehicular access to the block is not impeded by the PSU Station.

2.5 Harrison Street Station

The Harrison Street Station would primarily serve the South Auditorium area, an area defined in the Central City Plan as bounded by Fourth Avenue to the west, Front Avenue to the east, I-405 to the south, and generally Clay Street to the north. The South Auditorium is an existing high density, mixed use area.

2.5.1 Description of the Harrison Street Station

- The Harrison Street Station is a center platform type station located in the median of Harrison Street between the Second and Third Avenue pedestrian walkways. The location of the station is dictated by existing grades on Harrison Street. The location between Second and Third is the furthest east from the PSU station before grades on Harrison Street become too steep for a station.
- To accommodate light rail with or without a station, it will be necessary to rebuild Harrison Street within the existing 80-foot right-of-way. The proposed design with a station (see illustrations on the following page) retains the locations of existing curblines, resulting a street section with 7 ft. walks, 11.5 ft. travel lanes, and a 12 ft. station platform.
- The 12 ft. platform is the smallest width possible which meets ADA. However, a 12 ft. platform would not meet Tri-Met's minimum standard which requires 6 ft. clear from the edge of the platform to the nearest obstruction. Applying this standard would result in a minimum platform width of 15 feet.
- The 11.5 ft. auto lanes are the narrowest allowable lane widths given the two directional, single lane operation of Harrison Street. The street will also be used by trucks and buses.
- A single platform is proposed which would provide a passenger shelter, ticket machine, information pylons and other typical platform furnishings. The longitudinal slope of the platform would be about 3.5%, which is close to the preferred maximum of 4%.
- To accommodate the proposed platform, existing trees in the median would be removed. Most trees along Harrison Street would have to be removed with or without a station, because they would not survive the regrading and reconstruction of the street. Most trees currently exist in poor soil conditions and have reached their maximum size. Several trees are diseased and will need to be removed in the future. According to an arborist's preliminary findings, it appears that about 10 trees have a reasonable chance of survival along Harrison Street with the construction of LRT, with or without a station.



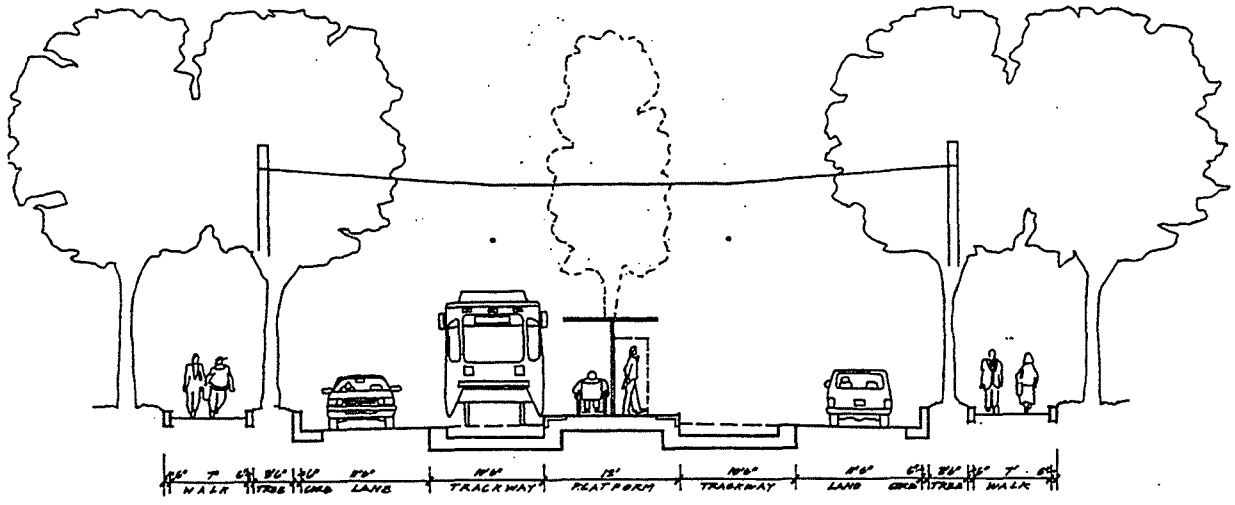
South/North
TRI-MET

ZGF

CONCEPT PLAN HARRISON STREET STATION

N

0' 20' 40' 60'



ZGF

PROPOSED SECTION WITH 12'-0" PLATFORM AND EXISTING SIDE TREES

South/North

2.5.2 Qualitative Evaluation of Harrison Street Station

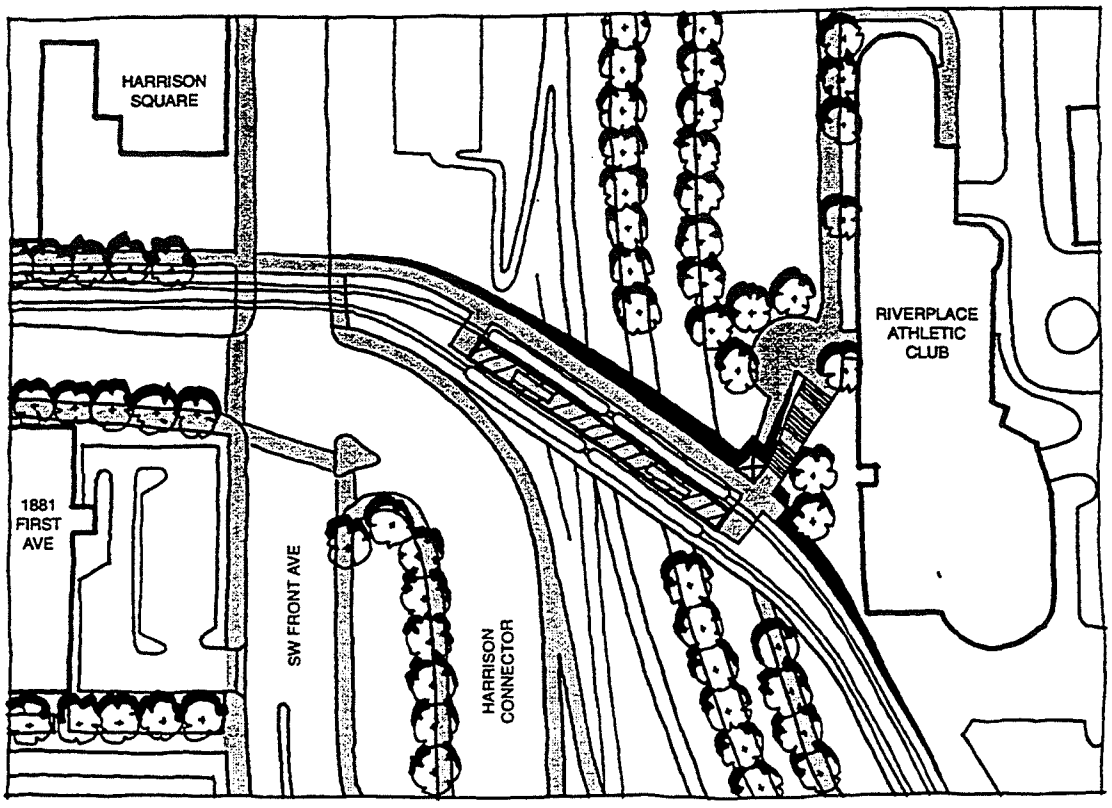
Criteria and Evaluation	Explanation
Pedestrian access Evaluation: ◕	• The pedestrian-only walkways along Second and Third form the spines of the walkway system within the South Auditorium neighborhood. • The proposed station, located on Harrison between Second and Third, would be directly fed by these walkways. • Pedestrian access from the east requires climbing steep grades between Front and Second.
Property impacts Evaluation: ◑	• Preliminary engineering studies indicate that no severe grade problems would exist in accommodating existing driveways to properties along Harrison Street. However, the removal of one travel lane eliminates the ability for service vehicles to temporarily use the street for loading. • About 10 trees have a reasonable chance of survival along Harrison Street with the construction of LRT, with or without a station. The removal of trees would change the character of Harrison Street, until replacement trees mature.
Potential to integrate station with existing or future development. Evaluation: ●	• The South Auditorium neighborhood is a high density, pedestrian oriented, mixed use neighborhood. It represents the type of transit oriented development around transit stations called for in the Region 2040 Plan. • Harrison Street is an attractive pedestrian oriented street with high-rise office and residential buildings located near the sidewalks.
Intermodal connections. Evaluation: ◑	• Currently two bus lines (40,43) serve Harrison Street. With the implementation of the PSU Transit Center, additional bus lines may be rerouted to Harrison Street. These lines could stop near the LRT station to allow transfers, although the PSU Transit Center would be the most convenient transfer point.
Impact to vehicular access and circulation Evaluation: ◕	• Harrison Street is classified as a Major City Traffic Street and a Major Transit Priority Street in the CCTMP. • Traffic on Harrison Street would be reduced to using one eastbound and one westbound lane. Presently, there are two in each direction. • Breaks in the center median of Harrison Street, which today allow U-turns, would be closed. • The above impacts stem from the proposed trackway. No additional impacts would occur as a result of adding a station to Harrison Street.

2.6 RiverPlace (Elevated) Station

The RiverPlace Station is designed to be a bridge which links and serves two neighborhoods, the South Auditorium area and RiverPlace, currently separated by major streets. The station is located on an elevated structure above Harbor Drive with a pedestrian bridge connection to the east to provide access to the station from the South Auditorium area via Harrison Street, and stair connections to west to provide access to the station from RiverPlace.

2.6.1 Description of the RiverPlace Station

- The RiverPlace Station is located between the South Auditorium and RiverPlace neighborhoods on an elevated structure above Harbor Drive.
- The platform is a center type with shelters, ticket machines, information pylons, and other furnishings located on the platform.
- Access to the station from the west (South Auditorium area) would occur from a bridge starting on the east side of the intersection of Front and Harrison. Pedestrians would walk about 100 feet to reach the end of the platform.
- Access to the station from the east (RiverPlace) would occur from stairs or elevators located in front of the RiverPlace Athletic Club. A pedestrian plaza could be developed at the base of the stairs to visually enhance the setting of the stairs. The stairs would rise about 28 feet from street level on Harbor Way.



2.6.2 Qualitative Evaluation of RiverPlace Station

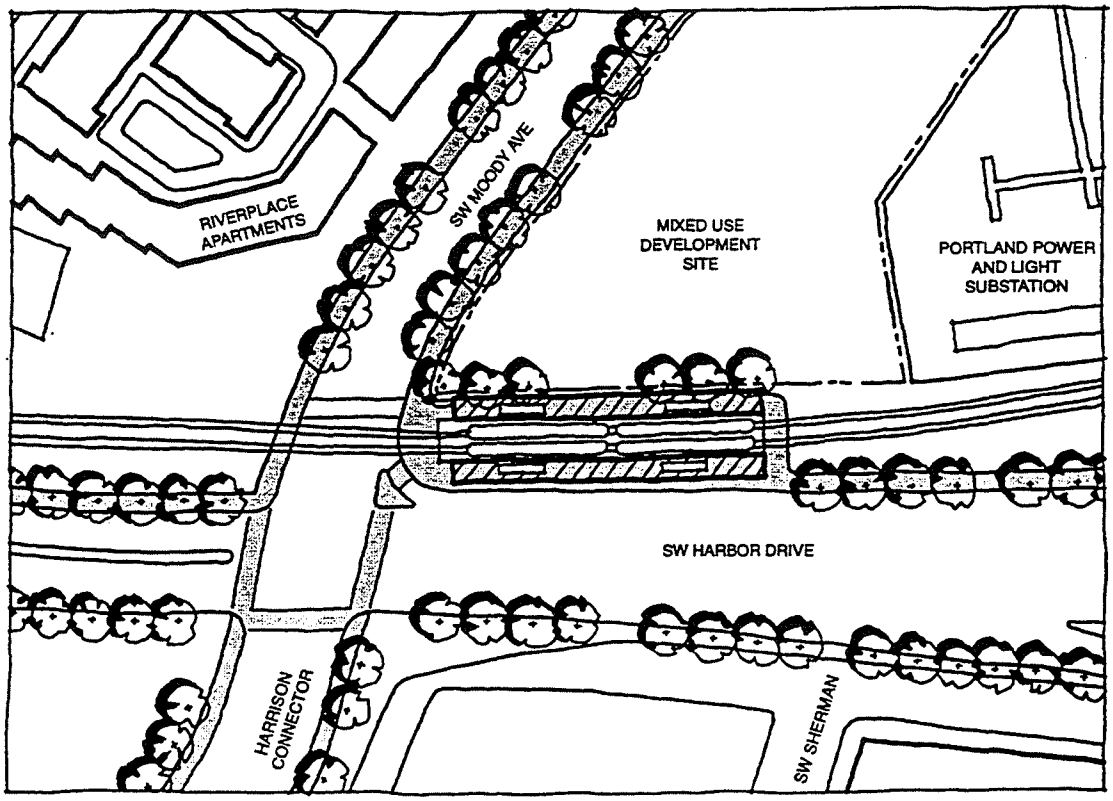
Criteria and Evaluation	Explanation
Pedestrian access Evaluation: ◔	• From destinations in the South Auditorium area, pedestrians will walk up or down grades of 7% on Harrison Street. In addition, pedestrians cross two busy streets at First Avenues and at Front Avenue to reach the bridge to the station. • From destinations within RiverPlace, pedestrians climb stairs (28 feet or 56 steps) or use an elevator to reach the elevated station. • Pedestrians in RiverPlace using Moody Street would use the sidewalk along Harbor Drive, a busy street which connects to I-5. • Surveillance of the proposed station from passing traffic on surrounding streets will be less than a typical downtown LRT station located at ground level. The station platform will only be visible from Front Avenue, located 100 feet away.
Property impacts Evaluation: ●	• No impacts are expected.
Potential to integrate station with existing or future development. Evaluation: ◔	• The station is located between South Auditorium and RiverPlace on a structure above a busy street without any strong connection to existing buildings or pedestrian activity on the street. • Because the station is located above Harbor Drive, it would be difficult and expensive to integrate with new development.
Intermodal connections. Evaluation: ◑	• Eight bus lines use First or Front Avenue (35, 36, 40, 43, 38, 54, 56, 92X). In addition lines 40 and 43 could be routed to Harrison, if this connector is built. • Transfers from buses to LRT at the RiverPlace Station could be made although transfers may be more conveniently made at the PSU Transit Center.
Impact to vehicular access and circulation Evaluation: ●	• The proposed Moody-Harrison connector is accommodated in the design of the station. • Significant congestion is projected at the Front Ave-Harrison Street intersection . This is not related to the proposed station location.

2.7 Moody-Harbor Drive Station

The Moody-Harbor Drive Station is proposed as an alternative to the elevated RiverPlace Station. The station is located on the ground on the south side of Moody Street at its intersection with Harbor Drive. The station is designed to serve RiverPlace.

2.7.1 Description of Moody-Harbor Drive Station

- Twin side platforms are proposed, with each providing a passenger shelter, ticket machine, information pylons and other typical platform furnishings. The slope of the platforms would be about 2%.
- PDC proposes to develop a mixed use project on the corner site just east of the proposed station. The proposed development concept includes a supermarket on the ground floor with parking and housing above. The supermarket could potentially have direct access to the northbound platform.
- West of the station is Harbor Drive, a four lane divided highway connecting to I-5. South of the station is a PP&L electrical substation.
- Primary access to the station would come from pedestrians walking along Moody Street. Pedestrians would enter the station from platforms which abut the sidewalk on the south side of Moody Street.
- As the walk isochrons maps indicate, the Moody-Harbor Drive Station serves the RiverPlace District, including its undeveloped portions at the south end.



2.7.2 Qualitative Evaluation of Moody-Harbor Drive Station

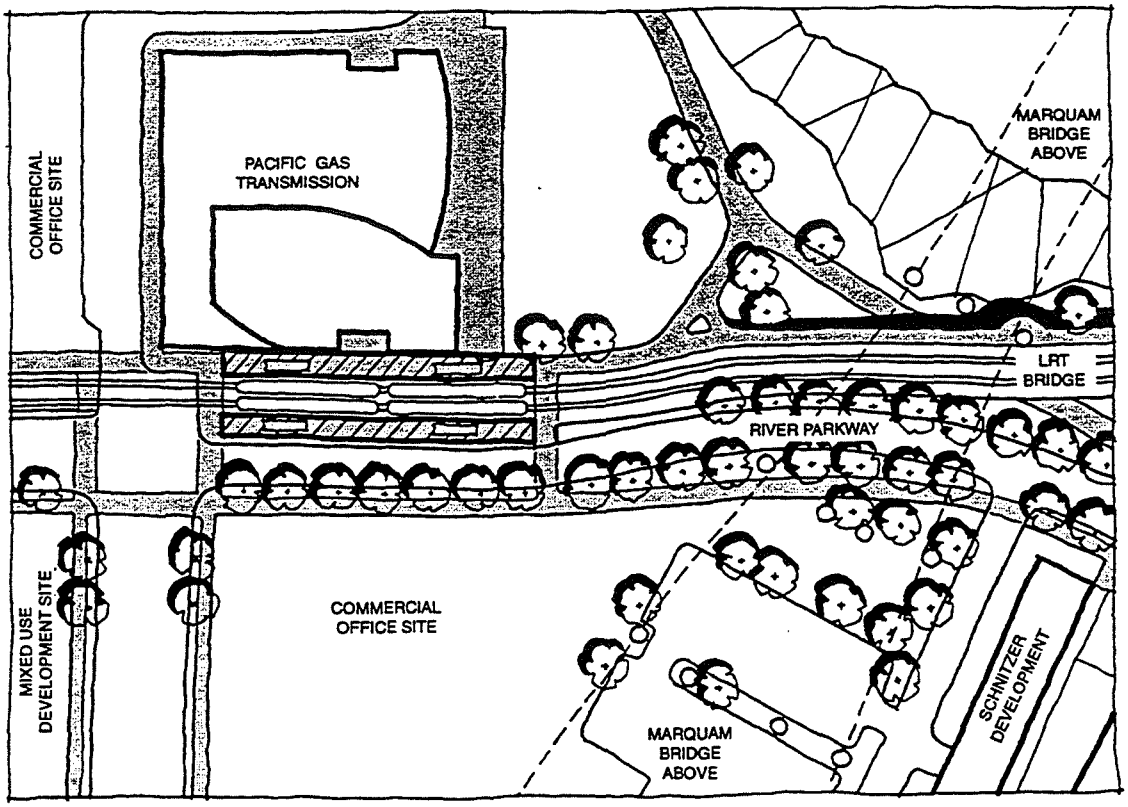
Criteria and Evaluation	Explanation
Pedestrian access Evaluation: ◑	• Moody Avenue, a five lane street, serves as the primary pedestrian route to the station from destinations in RiverPlace. To access the station, the majority of pedestrians would cross Moody at a signalized intersection. • Some pedestrians approaching the station from the RiverPlace Athletic Club would use the sidewalk along Harbor Drive. This sidewalk runs under the LRT bridge which crosses over Harbor Drive. Because Harbor Drive handles high volumes of high speed traffic, it is not a desirable pedestrian street. • Pedestrian access to the station from the west is limited because of traffic barriers created by Harbor Drive and Front Avenue, and grade changes.
Property impacts Evaluation: ◕	• To accommodate a station, approximately 60 feet is needed between Harbor Drive and the PDC site which is currently being used by the Willamette Shore Trolley (WST). The DEIS currently proposes to end the WST at the Porter St. Station.
Potential to integrate station with existing or future development. Evaluation: ◑	• The station could be potentially integrated with a proposed mixed use project proposed by PDC on the site just east of the station. Uses planned for the project include a supermarket, parking and housing. PDC staff view this as an excellent joint development opportunity. • On the west side of the station is Harbor Drive which, due to the high volumes and speeds of traffic, is not pedestrian friendly. Little development potential lies west of Harbor Drive.
Intermodal connections. Evaluation: ◕	• The DEIS transit network for 2015 shows bus lines 35 and 36 rerouted via Moody Street to serve the RiverPlace and the North Macadam District. By locating bus stops for these lines on Moody Street near the Moody-Harbor Drive Station, good bus to LRT connections could be achieved. • The Moody-Harbor Drive Station could also connect to the Willamette Shore Trolley although this would require additional right-of-way.
Impact to vehicular access and circulation Evaluation: ●	• Access to the PDC-owned site east of the station from Harbor Drive is already restricted due to the traffic operation of Harbor Drive. The proposed LRT station would not restrict access any further. • Circulation from Moody Street to Harbor Drive, or to the proposed connector street to Harrison Street, is unaffected by the Moody-Harbor Drive station location.

2.8 North Marquam Station

The North Marquam Station is one of two optional station sites associated with Caruthers Crossing Alternative. In this design option LRT crosses the river at OMSI, lands on the west bank of the river at an at-grade station in front of the PGT Building, heads west on Moody Ave., crosses above Harbor Drive on a structure, and then heads west toward PSU via Harrison Street. The station is intended to serve RiverPlace and the North Macadam district.

2.8.1 Description of the North Marquam Station

- The North Marquam Station is a side platform type station located at street level on the north side of Moody Street in front of the Pacific Gas Transmission (PGT) headquarters office building.
- The trackway is paved and follows an alignment on the north side of Moody Avenue west of the PGT building, and the north side of the proposed River Parkway to the east.
- Each platform is 15 feet wide and contains shelters, ticket machines, information pylons and other station furnishings.
- Grades of the station platforms are about 1% and match the existing entrance to the PGT building.



