NELSON
NYGAARD

AGENDA

Event: Bend MPO Transit and Land Use Study- Technical Advisory Committee Meeting #1

Location: DeArmond Room, Deschutes Service Center, 1300 NW Wall Street

Date: February 15, 2012

Time: 1:00 PM to 4:00 PM

Time	Topic	Presenter
1:00 – 1:15	TAC Introductions	Tyler Deke and All
1:15 – 1:30	Review of Project Charter	Nelson\Nygaard
1:30 – 1:45	Overview of Public Involvement Process	Nelson\Nygaard
1:45 – 2:20	Existing Conditions Overview • Transit and Land Use • Roadways • Public Facilities	Nelson\Nygaard DKS OTAK
2:20 – 2:30	BREAK	
2:30 – 2:50	Transit – Land Use Coordination	Nelson\Nygaard
2:50 – 3:45	Opportunities and Outcomes • What are desired outcomes for coordinating land use and transit development? • How do land use and public facility plans affect future transit service and/or infrastructure? • How can transit development leverage land use goals and/or other desired outcomes?	Facilitated Working Groups
3:45-4:00	Wrap Up and Next Steps	Tyler Deke

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APPENDIX A

Fleet Inventory and Capital Finance Plan

Appendix A Fleet Inventory and Capital Finance Plan

Figure A-1 Bus and Dial-a-Ride Fleet

#	Eq. No.	Year	Make	Model	Seating	Wheelchairs	Mileage[1]
Bus Fleet							
1	7740	2001	FORD	ELDORADO	22	3-Rear	187,144
2	7751	2003	FORD	ELDORADO	18	3	163,958
3	7752	2003	FORD	ELDORADO	18	3	192,164
4	7753	2003	FORD	ELDORADO	18	3	198,219
5	7760	2007	FORD	Eld/AeroTech	16	2	130,775
6	7761	2007	FORD	Eld/AeroTech	16	2	136,080
7	7764	2008	CHEVY	Eldorado/Elite	25	2	117,362
8	7765	2008	CHEVY	Eldorado/Elite	25	2	119,635
9	7766	2008	CHEVY	Eldorado/Elite	25	2	112,015
10	7767	2008	CHEVY	Eldorado/Elite	25	2	109,802
11	7774	2011	Freight	Champion/Def	27	2	18,571
12	7775	2011	Freight	Champion/Def	27	2	19,104
Dial-a-Ride Fleet							
1	7750	2003	FORD	ELDORADO	18	3	162,774
2	7762	2008	FORD	NATIONAL	16	2	61,369
3	7763	2008	FORD	NATIONAL	16	2	61,508
4	7768 [a]	2009	FORD	ACCUBUILT	8	2	26,552
5	7769	2009	FORD	ACCUBUILT	8	2	24,050
6	7770	2009	FORD	ACCUBUILT	8	2	17,847
7	7771	2009	FORD	ACCUBUILT	8	2	21,873
8	7772 [a]	2009	FORD	ACCUBUILT	8	2	31,403
9	7773	2009	FORD	ACCUBUILT	8	2	25,520
10	7776	2011	FORD	Eldorado/Aerotech	18	3	10,790
11	7777	2011	FORD	Eldorado/Aerotech	18	3	12,289
12	7778	2011	FORD	Eldorado/Aerotech	18	3	11,401
13	7779	2011	FORD	Eldorado/Aerotech	18	3	9,984

Notes: (a) Temporarily assigned to CET. (b) As of October or November of 2011.

Source: Cascades East Transit

Figure A-2 Capital Finance Plan, FY 2010 – FY 2014

	FY2009/10	FY2010/11	FY2011/12	FY2012/13	FY2013/14
Facilities	$463,000 Bus Stop Improvements ARRA funded, no local match required	---	----	---	---
Van (8+passenger, 5 yr life)	$294,000 6 replacement vans @ $49,000 each ARRA funded, no match	--	---	---	---
Capitalized Equipment	$86,000 Security Cameras at bus stop facilities and on-board 7 buses ARRA funded, no match	---	---	---	---
Transit Bus (7yr life)	--	--	$129,000 Replace 1 existing bus Use existing 5309 grant with 20% local match	$133,000 Replace 1 existing bus Use existing 5309 grant with 20% local match	$137,000 Replace 1 existing bus 5309 earmark requested in T-Bill Reauthorization with 20% local match
Small Bus (16+ passenger, 5 yr life)	--	--	$132,000 Replace 2 units @ $66,000 each Request a 5310 grant via ODOT Discretionary Process. Will have a 10.27% grant match.	$134,000 Replace 2 units @ $67,000 each Request a 5310 grant via ODOT Discretionary Process. Will have a 10.27% grant match.	---
Low Floor Transit Bus (10+yr life)	--	--	--	--	$270,000 Replace 1 existing bus 5309 appropriation requested with 20% local match
Non Revenue Support Vehicles	---	New shift relief vehicle – No Capital Cost	---	---	New service truck – No Capital Cost

Source: Cascades East Transit

APPENDIX B

Public Facilities: Roadways

Appendix B Public Facilities: Roadways

Note: The material in this appendix supplements the information presented in the Public Facilities section of the main report.

Assessment of Roadway Conditions

3rd Street (Highway 97 Business Route)

3rd Street was originally Highway 97 prior to construction of the Highway 97 Bypass (Bend Parkway). It is Bend's only principal arterial, serving as the transportation spine for the City, servicing many of Bend's commercial and restaurant businesses and providing access to many of Bend's Collector and Arterial roadways. Because it was formerly a highway, it was constructed for freight loads and high traffic counts. The roadway generally consists of 4 lanes of traffic and a painted center median, narrowing to 2 lanes of traffic at the Burlington Northern railroad underpass located approximately at midpoint of its length, creating congestion as vehicle traffic merges.