2.8.2 Qualitative Evaluation of North Marquam Station

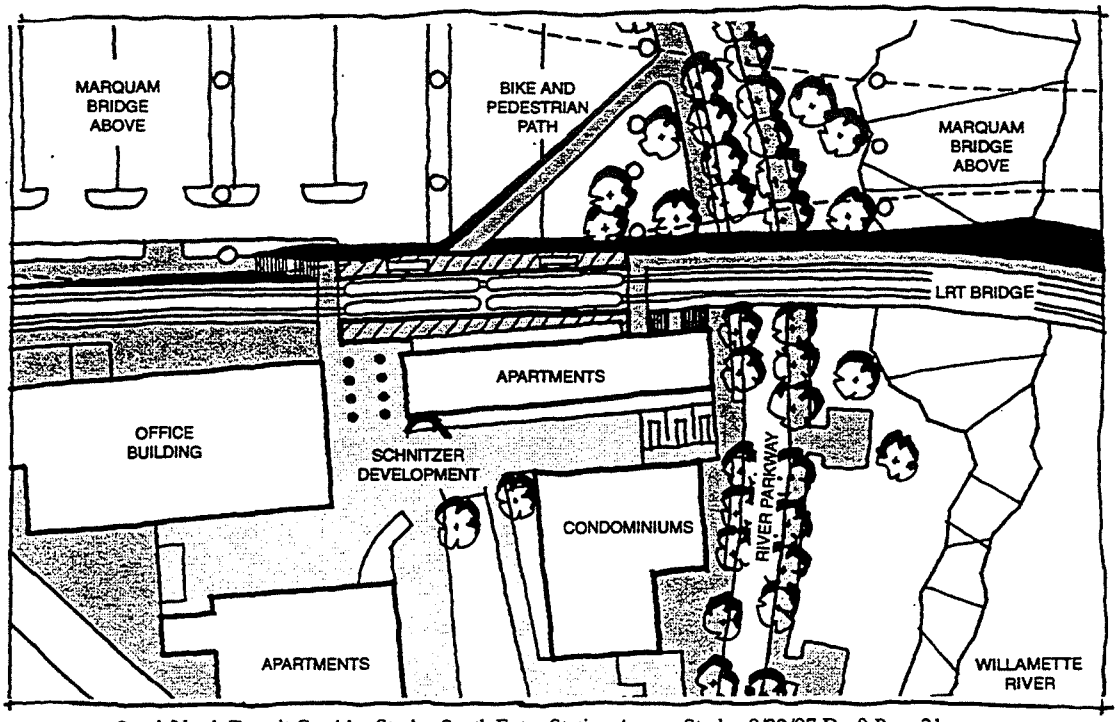
Criteria and Score	Explanation
Pedestrian access Evaluation: ●	• Several streets provide links between the station and the surrounding RiverPlace neighborhood. • The existing neighborhood to the north could use the promenade and River Drive to access the station. • The newly developing neighborhood to the south (including the proposed Schnitzer development) could use Moody Avenue or the proposed River Parkway.
Property impacts Evaluation: ◔	• An additional 15-20 feet of right-of-way from PDC-owned land south of the station would be needed to accommodate the station and trackway.
Potential to integrate station with existing or future development. Evaluation: ◕	• The existing sidewalk in front of the PGT building would become the northbound platform. The entrance to the PGT building would face the platform. • Future development on the south side of the station could be oriented to southbound platform.
Intermodal connections. Evaluation: ◑	• The DEIS transit network for 2015 shows bus lines 35 and 36 rerouted via Moody Street to serve RiverPlace and the North Macadam District. By locating bus stops near the North Marquam Station, bus to LRT connections could be achieved.
Impact to vehicular access and circulation Evaluation: ◑	• To accommodate the LRT station and alignment, the center left turn lane on Moody would be removed and the bike lanes relocated to the Willamette Shore Line trolley right-of-way. • Access to the PGT building and adjacent properties is maintained.

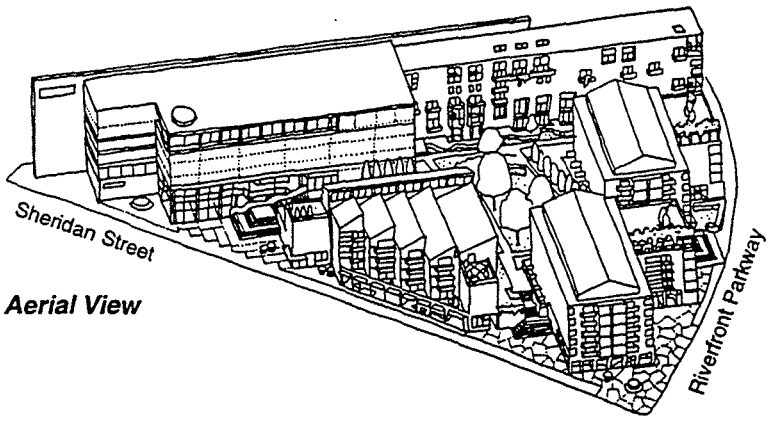
2.9 South Marquam Station

~~The~~ South Marquam Station is one of two optional station sites associated with Caruthers Crossing Alternative. In this design option LRT crosses the river at OMSI, lands at an elevated station on the west side of the river just south of the Marquam Bridge, heads west to Harbor Drive, then crosses above Harbor Drive on a structure, and then heads west toward PSU via Harrison Street. The station is intended to serve RiverPlace and the North Macadam district.

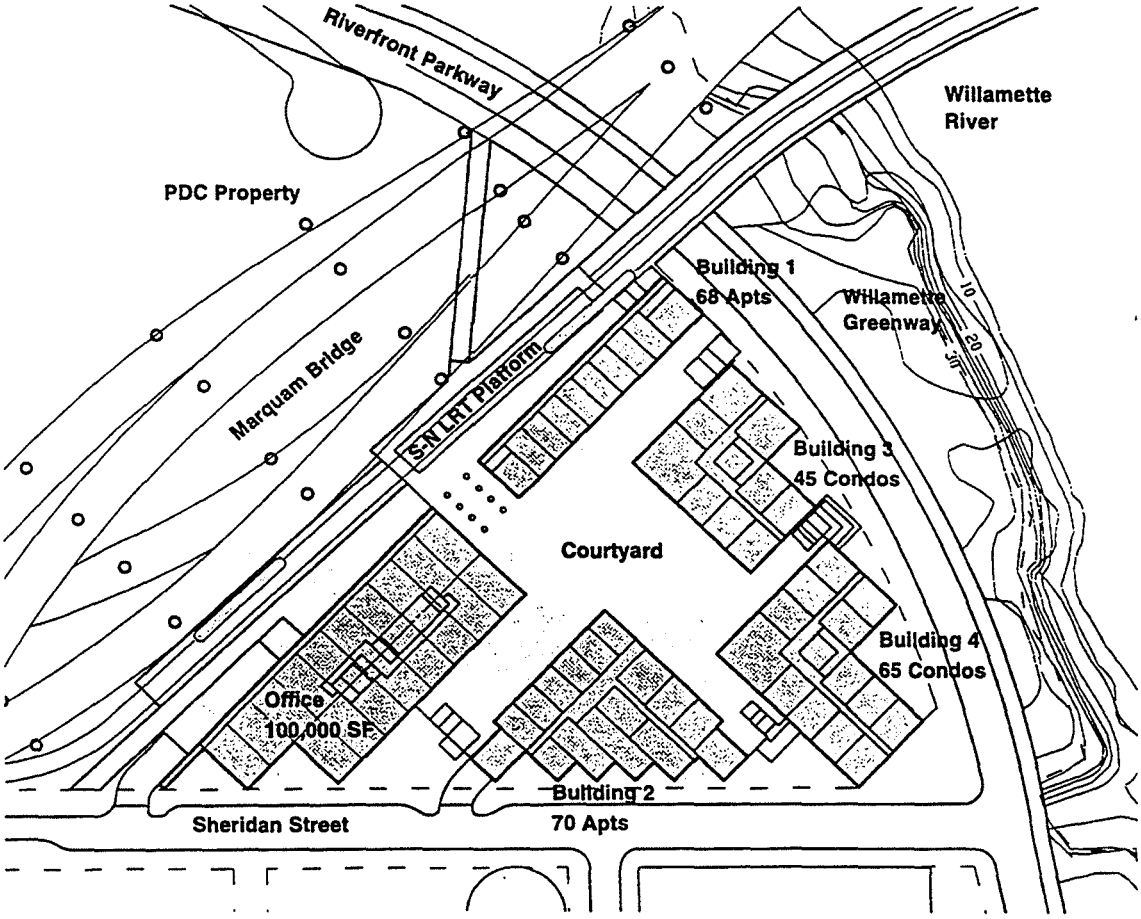
2.9.1 Description of the South Marquam Station

- The South Marquam Station is located south of the Marquam Bridge on an elevated structure just west of the proposed River Parkway.
- The station is located along the north edge of a proposed mixed use development on land owned by the Schnitzer Group. The station would be constructed next to auto ramps which provide vehicular access to parking decks, which create a platform for the proposed development.
- The elevated station would connect at the same level to a pedestrian plaza which provides the central focus for the proposed offices (100,000-120,000 SF) retail (10,000 SF), and housing (250 units). Access to the plaza, and to the station via the plaza, would be public and be open during hours of LRT service.
- Pedestrian access to the station from River Parkway would occur via stairs connected to the sidewalk along River Parkway. A straight ramp is proposed to connect the elevated station which will serve two functions: wheelchair access to the station and emergency vehicle access to the plaza.
- The South Marquam Station will have two side platforms each with shelters, ticket machines, and other station furnishings.





Aerial View



Phase 1 Site Plan

2.9.2 Qualitative Evaluation of South Marquam Station

Criteria and Evaluation	Explanation
Pedestrian access Evaluation: ◑	• The South Marquam Station is centrally located between the RiverPlace neighborhood to the north and the North Macadam District to the south. • Primary access to the station from RiverPlace would occur via River Parkway to Moody Avenue to River Drive. • Primary access to the station from the North Macadam District would occur via River Parkway, a proposed pedestrian friendly two-lane boulevard along the waterfront, or via Moody Street, a five-lane street. The pedestrian connection between Moody Street and the station would be encouraged to occur via the elevated plaza. • To reach the platform, pedestrians would climb stairs, walk up a ramp, or use an elevator. The change in elevation is in 20-25 ft. range.
Property impacts Evaluation: ◑	• The station and trackway alignment require a right-of-way dedication from Schnitzer property. • Preliminary development plans for the Schnitzer property include an option with a South Marquam station.
Potential to integrate station with existing or future development. Evaluation: ◑	• The plan for Schnitzer's mixed use development provides a direct link between its central plaza (which all buildings are oriented to) and the proposed station. • The area on the north side of the station which is under the Marquam Bridge will not likely be developed with uses other than parking, thus limiting the station's potential for integrating development. Also, the station environment under the Marquam Bridge will be noisy.
Intermodal connections. Evaluation: ◔	• Connections to future potential bus service on Moody Street (lines 35 and 36 in the DEIS transit network) are two blocks away. • The existing Willamette Shore Line trolley is four blocks away.
Impact to vehicular access and circulation Evaluation: ●	• The proposed alignment crosses Moody Street at grade at a new signalized intersection with Sheridan Street. • The alignment crosses the proposed River Parkway on an elevated structure, eliminating any conflicts with vehicles. • Access to the Schnitzer property is planned to accommodate the proposed station and its approaches to the station.

2.10 Station Site Evaluation Summary

The table below summarizes the evaluation of the six station sites.

Table 1: Evaluation of South Entry Station Sites

	Pedestrian Access	Property Impacts	Integrate Development	Intermodal Connections	Vehicular Access
PSU Station	●	◑	●	●	◑
Harrison Street Station	◕	◑	●	◑	●
Riverplace (Elevated) Station	◔	●	◑	◔	●
Moody-Harbor Drive Station	◑	◕	◑	◕	●
North Marquam	●	◔	◕	◑	◑
South Marquam	◑	◑	◑	◔	●

3. Evaluation of Station Combination Options

3.1 Description of Station Combination Options

This section evaluates various combinations of stations. Each of the three DEIS alignment alternatives has two additional station combination options, resulting in a total of nine station combination options. The nine station combination options are:

Ross Island Crossing Alternative

1. PSU Station and Elevated RiverPlace Station (DEIS)
2. PSU Station and Moody/Harbor Drive Station
3. PSU Station, Harrison Street Station, and Moody/Harbor Drive Station

Caruthers Crossing Alternative via North Marquam

4. PSU Station and North Marquam Station (DEIS)
5. PSU Station, RiverPlace Station, and North Marquam Station
6. PSU Station, Harrison Street Station, and North Marquam Station

Caruthers Crossing Alternative via South Marquam

7. PSU Station and South Marquam Station (DEIS)
8. PSU Station, RiverPlace Station, and South Marquam Station
9. PSU Station, Harrison Street Station, and South Marquam Station

The station combination options are evaluated quantitatively in terms of:

- projected number of jobs and housing units in the year 2015 within a five minute walk of stations
- projected travel time of LRT
- projected differences in daily ridership
- estimated capital costs

In the following section all nine station combination options are evaluated using the above criteria. At the conclusion of the section the DEIS station combination options are compared to the new station combination options developed for this study.

3.2 Walk Isochron Analysis

3.2.1 Methodology

The methodology used to calculate the number of jobs or housing within a 2.5 or 5 minute walk of a given combination of station locations involved four steps:

1. The Portland Office of Transportation (PDOT) generated block-by-block housing and employment estimates for the years 1994, 2015 and a longer term scenario. PDOT's block level estimates were aggregated to match regionally adopted control totals. The years 1994 and 2015 are consistent with the study years for the DEIS for the South/North Transit Corridor Study. A complete description of PDOT's methodology to allocate block-level employment and housing unit projections in found in Appendix A.

2. The transportation and development conditions likely to exist in the 2015 were researched and mapped. This task was particularly critical in determining the extent of the sidewalk system serving a possible station site in 2015. ZGF completed this task which is documented in Appendix B.

3. Two and one/half and five minute walk isochrons were plotted for each station location. The methodology used was adapted for Downtown Portland from the *Design Option Narrowing Technical Summary Report (Metro, October, 1995).*

- Walk isochrons were calculated separately for northbound and southbound platforms. This was done to allow fair comparisons between stations having the northbound and southbound platforms in separate blocks with stations having the northbound and southbound platforms in the same block.
- Where isochrons overlapped with isochrons from adjacent stations located outside the South Entry study area, boundaries were drawn which evenly split the overlapped area.
- All walking times were measured from the ends of the platforms.
- On grades of 6% or less, a walking speed of 3 mph was assumed. On grades steeper than 6%, a walking speed of 1.5 mph was assumed.
- At typical downtown intersections, a 15 second penalty was added for crossing each leg of the intersection in addition to the walk time crossing the street. For downtown intersection with signal cycles longer than 60 seconds, longer penalties were added equal to 1/4 of the cycle.
- For ascending and descending stairs, a half second per step was added.

4. Overlay the walk isochrons for each station combination option onto the block level projections and calculate the number of jobs and housing units within a 2.5 and 5 minute walk of the stations included in the option. If a walk isochron serves less than half of the block, exclude the block from the calculations. If a walk isochron serves more than half of the block, include the whole block in the calculations.

On the following pages are the results of the walk isochron analysis including a table summarizing the data and maps of the northbound and southbound platforms for each of the nine station combination options.

South/North Project

South Entry Station Access Study
Access to Housing Units and Employment
Summary Table - 5 Minute Isochrons

DRAFT

Year 2015 Projection

		Employment	Housing Units
		5 Minute	5 Minute
Ross Island Crossing Alternative			
PSU and RiverPlace (DEIS) Option 1	**Average**	17,700	2,200
PSU and Moody/Harbor Drive Option 2	**Average**	15,100	2,500
PSU, Harrison St., and Moody/Harbor Dr. Option 3	**Average**	20,400	3,000
Caruthers Crossing Alternative			
PSU and North Marquam (DEIS) Option 4	**Average**	15,700	2,700
PSU, RiverPlace, and North Marquam Option 5	**Average**	20,700	*3,200*
PSU, Harrison St., and North Marquam Option 6	**Average**	21,000	*3,200*
PSU and South Marquam (DEIS) Option 7	**Average**	17,100	*2,600*
PSU, RiverPlace, and South Marquam Option 8	**Average**	22,200	*3,300*
PSU, Harrison St., and South Marquam Option 9	**Average**	22,400	*3,100*

Sources: Transportation Analysis Zone Population and Employment Estimates, The Portland Department of Transportation allocated these estimates on a block-by-block basis; iso-chron analysis.

Notes: The Framework Development Plan for North Macadam projects higher housing units than the TAZ allocation.

All numbers have been rounded to the nearest hundred to reflect their status as estimates.

This table has excluded the northbound and southbound average of 8,600 students.

The student numbers are identical in all station scenarios.

South/North Project

South Entry Station Access Study
Access to Housing Units and Employment
Station Combinations: Options 1 - 9

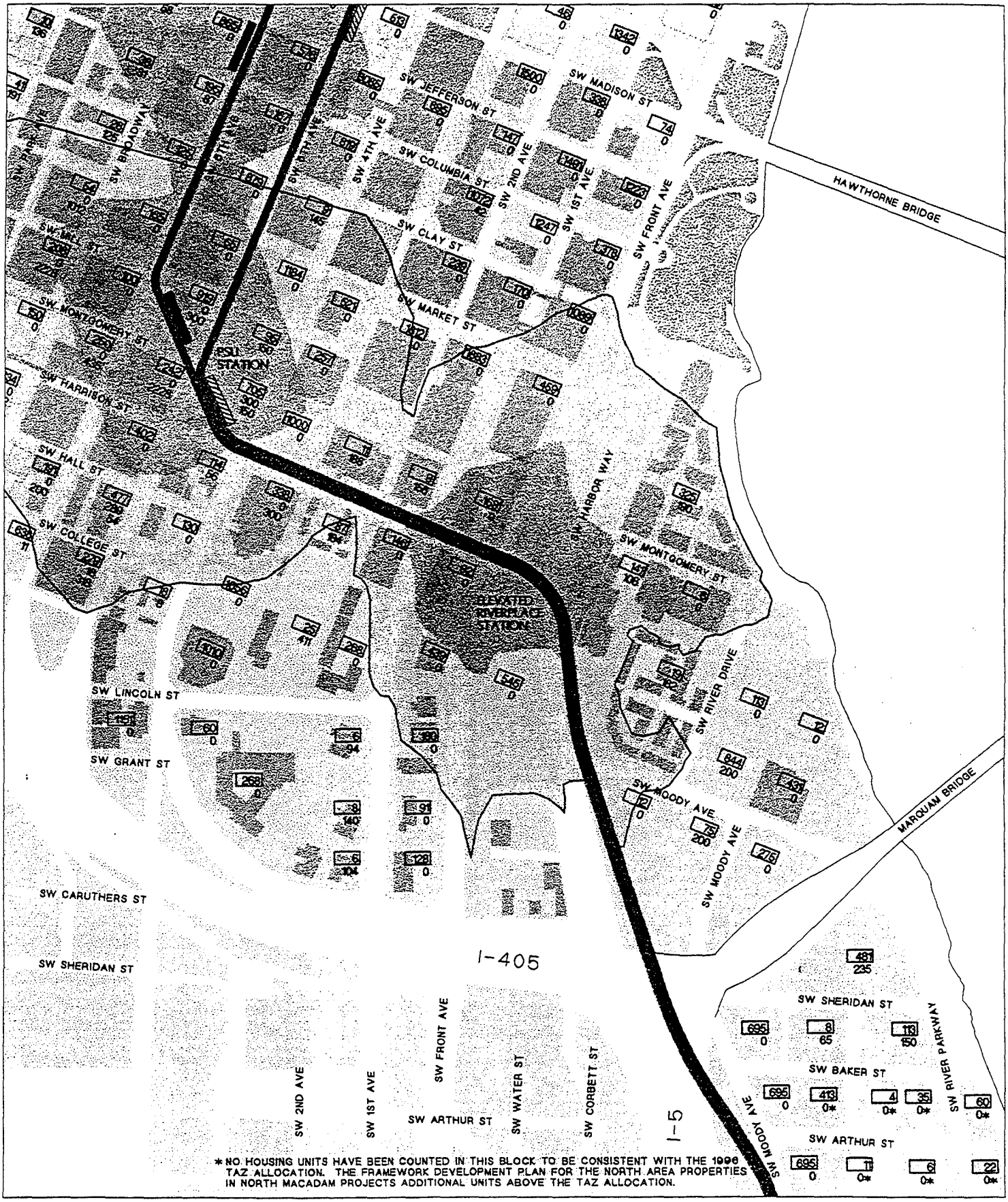
DRAFT

Year 2015 Projection

		Employment		Housing Units	
		5 Minute	2 1/2 Minute	5 Minute	2 1/2 Minute
Ross Island Crossing Alternative					
PSU and RiverPlace (DEIS)	Southbound	18,695	4,076	2,021	506
Option 1	Northbound	16,706	4,083	2,457	450
	Average	**17,701**	**4,080**	**2,239**	**478**
PSU and Moody/Harbor Drive	Southbound	16,081	3,921	2,593	888
Option 2	Northbound	14,114	3,163	2,407	888
	Average	**15,098**	**3,542**	**2,500**	**888**
PSU, Harrison St., and Moody/Harbor Dr.	Southbound	20,433	8,412	2,687	1,827
Option 3	Northbound	20,431	9,260	3,369	1,827
	Average	**20,432**	**8,836**	**3,028**	**1,827**
Caruthers Crossing Alternative					
PSU and North Marquam (DEIS)	Southbound	16,686	5,577	2,735	906
Option 4	Northbound	14,711	4,807	2,684	906
	Average	**15,699**	**5,192**	**2,710**	**906**
PSU, RiverPlace, and North Marquam	Southbound	21,773	5,838	*3,053*	*906*
Option 5	Northbound	19,663	5,833	*3,274*	*850*
	Average	**20,718**	**5,836**	**3,164**	**878**
PSU, Harrison St., and North Marquam	Southbound	21,038	10,068	*2,829*	*1,845*
Option 6	Northbound	21,028	10,904	*3,646*	*1,845*
	Average	**21,033**	**10,486**	**3,238**	**1,845**
PSU and South Marquam (DEIS)	Southbound	18,274	5,387	*2,553*	*956*
Option 7	Northbound	15,907	3,813	*2,567*	*741*
	Average	**17,091**	**4,600**	**2,560**	**849**
PSU, RiverPlace, and South Marquam	Southbound	23,380	5,648	*3,053*	*956*
Option 8	Northbound	20,991	4,539	*3,489*	*685*
	Average	**22,186**	**5,094**	**3,271**	**821**
PSU, Harrison St., and South Marquam	Southbound	16,307	4,629	*2,567*	*956*
Option 9	Northbound	4,266	756	*850*	*235*
	Average	**10,287**	**2,693**	**1,709**	**596**

Sources: Transportation Analysis Zone Population and Employment Estimates, The Portland Department of Transportation allocated these estimates on a block-by-block basis; iso-chron analysis.

Notes: The Framework Development Plan for North Macadam projects higher housing units than the TAZ allocation.
The table has excluded 3,100 students in a 2 1/2 minute walk area and 8,600 students in the 5 minute walk area.
The student numbers are identical in all station scenarios.



South North

2015

EMPLOYMENT AND POPULATION WALK ISOCHRONS
PSU AND RIVERPLACE STATIONS (DEIS) NORTHBOUND – OPTION 1

0 200' 400'

KEY

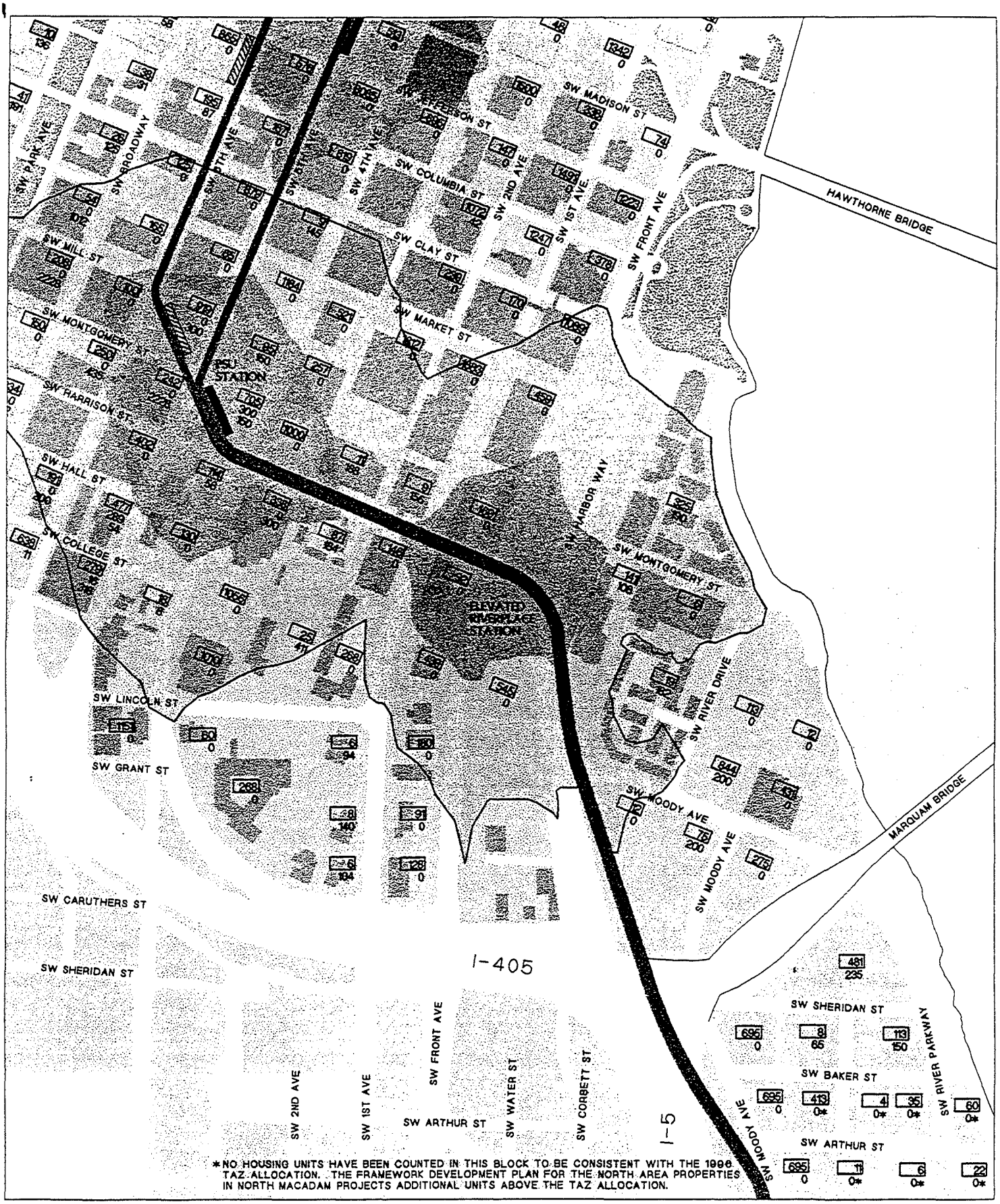
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



*NO HOUSING UNITS HAVE BEEN COUNTED IN THIS BLOCK TO BE CONSISTENT WITH THE 1996 TAZ ALLOCATION. THE FRAMEWORK DEVELOPMENT PLAN FOR THE NORTH AREA PROPERTIES IN NORTH MACADAM PROJECTS ADDITIONAL UNITS ABOVE THE TAZ ALLOCATION.

South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND RIVERPLACE STATIONS (DEIS) SOUTHBOUND – OPTION 1

0 200' 400'

KEY

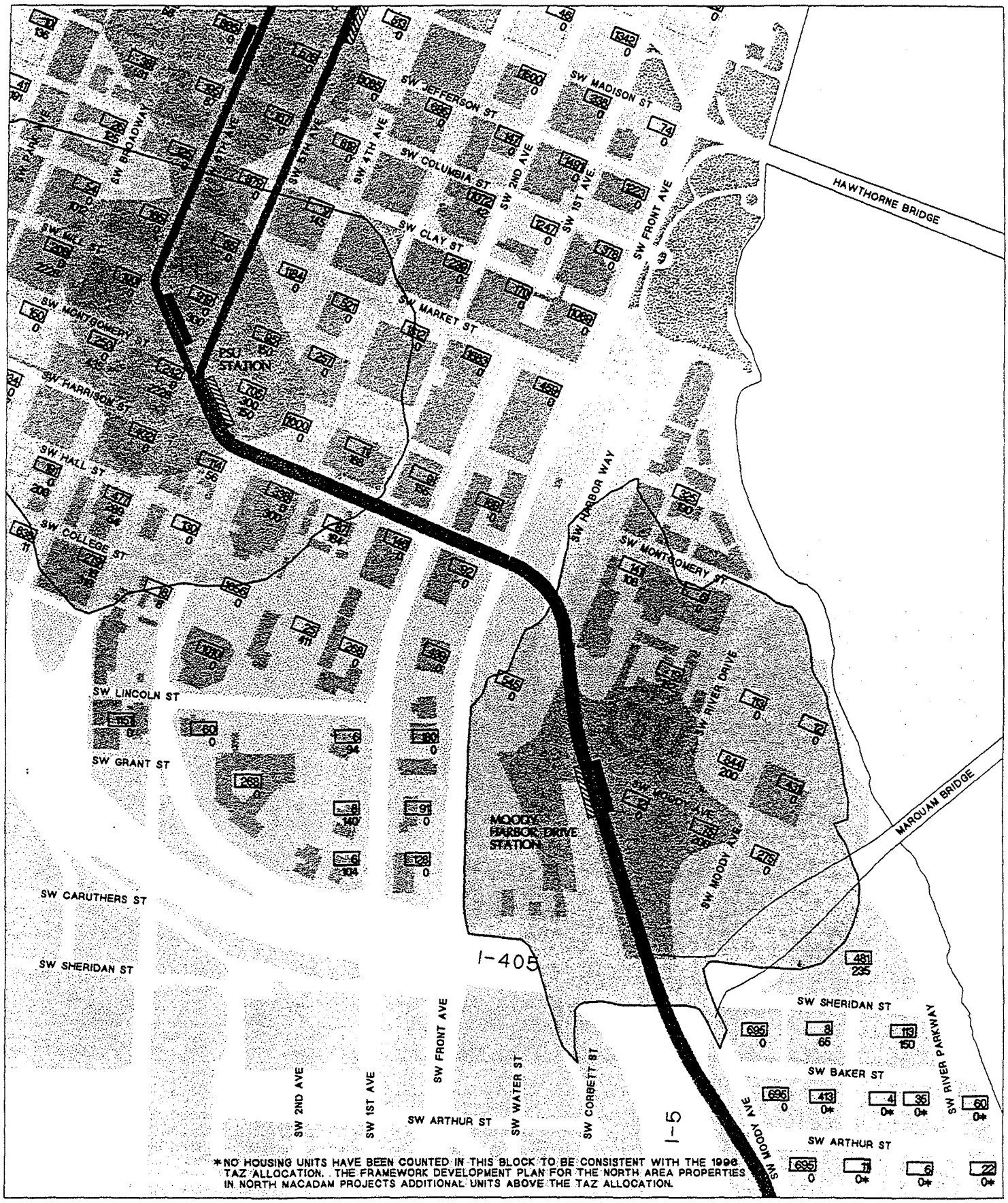
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND MOODY/HARBOR DRIVE STATIONS NORTHBOUND – OPTION 2

0 200' 400'

KEY

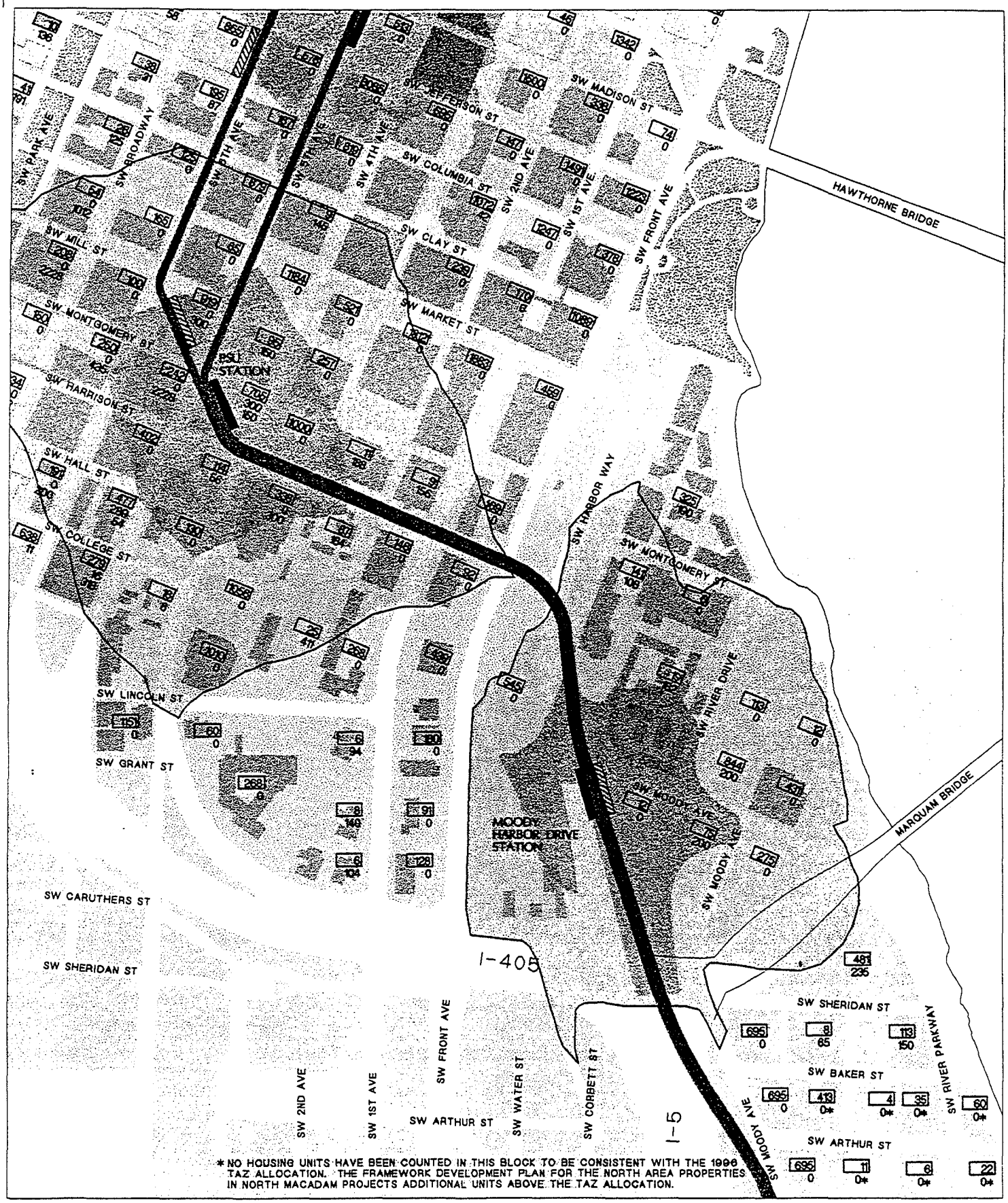
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 300

HOUSING UNITS — 50

STUDENTS — 40



South / North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND MOODY/HARBOR DRIVE STATIONS SOUTHBOUND - OPTION 2

0 200' 400'

2.5 MIN. WALK ISOCHRON

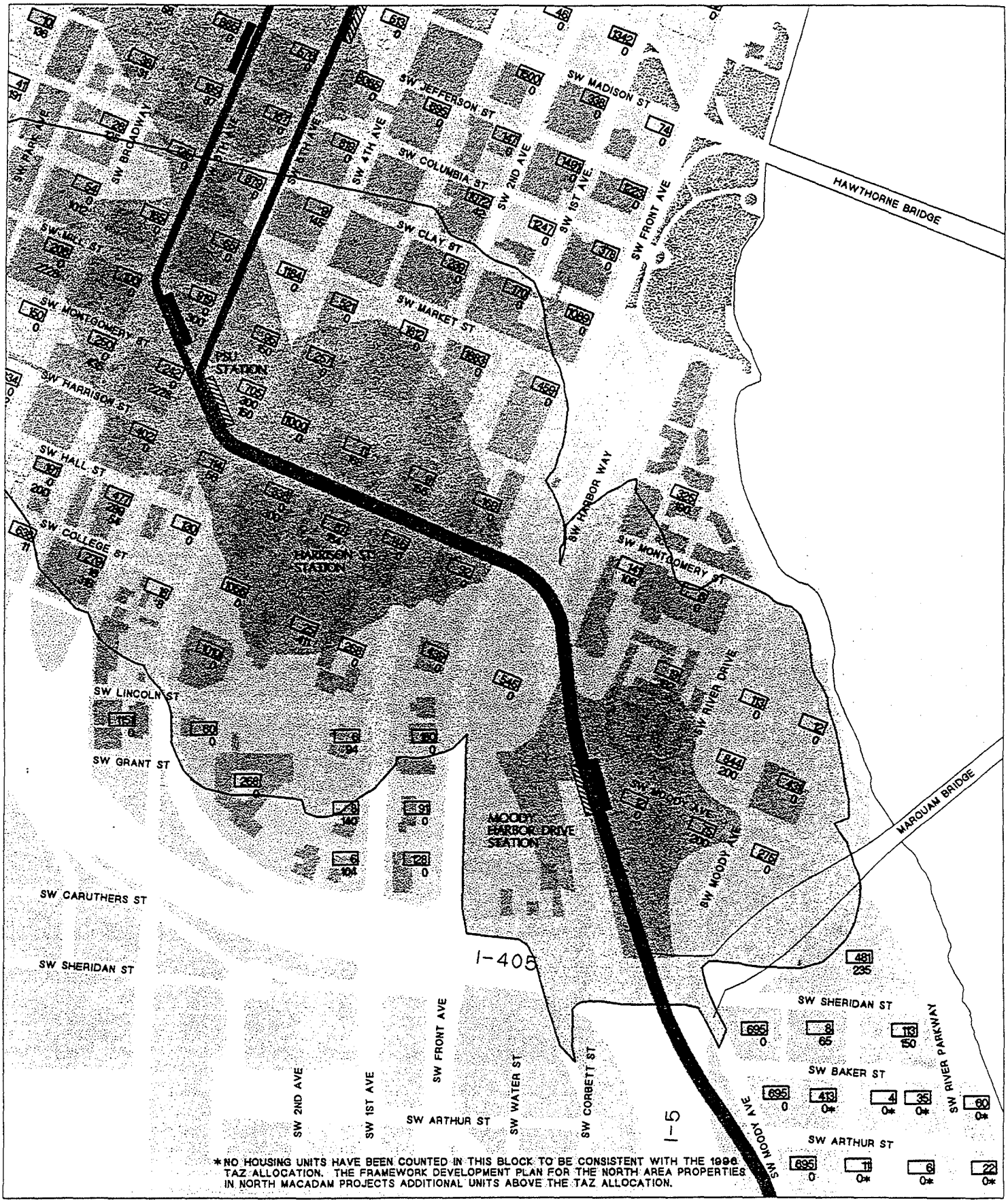
5 MIN. WALK ISOCHRON

KEY

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



*NO HOUSING UNITS HAVE BEEN COUNTED IN THIS BLOCK TO BE CONSISTENT WITH THE 1996 TAZ ALLOCATION. THE FRAMEWORK DEVELOPMENT PLAN FOR THE NORTH AREA PROPERTIES IN NORTH MACADAM PROJECTS ADDITIONAL UNITS ABOVE THE TAZ ALLOCATION.

South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, HARRISON ST., AND MOODY/HARBOR DRIVE STATIONS NORTHBOUND – OPTION 3

0 200' 400'

2.5 MIN. WALK ISOCHRON

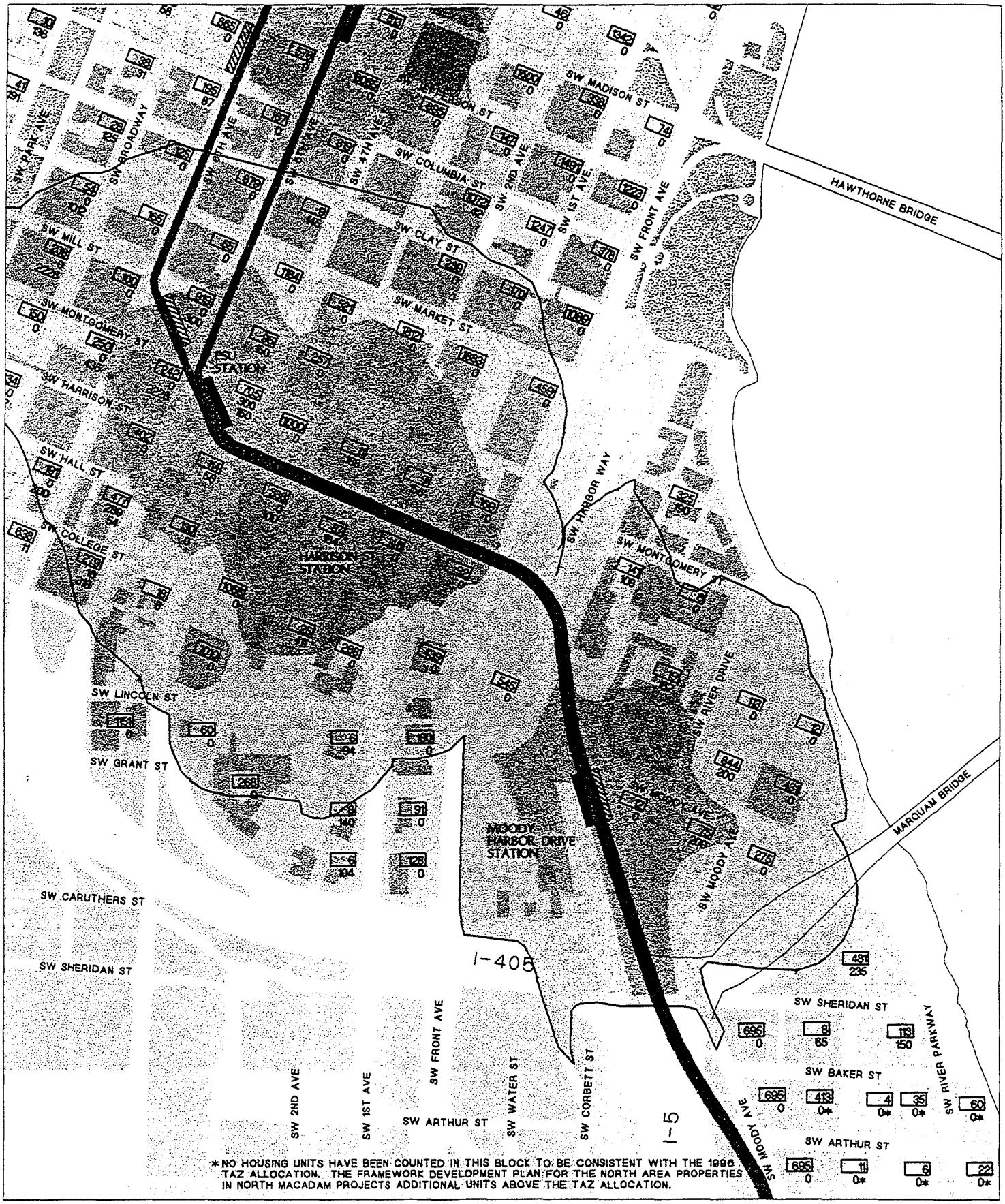
5 MIN. WALK ISOCHRON

KEY

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



*NO HOUSING UNITS HAVE BEEN COUNTED IN THIS BLOCK TO BE CONSISTENT WITH THE 1996 TAZ ALLOCATION. THE FRAMEWORK DEVELOPMENT PLAN FOR THE NORTH AREA PROPERTIES IN NORTH MACADAM PROJECTS ADDITIONAL UNITS ABOVE THE TAZ ALLOCATION.

South North

2015
POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, HARRISON ST., AND MOODY/HARBOR DRIVE STATIONS SOUTHBOUND – OPTION 3

0 200' 400'

KEY

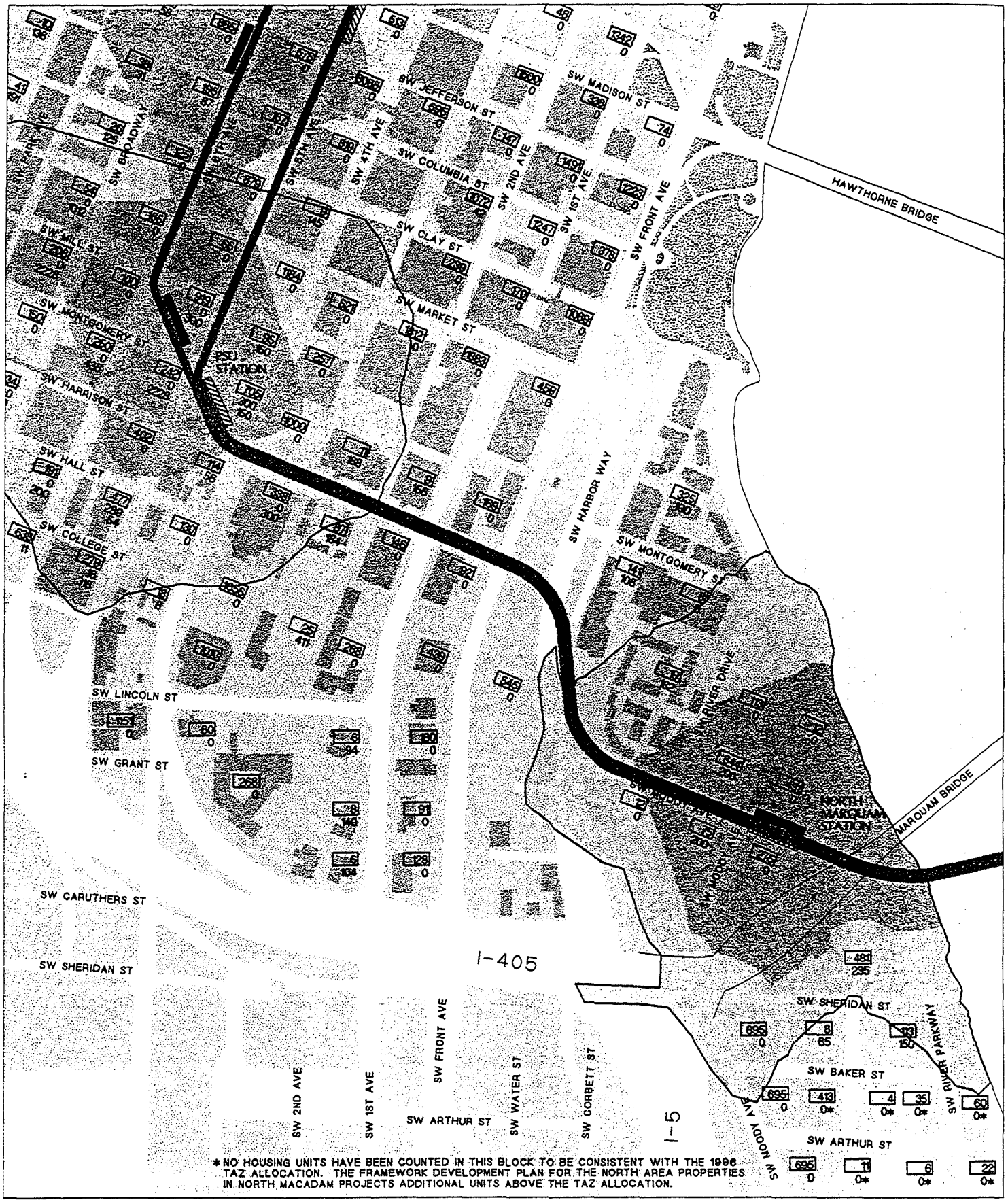
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



*NO HOUSING UNITS HAVE BEEN COUNTED IN THIS BLOCK TO BE CONSISTENT WITH THE 1996 TAZ ALLOCATION. THE FRAMEWORK DEVELOPMENT PLAN FOR THE NORTH AREA PROPERTIES IN NORTH MACADAM PROJECTS ADDITIONAL UNITS ABOVE THE TAZ ALLOCATION.

South Option

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND NORTH MARQUAM STATIONS (DEIS) NORTHBOUND – OPTION 4

0 200' 400'

2.5 MIN. WALK ISOCHRON

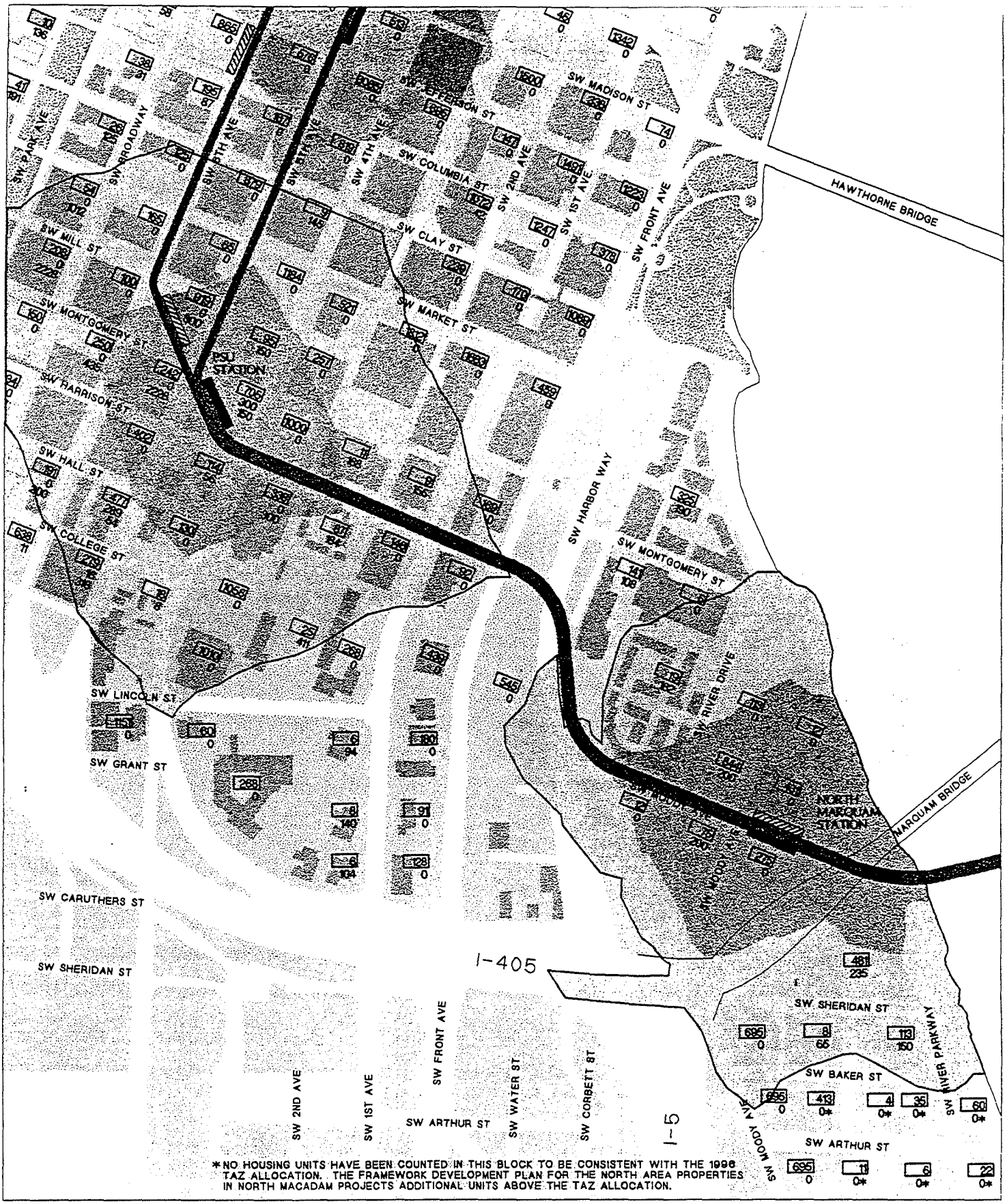
5 MIN. WALK ISOCHRON

KEY

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



*NO HOUSING UNITS HAVE BEEN COUNTED IN THIS BLOCK TO BE CONSISTENT WITH THE 1998 TAZ ALLOCATION. THE FRAMEWORK DEVELOPMENT PLAN FOR THE NORTH AREA PROPERTIES IN NORTH MACADAM PROJECTS ADDITIONAL UNITS ABOVE THE TAZ ALLOCATION.

South North

2015

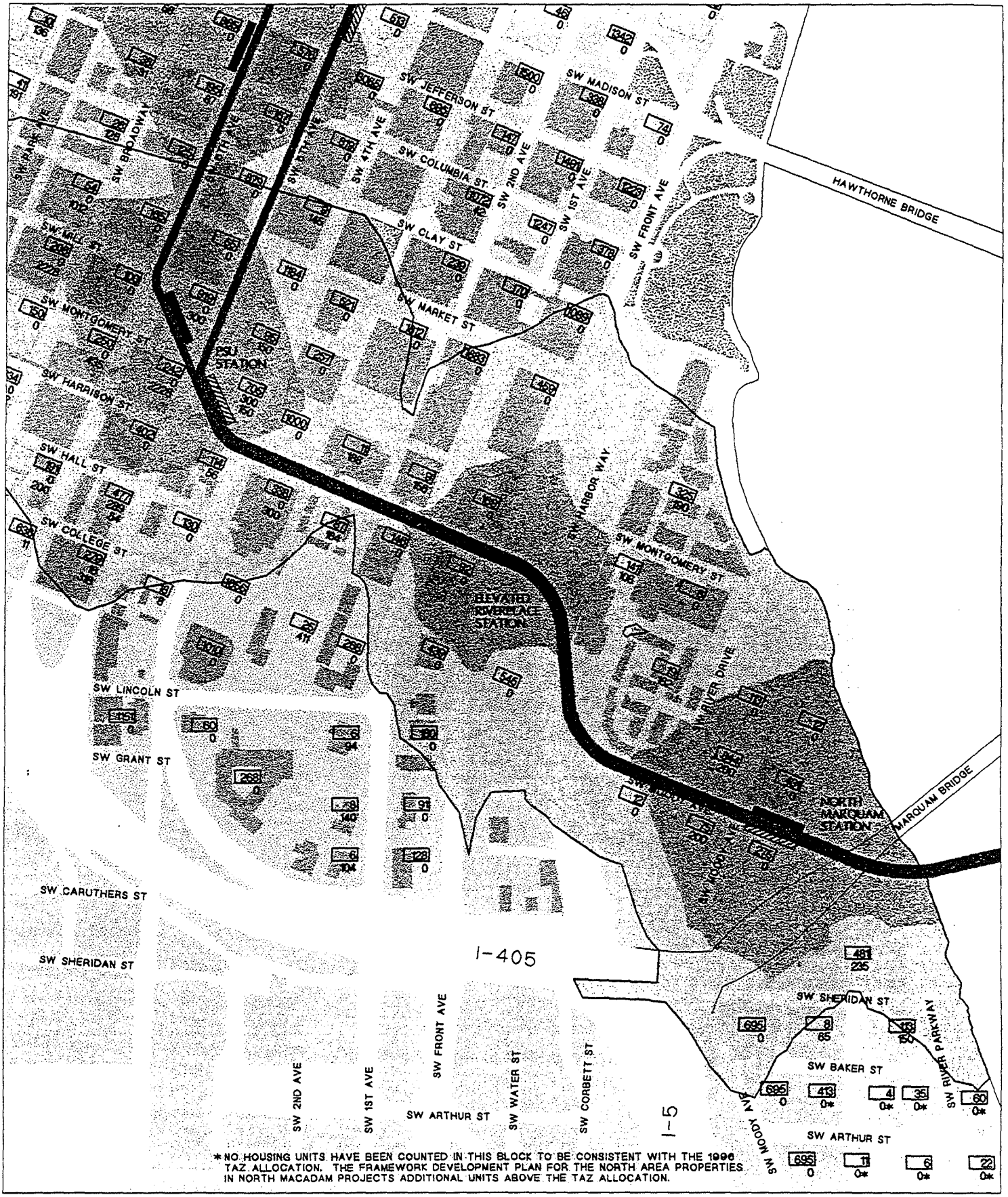
POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND NORTH MARQUAM STATIONS (DEIS) SOUTHBOUND – OPTION 4

0 200' 400'

2.5 MIN. WALK ISOCHRON
5 MIN. WALK ISOCHRON

KEY

EMPLOYMENT — 100
HOUSING UNITS — 50
STUDENTS — 40



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South North

2015

EMPLOYMENT AND POPULATION WALK ISOCHRONS
PSU, RIVERPLACE AND NORTH MARQUAM STATIONS NORTHBOUND – OPTION 5

0 200' 400'

KEY

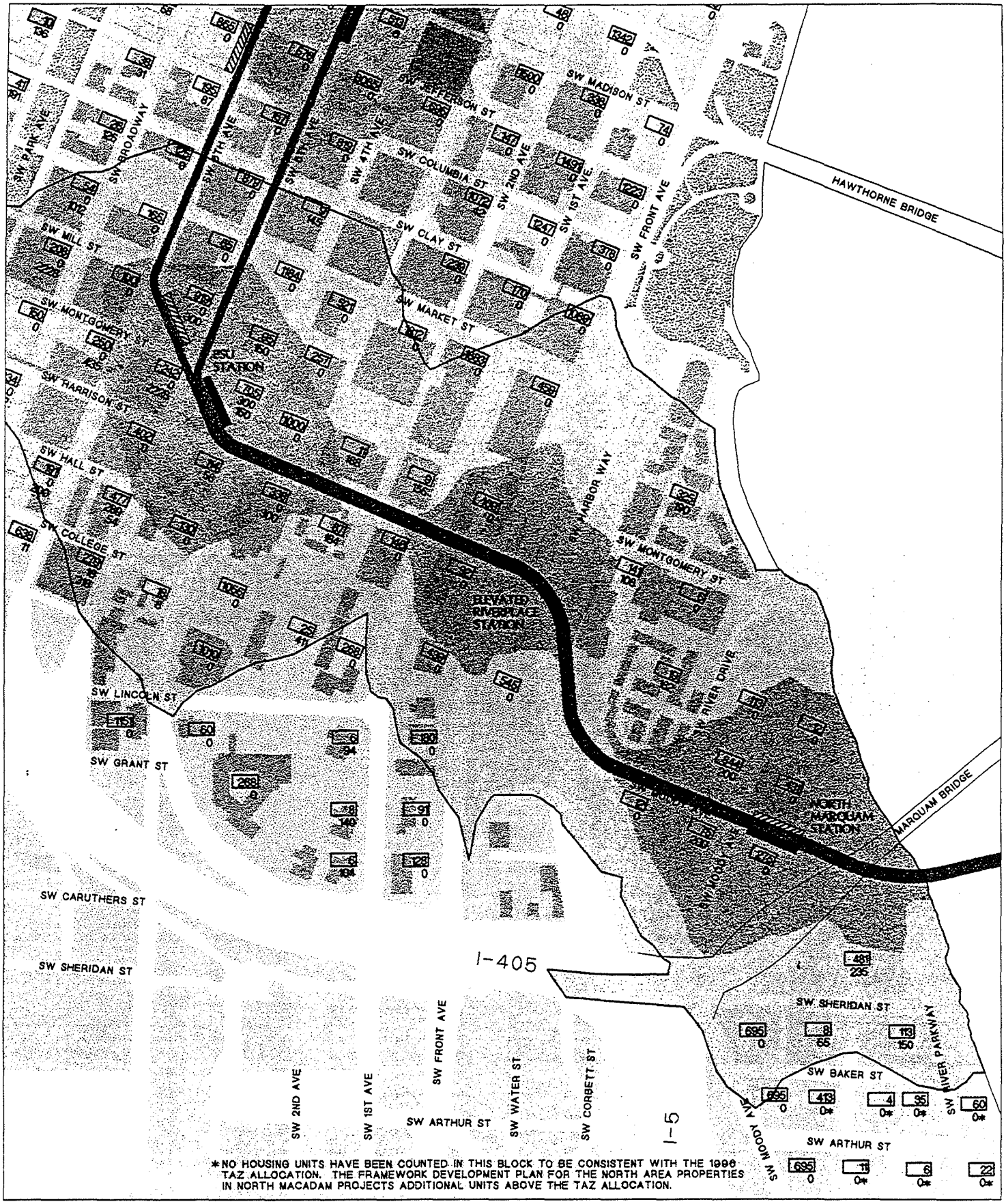
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, RIVERPLACE, AND NORTH MARQUAM STATIONS SOUTHBOUND – OPTION 5

0 200' 400'

KEY

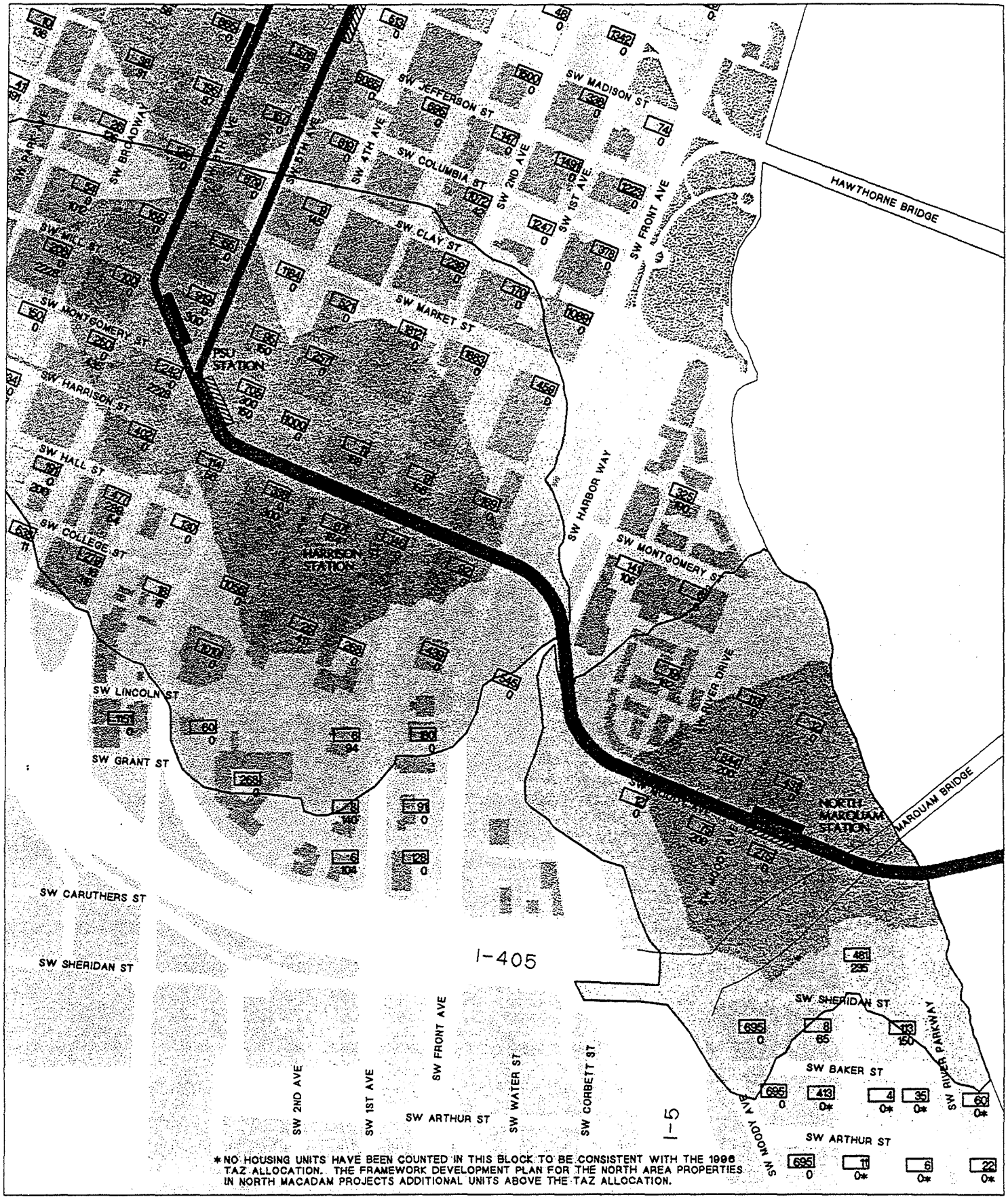
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, HARRISON ST., AND NORTH MARQUAM STATIONS NORTHBOUND – OPTION 6

0 200' 400'

KEY

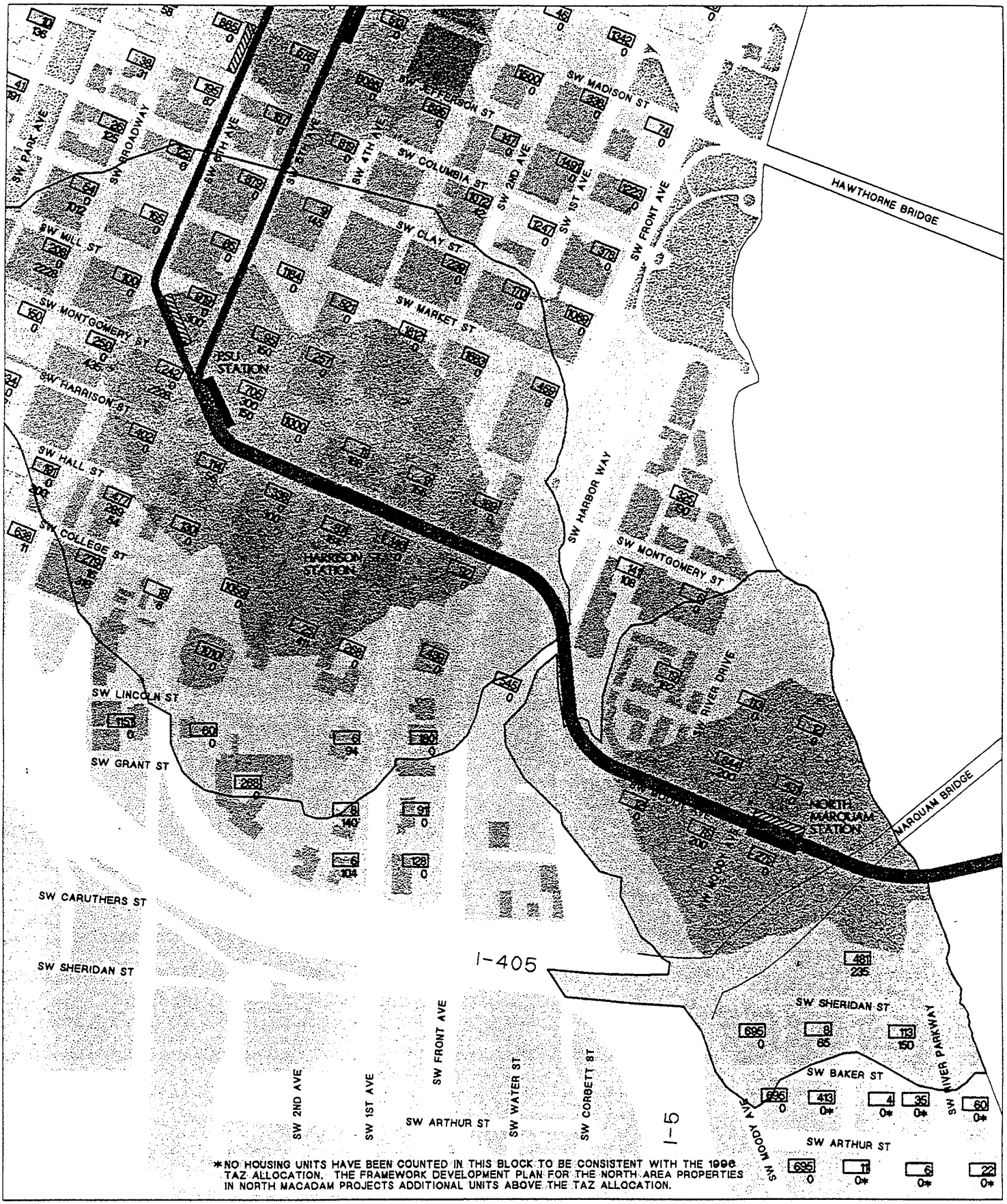
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, HARRISON ST., AND NORTH MARQUAM STATIONS SOUTHBOUND - OPTION 6

0 200' 400'

2.5 MIN. WALK ISOCHRON

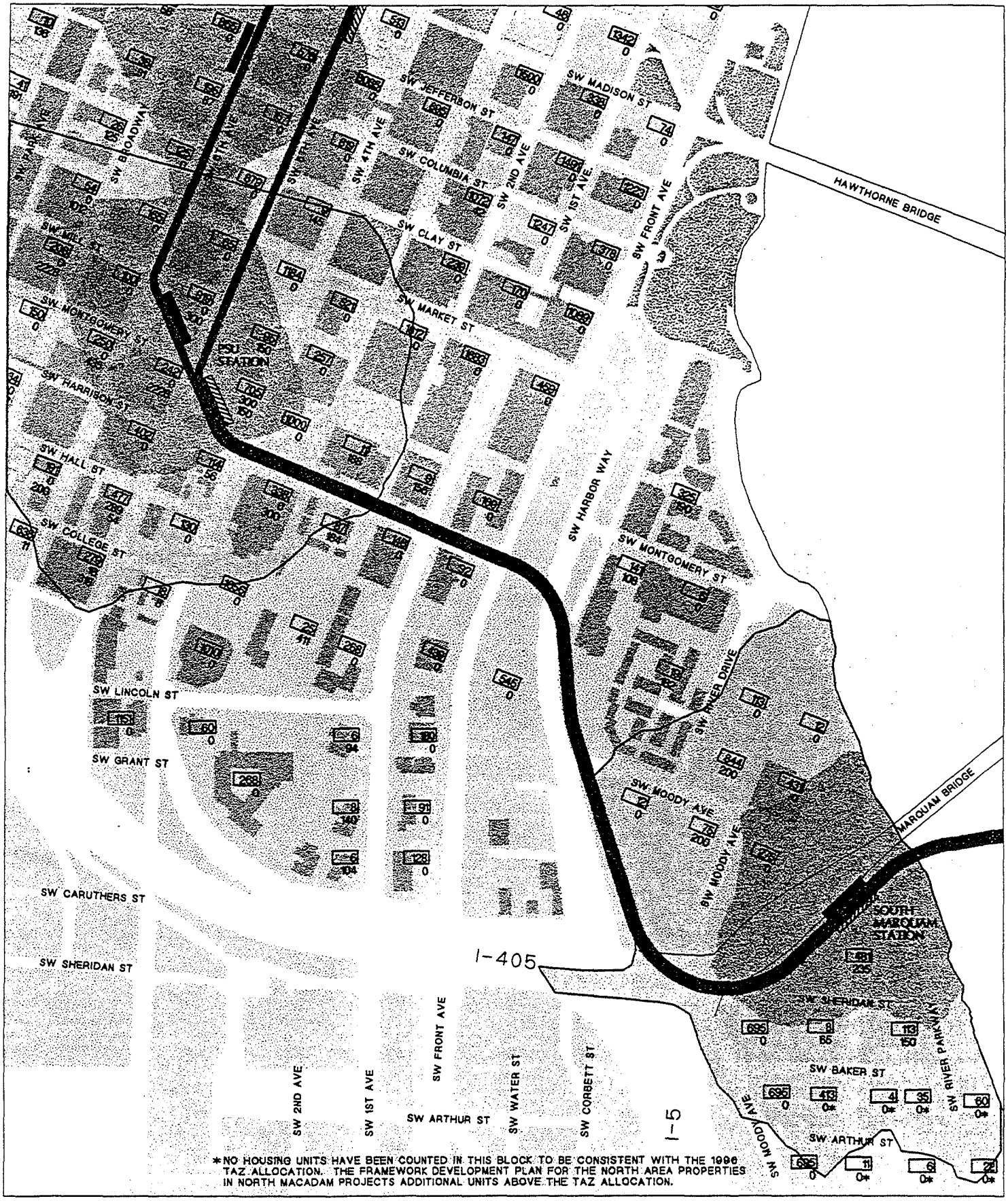
5 MIN. WALK ISOCHRON

KEY

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND SOUTH MARQUAM STATIONS (DEIS) NORTHBOUND – OPTION 7

0 200' 400'

KEY

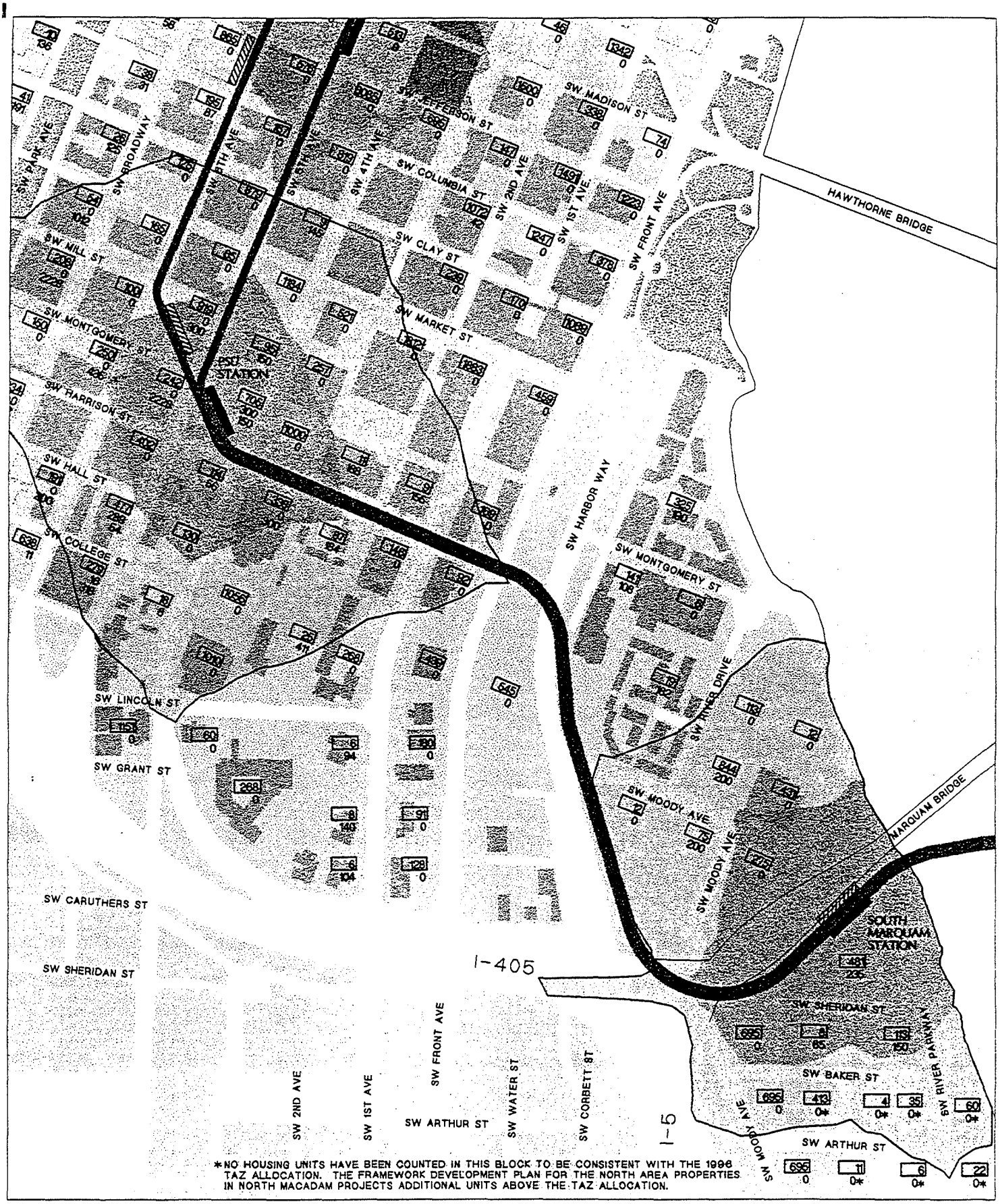
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU AND SOUTH MARQUAM STATIONS (DEIS) SOUTHBOUND - OPTION 7

KEY

0 200' 400'

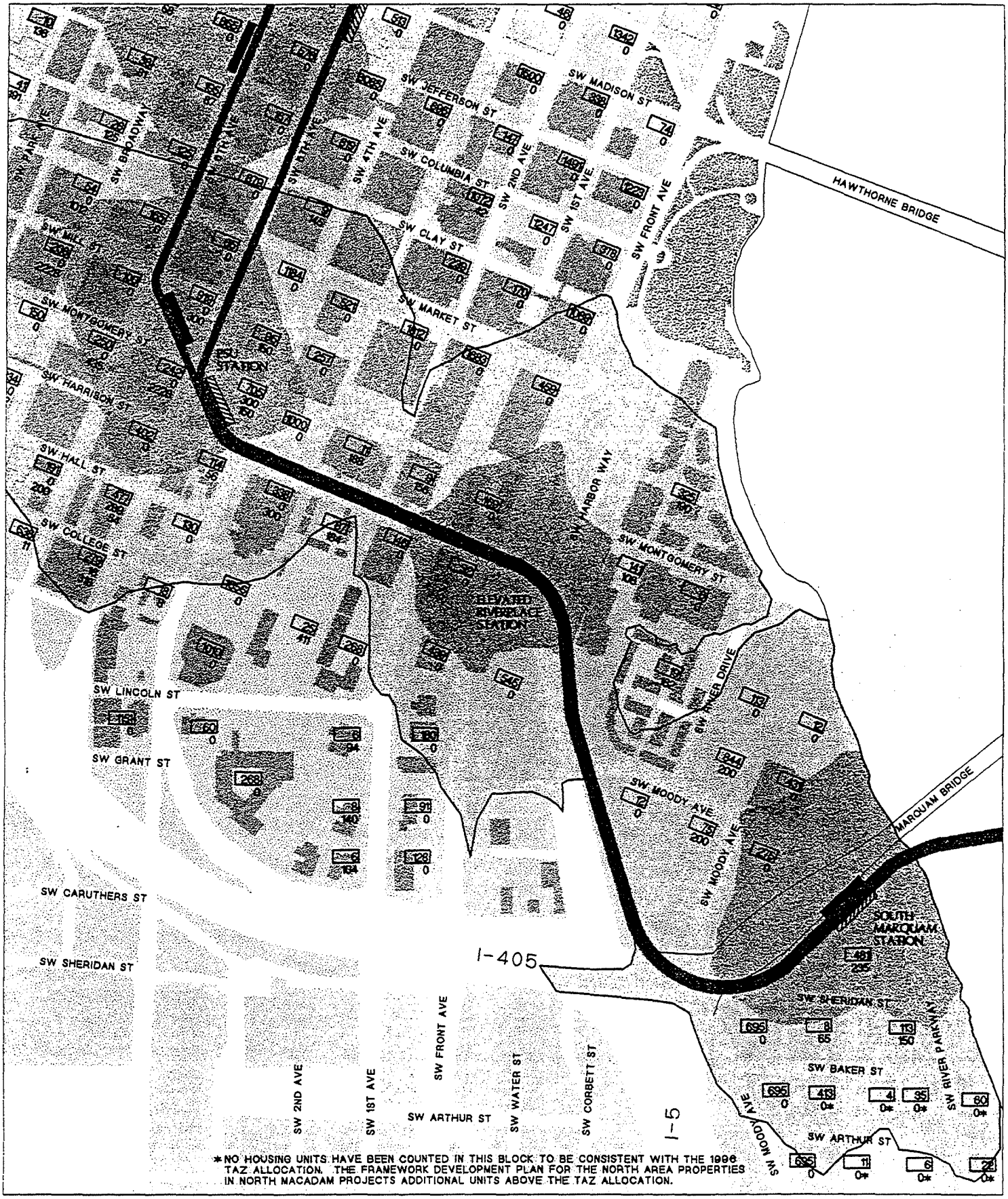
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South Portland

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, RIVERPLACE, AND SOUTH MARQUAM STATIONS NORTHBOUND – OPTION 8

KEY

0 200' 400'

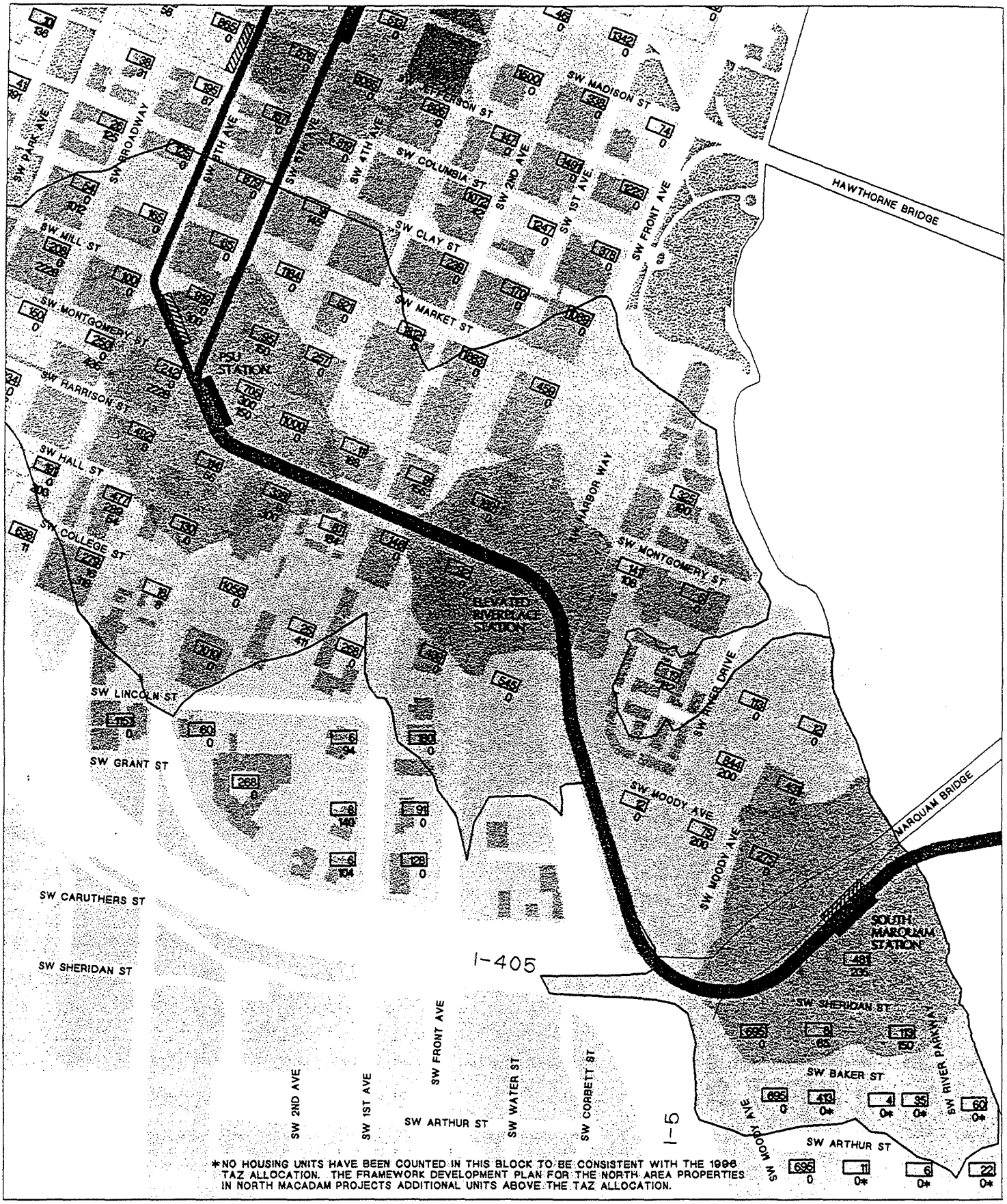
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, RIVERPLACE AND SOUTH MARQUAM STATIONS SOUTHBOUND – OPTION 8

KEY

0 200' 400'

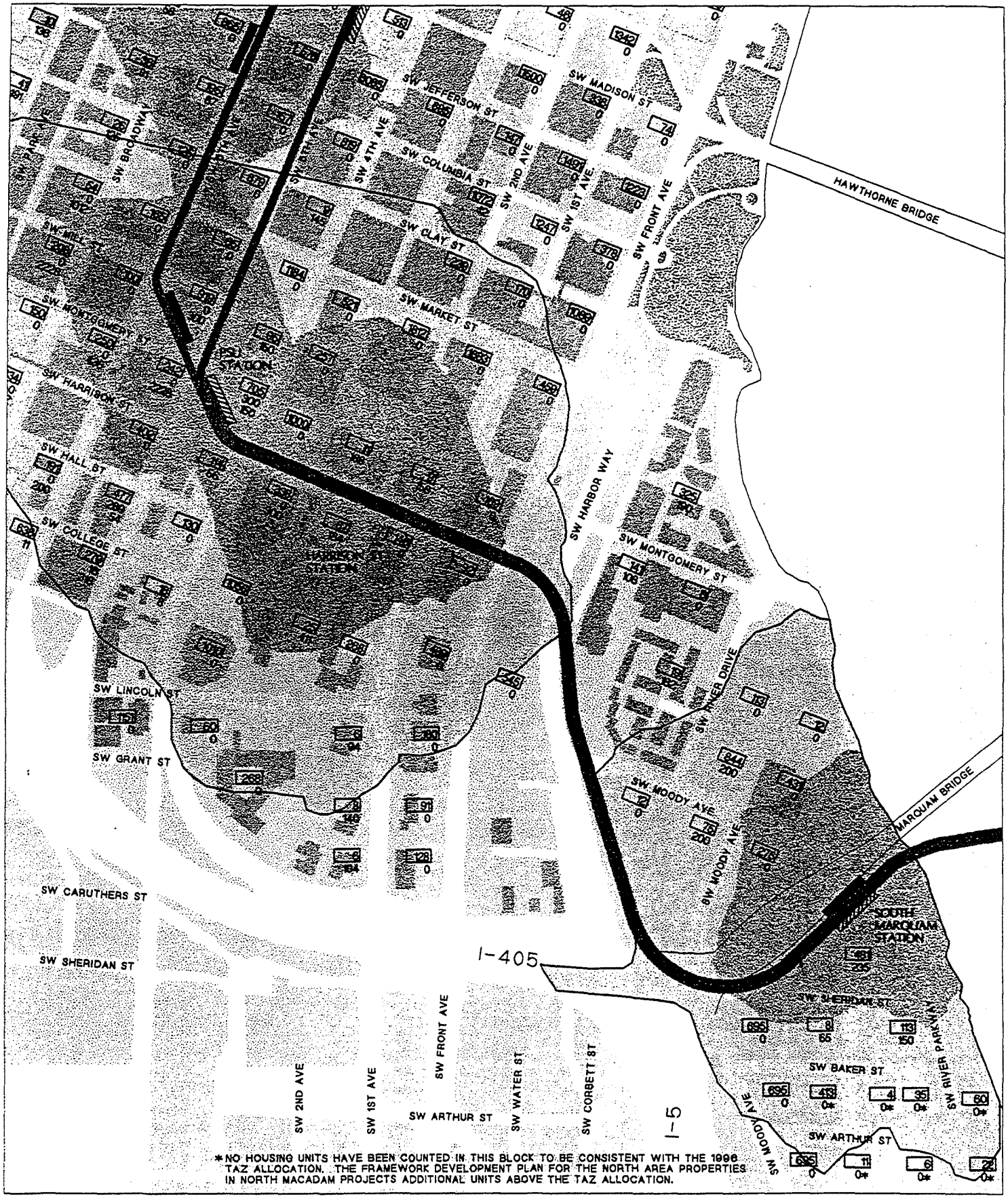
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, HARRISON ST., AND SOUTH MARQUAM STATIONS NORTHBOUND – OPTION 9

0 200' 400'

KEY

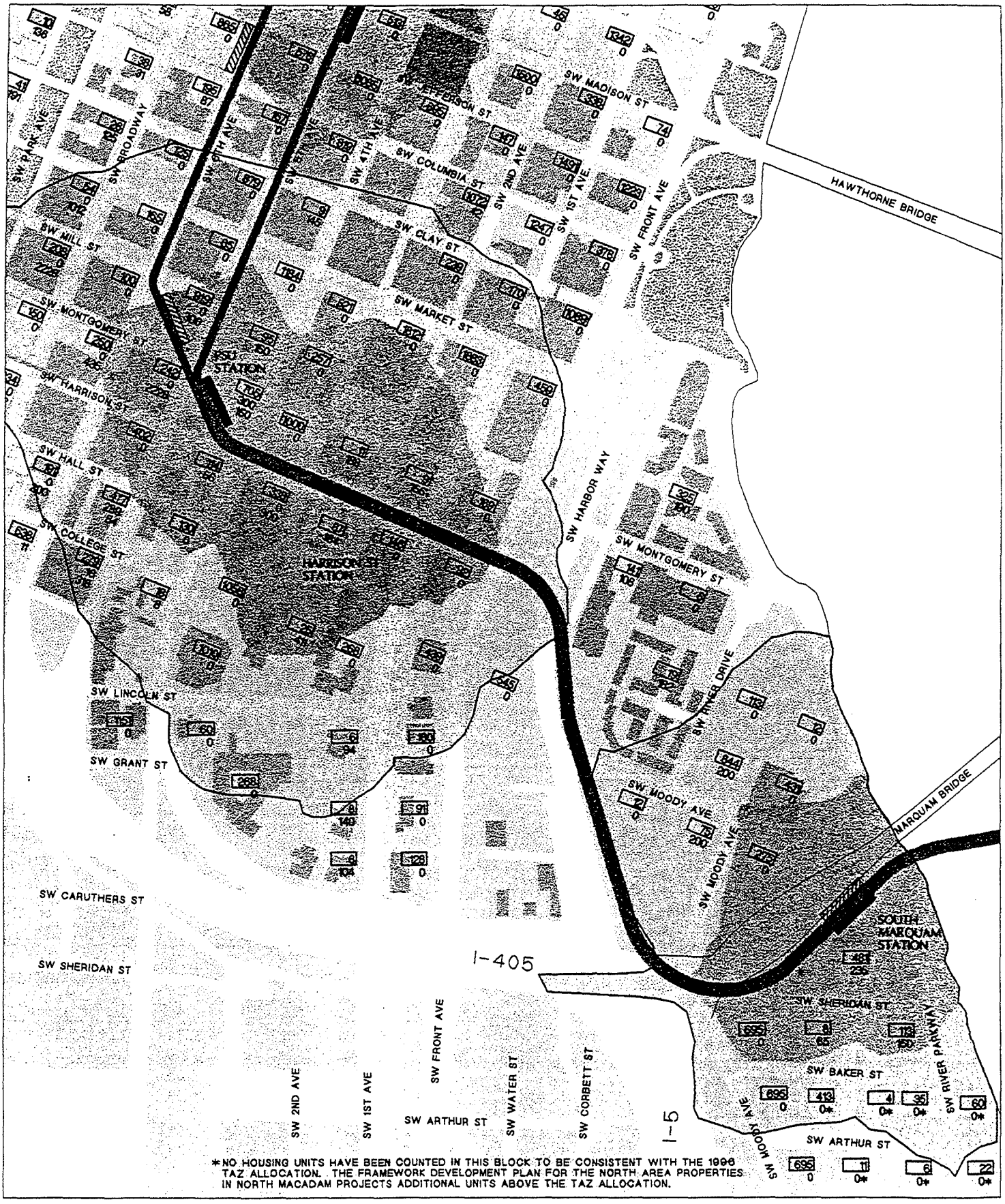
2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40



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South North

2015

POPULATION AND EMPLOYMENT WALK ISOCHRONS
PSU, HARRISON ST., AND SOUTH MARQUAM STATIONS SOUTHBOUND – OPTION 9

0 200' 400'

KEY

2.5 MIN. WALK ISOCHRON

5 MIN. WALK ISOCHRON

EMPLOYMENT — 100

HOUSING UNITS — 50

STUDENTS — 40

3.3 Travel Time Analysis

3.3.1 Methodology

The Ross Island Crossing options (Options 1,2,3) run from the Porter Station to the PSU Station. The Caruthers Crossing options (Options 4,5,6,7,8,9) run from the Clinton Station to the PSU Station. Comparisons between options can be made only between the Ross Island Crossing options or the Caruthers Crossing options. The methodology does not allow for a direct comparison between Ross Island and Caruthers options.

3.3.2 Travel Times

Two sets of travel times were completed for all options concerning the speed assumption for Harrison Street. The DEIS runs used the assumption that LRT speeds on Harrison Street would be 15 mph based on the existing grade and signal progression. The project requested to change this assumption to 25 mph to match the existing speed limit and due to signal pre-emption on Harrison between Front Avenue and PSU. The difference between the 15 and 25 mph runs is shown as the delta in the table below.

Table 2: South Entry Station Combination Options
Travel Times

South Entry Station Access Study - July 3, 1997	15 MPH Total Time (min.)	25 MPH Total Time (min.)	Delta (min.)	Total Distance (miles)
Ross Island Crossing Options				
Option 1 - PSU and RiverPlace (DEIS)	3.86	3.47	0.39	0.82
Option 2 - PSU and Moody/Harbor Drive	3.89	3.38	0.51	0.82
Option 3 - PSU, Harrison Street, and Moody/Harbor Drive	4.31	3.87	0.44	0.82
Caruthers Crossing Options				
Option 4 - PSU and North Marquam (DEIS)	6.01	5.51	0.50	1.66
Option 5 - PSU, RiverPlace, and North Marquam	6.55	6.04	0.51	1.66
Option 6 - PSU, Harrison Street, and North Marquam	6.44	6.00	0.44	1.66
Option 7 - PSU and South Marquam (DEIS)	6.28	5.78	0.50	1.79
Option 8 - PSU, RiverPlace, and South Marquam	6.86	6.35	0.51	1.79
Option 9 - PSU, Harrison Street, and South Marquam	6.7	6.27	0.43	1.8

The analysis shows that *replacing* the RiverPlace station with Harrison Street does not change the overall travel time by more than 5 seconds. *Replacing* the RiverPlace Station with a Moody/Harbor Drive station has a similar effect, changing the overall travel time by only 5 seconds. *Adding* a Harrison Street station adds 30 seconds to the overall time.

3.4 Ridership Analysis

The nine South Entry station combinations have been evaluated based on each combinations' potential impact on South/North LRT ridership. Potential ridership impacts come from two sources:

- from differences in the areas served by each station combination (access-based),
- from variations in light rail run time which impacts trips traveling through the South Entry area (run time-based).

This section describes the methodology and results of the South/North LRT ridership assessment for each of the nine station combinations.

3.4.1 Background

Metro prepares travel demand forecasts that are used to evaluate a wide range of transportation issues throughout the region. Regional travel forecasting models are used to prepare forecasts which consider a variety of factors which can influence trip-making. These models provide the foundation for the development of the ridership evaluation methods used to compare among the South Entry station combinations.

Factors which influence the forecasting of transit demand and ridership include the cost of auto and transit trips, the quality of service and the service coverage. For purposes of this analysis we have assumed that several factors remain the same as we compare among the South Entry station combinations. For example, the auto-based factors would not change based on LRT station location, the cost factors would not change, and for this assessment we have assumed the headways of the LRT service and the adjacent bus service would be the same. All of these assumptions are reasonable as none of these factors which can affect transit demand are related to light rail station location, This leaves two significant factors which can be isolated and measured as to each factors' influence on South/North light rail ridership.

Transit coverage varies among the South Entry station combinations. This study has evaluated the variations in transit service coverage of the station combinations using walk isochrons to measure the walk market area within a five minute walk of the stations included in the various station combinations. This provides a means of differentiating among the number of jobs and households within the five minute walk market for each of the nine station combinations.

The light rail run time can vary based on the alignment and based on the number of stations. In particular the station combinations with an additional station tend to have a longer travel time. The run time estimates show that the three-station combinations tend to add about 1/2 minute of time to a trip traveling through this South Entry area compared with the combinations which have two stations.

This evaluation uses an analysis of both coverage and run times and blends them together to provide a composite ridership impact for each of the nine station combinations. The methods for evaluating each are presented in more detail below.

3.4.2 Transit Coverage Method

As described earlier, a walk isochron approach was used to estimate the geographic area served within a 5-minute walk for each station combination. For the nine geographic areas served by the nine station combinations the number of jobs and households forecast for year 2015 were identified. Using this data as a base, the following simplified ridership forecasting technique was applied.

Step One - Trip Generation/Mode Split - Transit trips were estimated by using actual model data to determine the number of transit trips produced in and attracted to the South Entry area. This allowed the development of a rate for transit trips produced per household and transit trips attracted per employee. This rate was applied to the walk isochron household and employment data and an estimate of transit trips to and from each of the nine market areas was prepared. The following table presents the number of employees and households in the nine market areas and the table includes the estimate of transit trips to and from the market area.

Step Two - Trip Distribution/Assignment - A key determinant of whether a transit trip would be influenced by changes in access to South/North light rail in the South Entry area is whether that transit trip has an origin or destination in an area served by South/North light rail. The regional model was used to evaluate data on the origin and destination of transit trips to and from the South Entry area. The first step to accomplish this was to break out the trips into seven geographic areas. The following table presents the geographic areas and the percentage, of transit trips to and from the south entry area that have an origin or destination in those areas.

Table 3: South Entry Transit Trips Per Employee and Per Household (2015)

	Walk Market Area Households (2015)	Walk Market Area Employment (2015)	Transit Trips per Household	Transit Trips per Employee	Transit Trips to S. Entry Area	Transit Trips from S. Entry Area
Ross Island Crossing						
PSU and RiverPlace (DEIS) Option 1	2200	17700	1.1	.62	10974	2420
PSU and Moody/ Harbor Drive (DEIS) Option 2	2500	15100	1.1	.62	9362	2750
PSU, Harrison, and Moody/Harbor Drive Option 3	3000	20400	1.1	.62	12648	3300
Carruthers Crossing						
PSU and North Marquam (DEIS) Option 4	2700	15700	1.1	.62	9734	2970
PSU, RiverPlace, and North Marquam Option 5	3200	20700	1.1	.62	12834	3520
PSU, Harrison, and North Marquam Option 6	3200	21000	1.1	.62	13020	3520
PSU and South Marquam Option 7	2600	17100	1.1	.62	10602	2860
PSU, RiverPlace, and South Marquam Option 8	3300	22200	1.1	.62	13764	3630
PSU, Harrison, and South Marquam Option 9	3100	22400	1.1	.62	13888	3410

Table 4: Transit Trip Demand to/from South Entry Area

AREA	% of All Transit Trips Destined to S. Entry Area from the following origins	% of All Transit Trips Originating in S. Entry Area to the following destinations	% of All Transit Trips between S. Entry Area and the following origin/destinations that use S/N LRT
Downtown	10%	53%	50%
Central City Area (non-Downtown)	4%	7%	50%
N. Portland	8%	3%	50%
SE Portland	14%	9%	50%
Clackamas County (east of Willamette)	7%	2%	100%
Clark County (w/in S/N Corridor)	2%	1%	100%
All Non-Corridor Locations	54%	25%	10%
TOTAL	100%	100%	NA

The table also includes an estimate of the proportion of transit trips between the geographic areas and the south entry area that would utilize South/North LRT. This estimate was derived from model output and recognizes that the south entry area is served by buses as well as by South/North LRT. Bus service to the area is assumed to serve areas that buses serve today such as 5th and 6th Avenues near PSU, Front Avenue, Market Street and Lincoln Street. Another bus service assumption is that the Macadam Avenue bus service with the #35 and #36 buses would be routed along Moody Avenue to serve the North Macadam and RiverPlace areas.

The proportion of transit riders using South/North LRT varies depending on the origin or destination of the trip. For locations in Clackamas County south of Milwaukie a transit rider must utilize South/North LRT between the Milwaukie Transit Center and Central Portland (including the south entry area) as it is the only transit option. The same is true for Clark County trips, assuming a full length alignment. Trips to and from locations such as Southeast Portland and North Portland have a range of transit options including in some cases one-seat rides on buses.

The next step is to apply the distribution of trips to the transit trips identified in step one. The result of this step is an estimate of the set of transit riders that would potentially use South/North LRT for a portion of their trip. The walk market ridership for the station combinations fall within a range consistent with the regional model results for the RiverPlace and PSU stations. The actual forecasts may differ slightly from the regional model assignment due to differences in the geographic coverage of the transportation analysis zones (TAZ) compared to the walk isochron market areas. The following table presents data on the walk market area South/North LRT riders.

Table 5: S/N LRT Ridership to/from Walk Market Areas (2015)

	Employment-Based Transit Trip Attractions	Employment-Based South/North LRT - Riders	Household-Based Transit Trip Attractions	Household-Based South/North LRT Riders	Total S/N LRT Riders
Ross Island Crossing PSU and RiverPlace (DEIS) Option 1	10974	3556	2420	784	4340
PSU and Moody/ Harbor Drive (DEIS) Option 2	9362	3033	2750	891	3924
PSU, Harrison, and Moody/Harbor Drive Option 3	12648	4098	3300	1069	5167
Caruthers Crossing PSU and North Marquam (DEIS) Option 4	9734	3154	2970	962	4116
PSU, RiverPlace, and North Marquam Option 5	12834	4158	3520	1141	5299
PSU, Harrison, and North Marquam Option 6	13020	4218	3520	1140	6358
PSU and South Marquam Option 7	10602	3435	2860	927	4362
PSU, RiverPlace, and South Marquam Option 8	13764	4460	3630	1176	5636
PSU, Harrison, and South Marquam Option 9	13888	4500	3410	1105	6606

3.4.3 Light Rail Run Time Ridership Impacts

The ridership impact of variations in light rail run time among the nine station combinations can be measured by applying the regional mode choice model. The mode choice model uses a wide range of inputs to develop a forecast of the number of trips using transit for the 2015 forecast year. One of the key mode choice variables is the travel time that is available on the transit system. For trips using South/North light rail, that travel time is dependent, in part, on the run time for the LRT system.

For purposes of this analysis we have added increments of time which are representative of the station combination run time variations to a base model run. This sensitivity test found that an added minute of LRT run time between RiverPlace and PSU would result in a decrease in South/North LRT ridership of approximately 400 trips per day.

The two-station combinations being examined in the South Entry Station study have LRT run times similar to the base model run. The three-station combinations show slight variations in run time but are all approximately 30 seconds slower than the two station combinations. For purposes of this analysis we have treated all of the three-station combinations the same and applied a 30 second impact to through ridership for each of the three-station combinations. The result of this assessment shows a loss of 200 through-riders (based on a loss of 400 with a 60 second run time differential) with any of the three station combinations.

Combined Ridership Impact

The following table presents information from both the walk market area analysis and the through-rider impact assessment. The combination of data from both analyses allows for an approximation of the ridership impact of station combinations that serve different markets and have different run times.

Table 6: Net South/North LRT Ridership

Station Combinations	Walk-Market Based South/North LRT Riders	LRT Run Time Change from Base South/North LRT Run	Change in South/North LRT Riders Based on Run Time Change	Net South/North LRT Ridership Estimate by Station Combination
Ross Island Crossing PSU and RiverPlace (DEIS) Option 1	4350	0	0	4350
PSU and Moody/ Harbor Drive (DEIS) Option 2	3900	0	0	3900
PSU, Harrison, and Moody/Harbor Drive Option 3	5150	30 sec.	-200	4950
Caruthers Crossing PSU and North Marquam (DEIS) Option 4	4100	0	0	4100
PSU, RiverPlace, and North Marquam Option 5	5300	30 sec.	-200	5100
PSU, Harrison, and North Marquam Option 6	5350	30 sec.	-200	5150
PSU and South Marquam Option 7	4350	0	0	4350
PSU, RiverPlace, and South Marquam Option 8	5650	30 sec.	-200	5400
PSU, Harrison, and South Marquam Option 9	5600	30 sec.	-200	5400

The data in the above table is not intended as a complete forecast of South/North ridership in the south entry area. This process utilizes inputs from travel demand forecasts prepared for the South/North DEIS to compare potential ridership impacts among the station combination options.

3.5 Capital Cost Analysis

Capital costs for the nine South Entry Station combinations have been developed using the cost estimating methodology of the South/North DEIS as presented in *Capital Cost Methods Report* (Metro: May 1997). An additional station tends to increase alignment cost due to station construction, fare collection equipment, additional roadwork and the slower overall travel time which increases the risk that additional light rail vehicles would be needed to maintain desired operating headways. This section describes the estimating methodology and presents capital cost estimates for each station combination.

3.5.1 Capital Costing Method

The capital costs are created from quantity take-offs and right-of-way estimates based on the conceptual engineering drawings prepared by Tri-Met. Estimates for the Riverplace, North Marquam and South Marquam stations were previously developed in the South/North DEIS estimates. New conceptual designs were prepared for the Harrison and Moody-Harbor Way stations to identify roadwork or grading changes beyond the DEIS designs. Estimates were prepared based on these new designs.

The capital cost estimates were created using the DEIS Capital Cost Methodology which is based on 18 capital cost categories (including ROW). The station site estimates included the LRT platforms, fare collection equipment, elevators, site grading, structures, retained fill, and modifications to adjacent streets or sidewalks. The estimates include contingency, engineering and administration, and right-of-way. All estimates are in 1994 dollars unless otherwise indicated.

3.5.2 Results

The following tables present the capital costs for each of the options evaluated in this report. This report does not attempt to compare costs between the Ross Island and Caruthers Alternatives or between the different Caruthers Design Options. The cost estimates are summarized in Table 7. Additional detail by cost category can be found in Tables 8, 9 and 10.

The DEIS Ross Island Alternative would include stations at PSU, Riverplace and Porter. Replacing the aerial Riverplace station with a ground-level Moody-Harbor Drive station would save approximately $0.6 M. However, replacing the aerial Riverplace station with a ground-level Moody-Harbor Drive station and adding a Harrison station would raise costs by $1.5 M.

The DEIS Caruthers/Moody Alternative would include the PSU and North Marquam stations. Adding an aerial Riverplace station would increase costs by $3.3 M while adding a Harrison station would increase costs by $2.1 M.

The DEIS Caruthers/South Marquam Alternative would include the PSU and South Marquam stations. Adding an aerial Riverplace station would increase costs by $3.5 M while adding a Harrison station would increase costs by $2.1 M.

Table 7a: South Entry Station Combination Capital Costs

Alternative		# Stations	1994$[1]	$ Delta
Ross Island				
1	PSU, Riverplace, Porter	3	$224.0 M	$0 M
2	PSU, Moody/Harbor, Porter	3	$223.4 M	($0.6 M)
3	PSU, Harrison, Moody/Harbor, Porter	4	$225.4 M	$1.5 M
Caruthers/Moody				
4	PSU, North Marquam	2	$223.4 M	$0 M
5	PSU, Riverplace, North Marquam	3	$226.8 M	$3.3 M
6	PSU, Harrison, North Marquam	3	$225.6 M	$2.1 M
Caruthers/South Marquam				
7	PSU, South Marquam	2	$228.3 M	$0 M
8	PSU, Riverplace, South Marquam	3	$231.8 M	$3.5 M
9	PSU, Harrison, South Marquam	3	$230.4 M	$2.1 M

Source: Fred Cooper Engineers, Andrew Janssen, Parsons Brinckerhoff Quade & Douglas. 1997.
All costs are in 1994 dollars.

1. All costs are from SW 4th/Harrison to a common point south of Brooklyn Yards. The actual costs of the PSU station are not included because they are common to each combination of stations.
2. All costs include the Brooklyn Yard operations and maintenance (O&M) facility to be consistent with the DEIS estimates. However, these costs are not completely comparable with the *South/North Capital Costs Report* because they include drawing number NA-00 which is typically not included in this segment. It was required to distinguish between options with and without a Harrison station.

Table 7b: Ross Island South Entry Capital Costs

	PSU, Riverplace, Porter	PSU, Moody/Harbor, Porter	PSU, Harrison, Moody/Harbor, Porter
Utilities	$2.2 M	$2.2 M	$2.2 M
Street Reconstruction	$3.2 M	$3.2 M	$3.2 M
Track Grade Construction	$7.8 M	$7.9 M	$7.9 M
Structures	$38.6 M	$38.3 M	$38.3 M
Trackwork	$7.2 M	$7.2 M	$7.2 M
Crossings	$2.5 M	$2.5 M	$2.5 M
Stations	$2.3 M	$2.2 M	$2.5 M
Fare Collection	$1.0 M	$1.0 M	$1.2 M
Park & Ride	$0 M	$0 M	$0 M
Traction Electrification	$4.6 M	$4.6 M	$4.6 M
Signal System	$3.7 M	$3.7 M	$3.7 M
Communications	$1.5 M	$1.5 M	$1.5 M
Special Conditions	$0.1 M	$0.1 M	$0.1 M
Maintenance Facility	$32.2 M	$32.2 M	$32.2 M
Light Rail Vehicles	$0 M	$0.1 M	$1.0 M
Sub-Total:	$107.0 M	$106.6 M	$108.0 M
Contingency in Category Costs	$25.7 M	$25.6 M	$25.7 M
Construction Sub-Total (A)	$132.6 M	$132.2 M	$133.8 M
Engineering & Administration (B)	$39.8 M	$39.6 M	$40.1 M
Right-of-Way	$43.0 M	$43.0 M	$43.0 M
ROW Contingency	$8.6 M	$8.6 M	$8.6 M
Row Sub-Total (C)	$51.6 M	$51.6 M	$51.6 M
1994$ Total (A+B+C)	$224.0 M	$223.4 M	$225.4 M

Source: Fred Cooper Engineers, Andrew Janssen, Parsons Brinckerhoff Quade & Douglas. 1997.
All costs are in 1994 dollars.

1. All costs are from SW 4th/Harrison to a common point south of Brooklyn Yards.
2. All costs include the Brooklyn Yard O&M facility.

Table 7c: Caruthers/Moody South Entry Capital Costs

	PSU, North Marquam	PSU, Riverplace North Marquam	PSU, Harrison, North Marquam
Utilities	$5.5 M	$5.5 M	$5.5 M
Street Reconstruction	$4.2 M	$4.2 M	$4.2 M
Track Grade Construction	$10.0 M	$10.0 M	$10.0 M
Structures	$23.4 M	$23.8 M	$23.4 M
Trackwork	$8.2 M	$8.2 M	$8.2 M
Crossings	$4.1 M	$4.1 M	$4.1 M
Stations	$1.8 M	$2.3 M	$2.1 M
Fare Collection	$1.0 M	$1.2 M	$1.2 M
Park & Ride	$0 M	$0 M	$0 M
Traction Electrification	$4.7 M	$4.7 M	$4.7 M
Signal System	$5.1 M	$5.1 M	$5.1 M
Communications	$1.5 M	$1.5 M	$1.5 M
Special Conditions	$0.2 M	$0.2 M	$0.2 M
Maintenance Facility	$32.2 M	$32.2 M	$32.2 M
Light Rail Vehicles	$3.1 M	$4.2 M	$4.0 M
Sub-Total:	$105.0 M	$107.2 M	$106.4 M
Contingency in Category Costs	$24.7 M	$25.0 M	$24.9 M
Construction Sub-Total (A)	$129.6 M	$132.2 M	$131.3 M
Engineering & Administration (B)	$38.9 M	$39.7 M	$39.4 M
Right-of-Way	$45.8 M	$45.8 M	$45.8 M
ROW Contingency	$9.2 M	$9.2 M	$9.2 M
Row Sub-Total (C)	$54.9 M	$54.9 M	$54.9 M
1994$ Total (A+B+C)	$223.4 M	$226.8 M	$225.6 M

Source: Fred Cooper Engineers, Andrew Janssen, Parsons Brinckerhoff Quade & Douglas. 1997.
All costs are in 1994 dollars.

1. All costs are from SW 4th/Harrison to a common point south of Brooklyn Yards.
2. All costs include the Brooklyn Yard O&M facility.

Table 7d: Caruthers/North Marquam South Entry Capital Costs

	PSU, South Marquam	PSU, Riverplace, South Marquam	PSU, Harrison, South Marquam
Utilities	$5.6 M	$5.6 M	$5.6 M
Street Reconstruction	$3.7 M	$3.7 M	$3.7 M
Track Grade Construction	$9.3 M	$9.3 M	$9.3 M
Structures	$26.0 M	$26.4 M	$26.0 M
Trackwork	$7.8 M	$7.8 M	$7.8 M
Crossings	$4.3 M	$4.3 M	$4.3 M
Stations	$1.8 M	$2.3 M	$2.1 M
Fare Collection	$1.0 M	$1.2 M	$1.2 M
Park & Ride	$0 M	$0 M	$0 M
Traction Electrification	$5.0 M	$5.0 M	$5.0 M
Signal System	$5.3 M	$5.3 M	$5.3 M
Communications	$1.6 M	$1.6 M	$1.6 M
Special Conditions	$0.1 M	$0.1 M	$0.1 M
Maintenance Facility	$32.2 M	$32.2 M	$32.2 M
Light Rail Vehicles	$3.6 M	$4.9 M	$4.5 M
Sub-Total:	$107.4 M	$109.7 M	$108.8 M
Contingency in Category Costs	$25.2 M	$25.5 M	$25.4 M
Construction Sub-Total (A)	$132.6 M	$135.3 M	$134.2 M
Engineering & Administration (B)	$39.8 M	$40.6 M	$40.3 M
Right-of-Way	$46.6 M	$46.6 M	$46.6 M
ROW Contingency	$9.3 M	$9.3 M	$9.3 M
Row Sub-Total (C)	$55.9 M	$55.9 M	$55.9 M
1994$ Total (A+B+C)	$228.3 M	$231.8 M	$230.4 M

Source: Fred Cooper Engineers, Andrew Janssen, Parsons Brinckerhoff Quade & Douglas. 1997.
All costs are in 1994 dollars.

1. All costs are from SW 4th/Harrison to a common point south of Brooklyn Yards.
2. All costs include the Brooklyn Yard O&M facility.

3.6 Comparative Evaluation of DEIS Options and New Options

3.6.1 Ross Island Crossing

The DEIS option for Ross Island Crossing proposes two stations: an elevated RiverPlace Station above Harbor Drive and a station at PSU (Option 1). The Station Access Study evaluated two additional options. Option 2 proposes an at-grade station at Moody St. and Harbor Drive (instead of the elevated RiverPlace Station) and a station at PSU. Option 3 proposes an at-grade station at Moody St. and Harbor Drive, a station on Harrison Street, and a station at PSU. The table below compares the two new options with the DEIS option.

Table 8: Comparison of New Options with DEIS Option (Ross Island Crossing)

New Options	Access to Jobs	Access to Housing Units	Travel Time	Ridership
Harbor Drive Station (Option 2)	-2,600 jobs	+300 houses	-5 seconds	-450 riders
Harrison Street and Harbor Drive Stations (Option 3)	+2,700 jobs	+800 houses	+24 seconds	+600 riders

- Moving the DEIS RiverPlace Station from its elevated location above Harbor Drive to an at-grade location at Moody Street and Harbor Drive, potentially reduces access to jobs (-2600 jobs), increases access to housing units (+300), and reduces daily ridership (-450 riders).
- Adding a station at Harrison Street in addition to a station at Moody Street and Harbor Drive, potentially increases access to jobs (+2700 jobs), increases access to housing units (+800), adds 24 seconds to travel time, and increases daily ridership (600 riders).

3.6.2 Caruthers Crossing via North Marquam Station

The DEIS option for the Caruthers Crossing via the North Marquam Station proposes two stations: an at-grade station on Moody Street outside the PGT Headquarters building, and a station at PSU (Option 4). The Station Access Study evaluated two additional options. Option 5 proposes an additional station, the elevated RiverPlace Station in addition to the North Marquam Station. Option 6 also proposes an additional station, located on Harrison Street, in addition to the North Marquam Station The table below compares the two new options with the DEIS option.

Table 9: Comparison of New Options with DEIS Option (Caruthers with North Marquam Design Option)

New Options	Access to Jobs	Access to Housing Units	Travel Time	Ridership
North Marquam and RiverPlace (Option 5)	+5,000 jobs	+500 houses	+32 seconds	+1,000 riders
North Marquam and Harrison St. (Option 6)	+5,300 jobs	+500 houses	+29 seconds	+1,050 riders

- Adding the elevated RiverPlace Station, in addition to the North Marquam Station, potentially increase access to jobs (+5000 jobs), increases access to housing units (+500), adds 32 seconds to travel time, and increases daily ridership (1000 riders).
- Adding the Harrison Street Station, in addition to the North Marquam Station, potentially increase access to jobs (+5300 jobs), increases access to housing units (+500), adds 29 seconds to travel time, and increases daily ridership (1050 riders).

3.6.3 Caruthers Crossing via South Marquam Station

The DEIS option for the Caruthers crossing via the South Marquam Station proposes two stations: an elevated station under the Marquam Bridge with stair connections to the planned River Parkway, and a station at PSU (Option 7). The Station Access Study evaluated two additional options. Option 8 proposes an additional station, the elevated RiverPlace Station in addition to the South Marquam Station. Option 9 also proposes an additional station, located on Harrison Street, in addition to the South Marquam Station The table below compares the two new options with the DEIS option.

Table 10: Comparison of New Options with DEIS Option (Caruthers with South Marquam Design Option)

New Options	Access to Jobs	Access to Housing Units	Travel Time	Ridership
South Marquam and RiverPlace (Option 5)	+5,100 jobs	+700 houses	+34 seconds	+1,050 riders
South Marquam and Harrison St. (Option 6)	+5,300 jobs	+500 houses	+29 seconds	+1,050 riders

- Adding the elevated RiverPlace Station, in addition to the South Marquam Station, potentially increase access to jobs (+5100 jobs), increases access to housing units (+700), adds 34 seconds to travel time, and increases daily ridership (1050 riders).
- Adding the Harrison Street Station, in addition to the North Marquam Station, potentially increase access to jobs (+5300 jobs), increases access to housing units (+500), adds 29 seconds to travel time, and increases daily ridership (1050 riders).

Appendix A
2015 Housing and Employment Projections Methodology

PDOT, February, 1997

METHODOLOGY: HOUSEHOLD AND EMPLOYMENT PROJECTIONS FOR DOWNTOWN PORTLAND

The Portland Office of Transportation (PDOT) generated block-by-block housing and employment estimates for the years 1994, 2015 and a longer-term or year 2020 scenario for the Downtown area bounded by Interstate 405 and the Willamette River. This work updated block-level population and employment estimates created during the study process for the Central City Transportation Management Plan (CCTMP) in 1990 and revised by PDOT in early 1995. The most recent estimates were generated in conjunction with a South/North Light Rail Station Access Study for Downtown Portland in order to determine the number of potential riders within each proposed station area.

Population and employment projections for the Portland metropolitan region were developed as part of the 2040 Regional Planning Process led by Metro. City of Portland and Metro staff jointly determined the appropriate share of regional job and housing growth expected to occur in different subareas of the city, including the central business district (CBD). PDOT's block-level estimates aggregate to match household and employment totals assigned to the CBD through this process. The years 1994 and 2015 are consistent with the study years for the Draft Environmental Impact Statement (DEIS) for the South/North Transit Corridor Study. The long-term or 2020 estimate represents a fuller growth scenario, reflecting housing goals described by River District development plans and the CCTMP.

This methodology report explains the assumptions and data sources used to allocate overall Downtown household and employment projections to the block level. The resulting household and employment estimates are depicted on the accompanying series of maps.

Employment

Block-level allocations for employment are based on the following:

- the floor areas of existing buildings devoted to different land use activities
- the floor areas of anticipated projects devoted to different land use activities
- direct reports from some public agencies on the number of employees in downtown buildings

Each of these data sources is described in more detail below.

Floor areas of existing buildings devoted to different land uses

Estimates of the number of employees per block are based on the floor area of existing building space devoted to different categories of land use activity. Building square footages are from County Tax Assessor data, and the area devoted to each type of land use was determined through surveys conducted in conjunction with development of the CCTMP in 1990. The CCTMP divided land uses into the following categories: office, retail, industrial, institutional, open space, and attractions. The building areas in each of these uses was updated based on recent building conversions or anticipated developments.

The floor areas devoted to different land use activities on each block were divided by employment density ratios as follows:

1 employee per 205 sf of office space
1 employee per 333 sf of retail space
1 employee per 750 sf of industrial space
1 employee per 16.67 housing units
1 employee per 1.33 hotel units

With the exception of the employment density for office uses, these ratios were developed by E.D. Hovee & Co. for the CCTMP High Growth Scenario and based on a study of average employment densities.

An employment density ratio of 275 sf per office employee was used for the 1990 CCTMP study. In the current round of allocations, this density was increased to 240 sf/office employee for the 1994 estimate and 205 sf in the 2015 and long-term scenarios. It is anticipated that densities will increase in the future along with demand for central city office space. We assumed a 94% occupancy rate for office uses in the 2015 scenario and a 92% occupancy rate for the longer-term scenario.

Floor areas of anticipated development

In addition to existing building areas in different land uses, we based future employment estimates on the anticipated developments listed in Figure 1. Anticipated development falls into four categories.

- *Committed projects* are those for which construction plans are definite.

  Examples: Morrison Tower, Phase I Union Station Housing, Agricultural Center.

- *Planned projects* are those in which an owner, developer, or public agency has initiated the land use application process or announced designs for a project.

  Examples: Fox Block, PSU Urban Center, Fred Meyer proposal for mixed-use development in River District.

- *Conceived projects* are those envisioned as part of a district plan or specific sites where a developer has at some point indicated interest in building.

  Examples: land use assumptions generated by PDC for the River District and Riverplace, projections created by PSU.

- *Redevelopment sites* are those where redevelopment is likely to occur based on existing land use, zoning, and floor-area-ratios.

  Example: The area between 9th and 13th Ave., Market and Salmon St. is residentially zoned and contains a number of surface parking lots which could redevelop into housing.

Information sources for anticipated development were land use applications, newspaper articles, district plans such as the River District Development Plan, and discussions with Portland Development Commission (PDC) and Planning Bureau staff.

Those projects which are most firmly committed are represented in the 2015 employment number which conforms to the downtown employment total used for the South/North DEIS. Projects which are more hypothetical or long-term were instead included in the 2020 employment scenario, which represents a longer horizon for new office and other development in the downtown.

It was assumed that the Central Post Office would continue to serve as a post office in the year 2015, as the U.S. Postal Service has indicated a desire to remain in this location. However, in a longer-term scenario, the site could redevelop into residential and retail uses.

Employment information supplied by agencies

Land uses classified in the CCTMP database as "institutional" represented a variety of activities without a single representative employment density ratio. Where government employees occupied a portion of a larger office building, and the area of that office building was available, the employment density ratio for office uses was used to estimate the number of employees. In other cases, we used information provided by agencies such as the U.S. Postal Service, U.S. General Services Administration, and Multnomah County about the number of public employees occupying downtown buildings.

Portland State University staff generated a set of block-by-block employment and housing projections for the PSU district. PSU's projections were incorporated into the current block-by-block employment allocation.

Households

Block-by-block household estimates were also developed for the years 1994, 2015, and a longer-term or 2020 scenario. As with employment estimates, household estimates for the year 2015 were held consistent within the downtown total for 2015 developed by Metro and City staff and used in the S/N DEIS process. Based on planned projects, development plans for various downtown subdistricts, and potential redevelopment sites, however, this 2015 housing control total was found to be relatively low. Many residential developments are already planned or under construction, and the city seems well on its way toward achieving the Central City Plan Goal of 10,000 more units in the downtown area. The longer-term or 2020 housing projection is a higher-growth scenario for housing development in the Central City than the DEIS 2015 total.

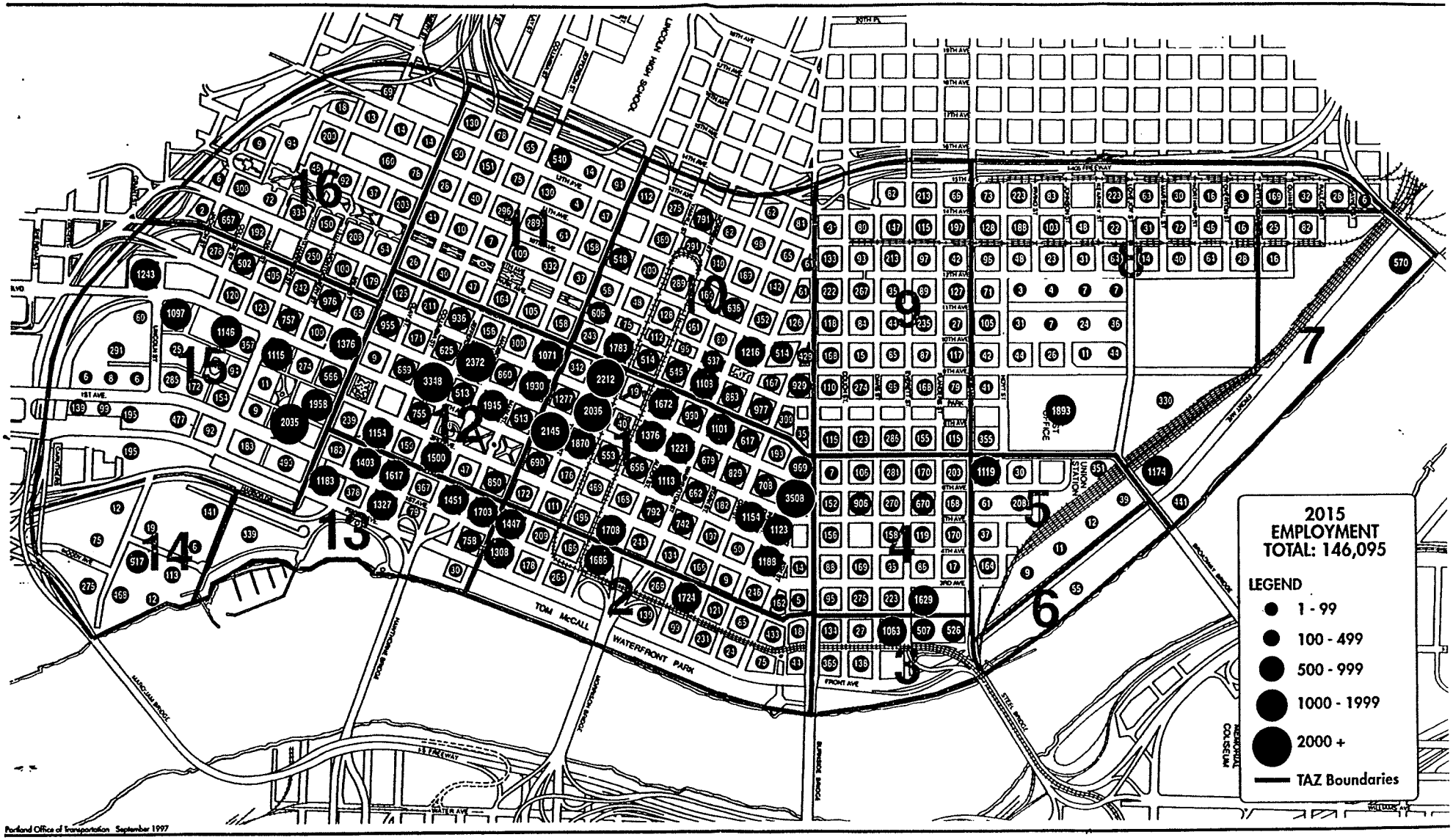
Previous analyses derived household estimates from U.S. Census population figures by dividing by a ratio for household size. The current block-by-block allocations used information about existing housing units and planned residential projects. This method was chosen because the housing unit data is relatively current and because the number of housing units more directly reflects the number of households with no need for a conversion factor.

PDC's 1992 Central City Housing Inventory was used to obtain a base number of existing housing units. Both single room occupancy (SRO) units and transient beds were included in these figures. New housing units developed between 1992 and 1994 were added to the existing inventory to obtain a figure for the number of 1994 households. Information regarding units developed between 1992 and 1994 came from a review of development applications in the central city as well as information provided by PDC and Planning Bureau staff.

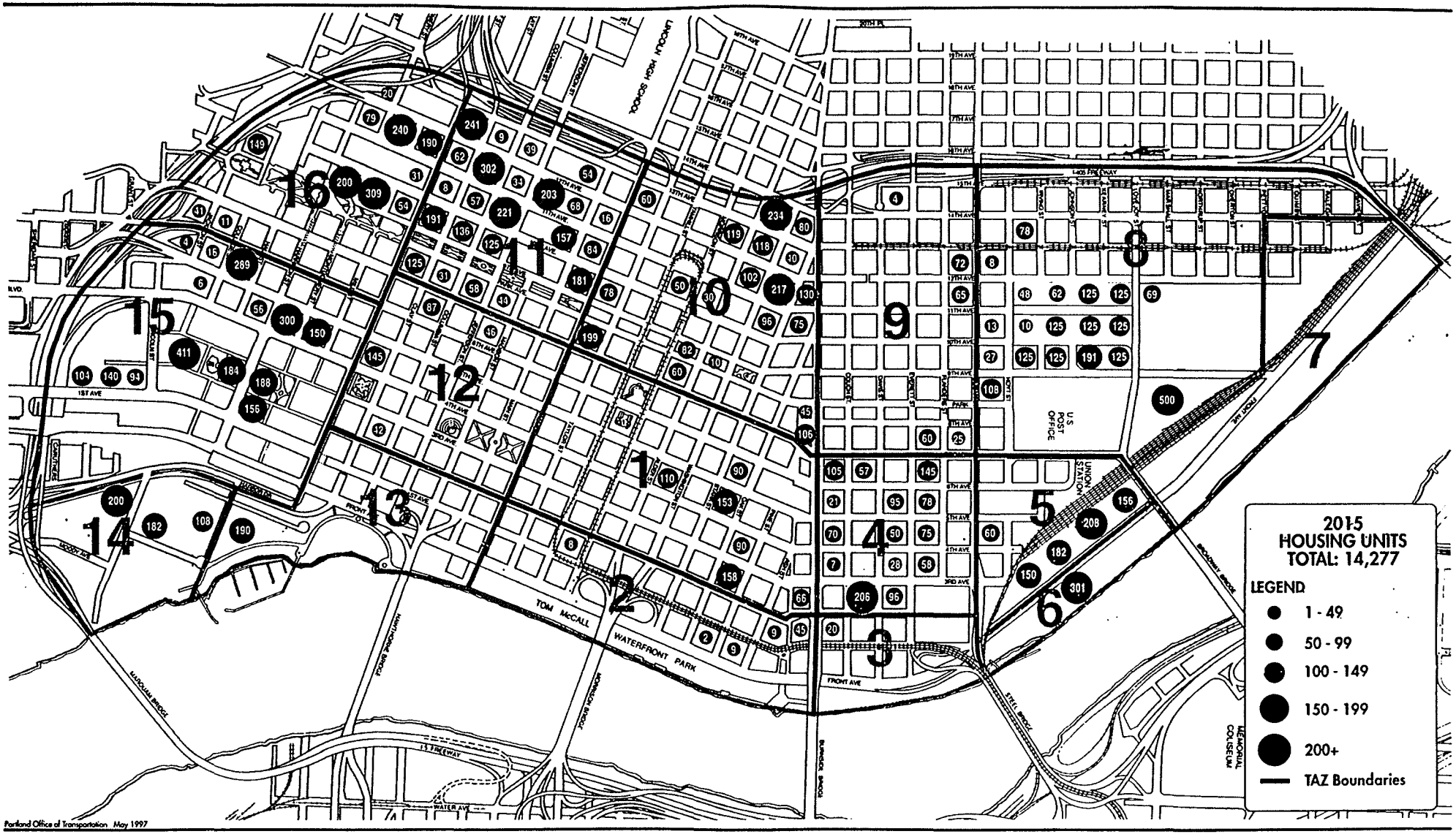
PDOT's block-by-block housing unit figures for 1994 aggregate to a total number of downtown households notably larger than the figure assigned to the CBD through the 2040 process. Because these estimates were based on existing unit counts which are considered relatively accurate, no attempt was made to rectify the total number of units with that used in the DEIS process for 1994.

As with future developments used to derive employment figures, future residential projects are categorized as *committed, planned, or conceived projects* , or *redevelopment sites* and listed in Figure 1. Information regarding future residential development was obtained from multiple sources. Plans for downtown subareas include the "Vision for a University District" for the area around Portland State, PDC estimates for development at Riverplace, and land use assumptions generated by PDC for implementation of the River District Plan. Parcel-level information was obtained from land use reviews, newspaper articles, and discussion with PDC, PSU, and Planning Bureau staff, as well as development or architecture firms involved with specific sites.

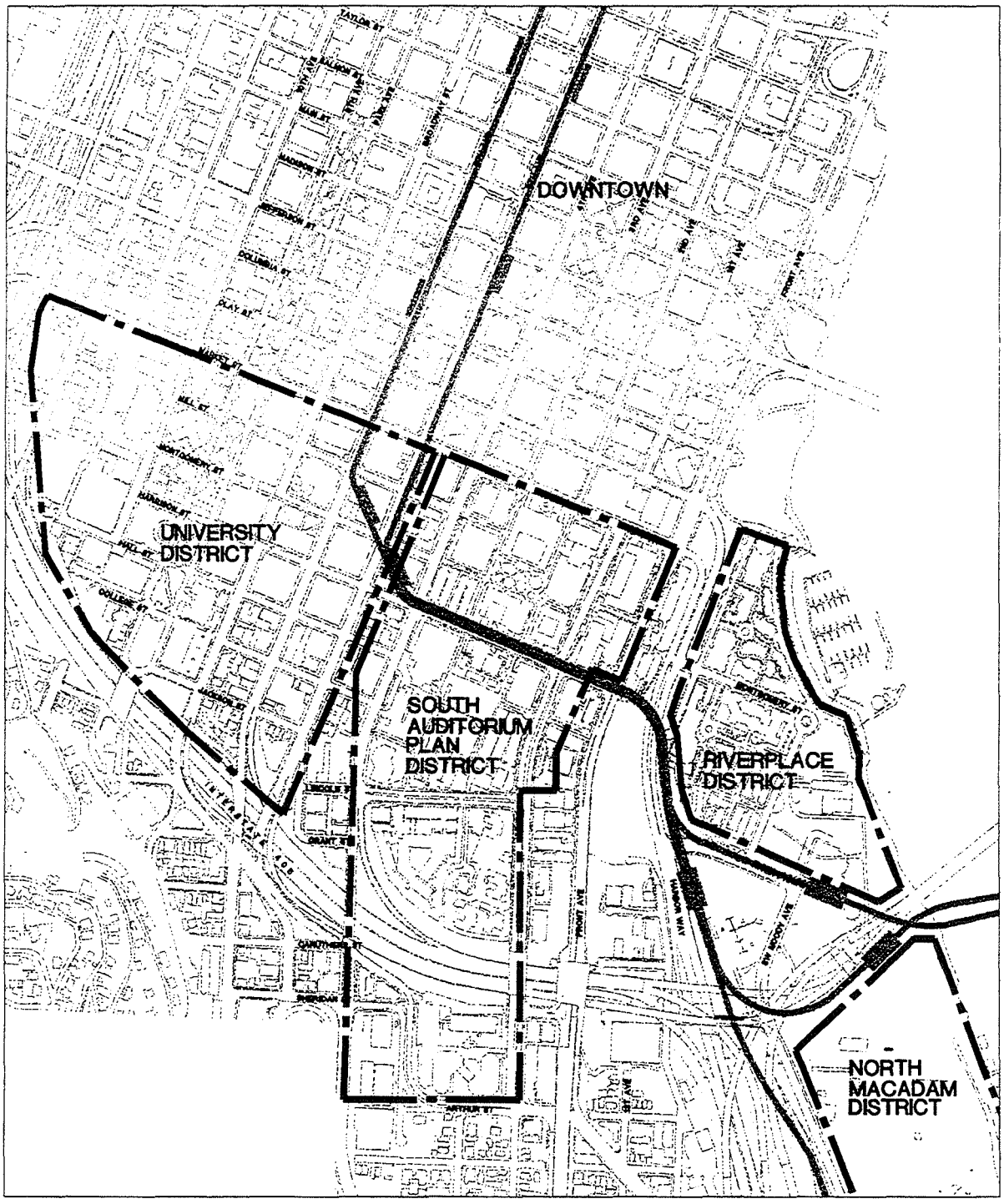
2015 EMPLOYMENT PROJECTION



2015 HOUSING UNITS



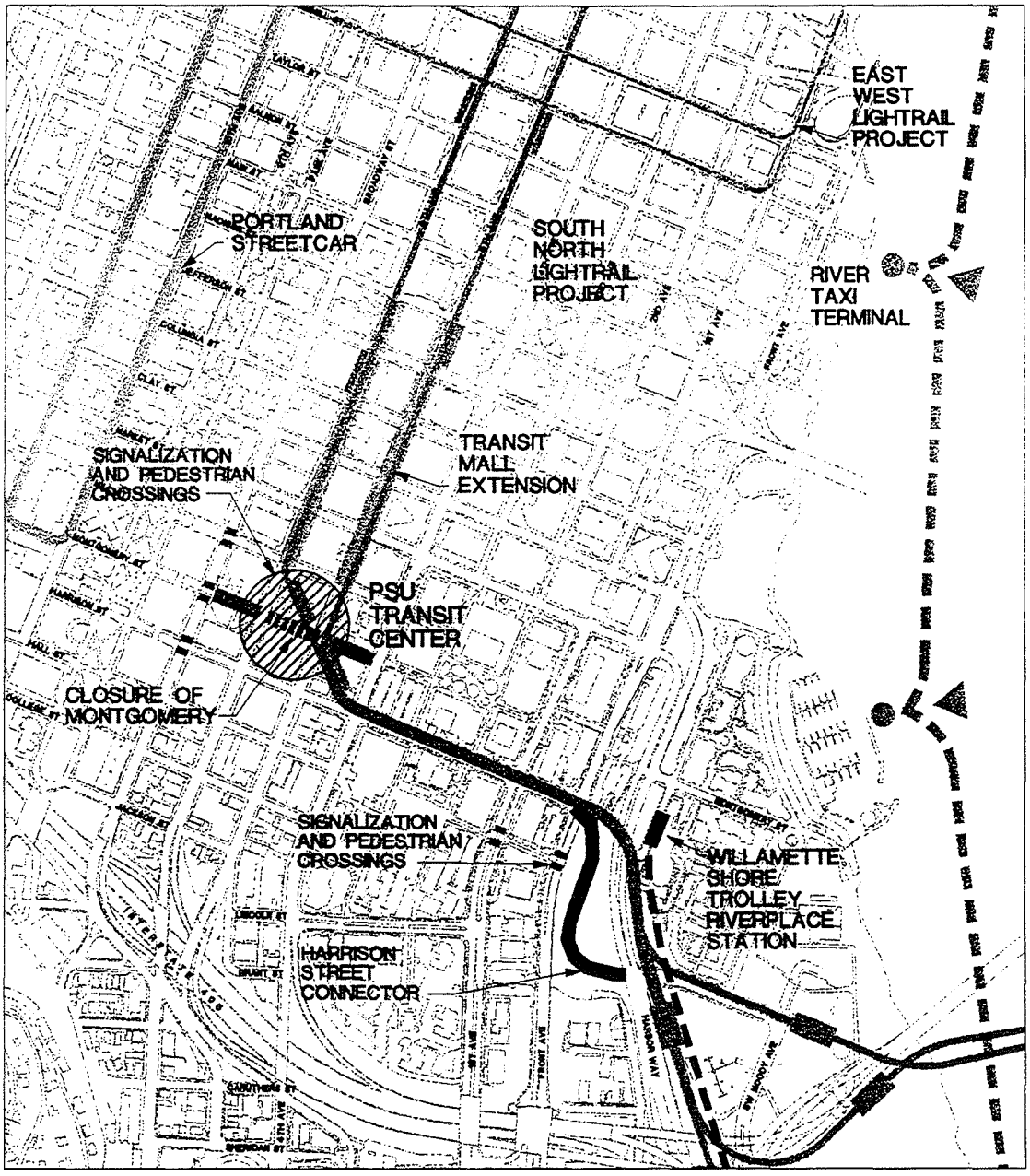
Appendix B
Maps of 2015 Infrastructure and Development



PLANNING CONTEXT: SPECIAL DESIGN AREAS

KEY

DISTRICT BOUNDARIES



South North

INFRASTRUCTURE CONTEXT: TRANSPORTATION PROJECTS

STATION AREA ASSESSMENT
SOUTH MALL

0 200' 400'

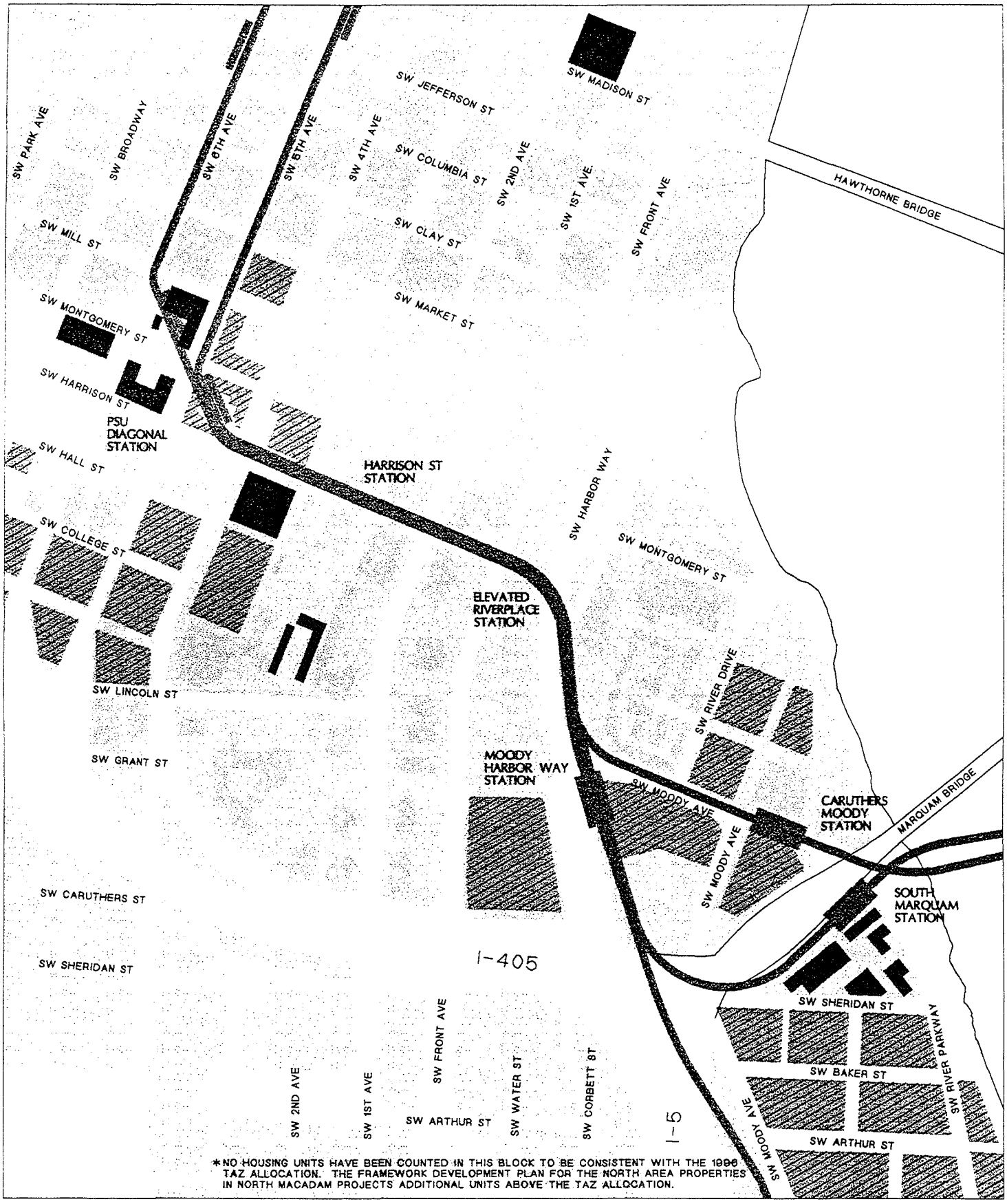
KEY

SIGNALIZATION AND PEDESTRIAN CROSSING

STREET CLOSURE

NEW STREETS

SMTRP



South North

NOVEMBER 1996 DRAFT

0 125 250

2015 DEVELOPMENT

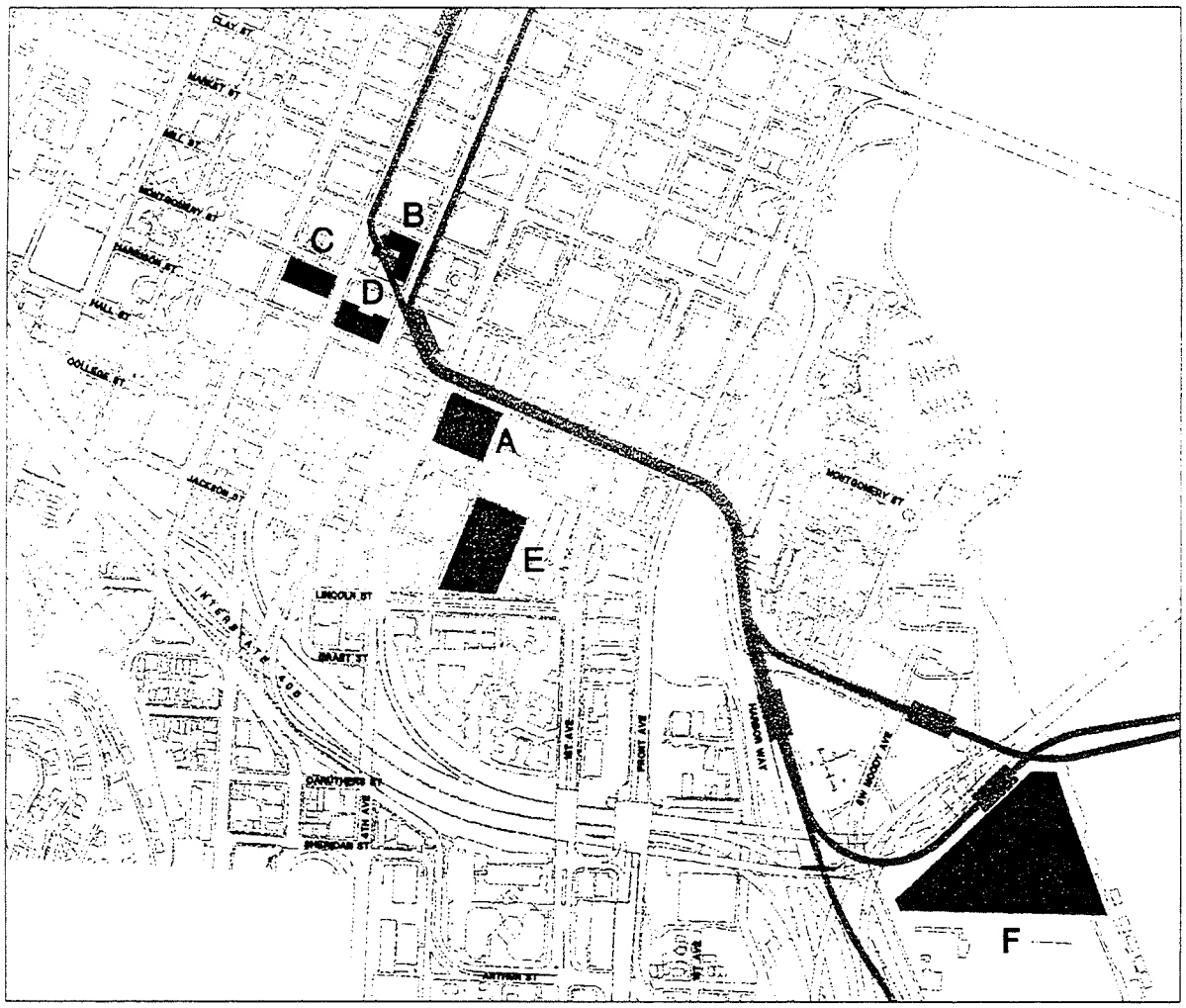
KEY

EXISTING DEVELOPMENT

PROPOSED DEVELOPMENT

POTENTIAL DEVELOPMENT

SDEV



A. U.S. WEST BUILDING CONVERSION FOR THE P.S.U. SCHOOL OF ENGINEERING: 20,000 SF

B. COMMERCIAL: 12, 700 SF
INSTITUTIONAL: 99,520 SF

C. COMMERCIAL: 7,600 SF

D. COMMERCIAL: 12,700 SF
INSTITUTIONAL: 99,520 SF

E. VILLAGE AT LOVEJOY FOUNTAIN
200 DWELLING UNITS

F. SCHNITZER DEVELOPMENT PHASE 1

COMMERCIAL: 100,000-120,000 SF
RETAIL: 10,000 SF
HOTEL: 150 ROOMS

South North

PROJECT CONTEXT: BUILDING PROJECTS

KEY
BUILDING SITES

0 200' 400'

SMUD