South 3rd Street

This section of 3rd Street runs from Greenwood Boulevard south to the intersection with the Bend Parkway.

South of the CET Hawthorne Transfer Station, 3rd Street narrows from four to two lanes and dips below the Burlington Northern railroad tracks, the 3rd Street Underpass. This underpass aids in preventing traffic disruption when a train traverses the area. However it poses flooding concerns during a moderate to large storm event, often closing the underpass to vehicular traffic. (Refer to the stormwater section of this memo for additional details).

Sidewalk connectivity is generally good, with occasional gaps that force pedestrians to walk on the roadway or in vegetated areas. Most sidewalks do not comply with current accessibility standards. Bicycle lanes are present, but generally hazardous because of the high traffic speeds and congestion.

Future improvements:

- Pedestrian improvements, Franklin Avenue south to Murphy Road. The City of Bend received an ODOT grant in 2011 for design services. Construction funding has not been identified.. The Central Oregon Irrigation District (COID) canal south of Division Street is a major obstacle that forces pedestrians to use the roadway's shoulder to cross the bridge. In addition, it is anticipated that COID will be piping the canal in the future (timing and scope depend on funding). This could result in minor improvements below the 3rd Street Bridge or the removal of the bridge and the installation of a normal roadway section over the piped canal.
- Murphy Road crossing project. This long term project, with construction beginning in 2013, includes extending Murphy Road over the Bend Parkway, connecting into Brookswood Boulevard. Improvements include installation of new roundabouts at several new and existing intersections.
- 3rd Street Underpass stormwater project (2012). Refer to the stormwater section of this memo for more information.

North 3rd Street

North of Greenwood Avenue, 3rd Street is maintained by the City of Bend and ODOT. (This differs from 3rd Street south of Greenwood Avenue, where the City maintains this section exclusively.) The Bend Parkway has no off-ramp to Greenwood Avenue / Highway 20, thus freight traffic on Highway 20 utilizes this section of 3rd Street to connect to Highway 20 east, Highway 20 west, and Highway 97 north.

3rd Street is entirely curbed, with sidewalks installed along most of the corridor. Sidewalk connectivity is limited north of Norwood Road (north of Bend River Promenade). Bike lanes are available, but because of the high speeds and high traffic counts, they are rarely used.

Franklin Avenue

Franklin Avenue provides direct access to Bend's downtown commercial core. At the west edge of downtown Bend, the road becomes Riverside Drive and connects to Galveston Avenue and the Galveston Bridge, crossing the Deschutes River and providing access to northwest Bend. East of 3rd Street on Franklin Avenue, the roadway enters into a neighborhood and conveys traffic on Bear Creek Road to east Bend. Sidewalk and bicycle accessibility is good, with a grade-separated path above the underpass that allows safe passage away from vehicles. Many large events during the summer months occur in downtown and in Drake Park; transit helps transport people in and out of the congested area.

Comment [TD1]: The City received a bike/ped grant from the state to upgrade Riverside Avenue. More info: http://www.bendoregon.gov/index.aspx?page=693

Similar to 3rd Street (South), both Franklin Avenue and Greenwood Avenue have underpasses that are frequently blocked by flooding during large storm events, requiring alternate routes to downtown. When flooding occurs, traffic to northwest Bend is redirected to other bridged corridors, causing congestion. (The stormwater section of this report provides further discussion of improvements to mitigate flooding.)

Greenwood Avenue, Newport Avenue and Shevlin Park Road

East of 3rd Street, Greenwood Avenue is also designated as Highway 20 beyond Pilot Butte; it is maintained jointly by ODOT and the City of Bend. West of 3rd Street, Greenwood Avenue has an undercrossing, conveying traffic into downtown Bend and servicing businesses and tourist attractions. Greenwood Avenue becomes Newport Avenue west of downtown at the Newport Bridge crossing the Deschutes River, a corridor with some commercial businesses that also provides access to historic/residential neighborhoods. West of College Way, Newport Avenue changes to Shevlin Park Road, a corridor that provides access to many of Bend's larger church campuses, COCC, and residential neighborhoods.

Pedestrian sidewalk connectivity is good; however bicycle connectivity on this corridor is challenging due to congestion and on-street parking (Greenwood Boulevard).

Wall Street and Bond Street

Wall Street and Bond Street are two-lane one-way streets with on-street angled parking that serve as a couplet to convey traffic though the congested downtown corridor. At night, traffic is greatly reduced and signalized intersections revert to blinking four-way stop intersections.

These streets are well constructed for pedestrian traffic, however bicycle connectivity is challenging due to on-street angled parking.

Most of Bend's seasonal festivals are held in downtown and these streets are sometimes closed to vehicle traffic. Although transit service to this area is essential, these streets may be more difficult

to service because of pedestrian and vehicle congestion, with limited areas for bus traffic to pull out of the traffic.

Brookswood Boulevard

Brookswood Boulevard is the primary roadway providing access between the City of Bend and Deschutes River Woods, a large unincorporated community south of the Bend city limits. It also serves as the main corridor for many residential developments west of the Bend Parkway and east of the Deschutes River. There are still undeveloped residential lots along this corridor; therefore additional congestion is anticipated during full build-out conditions.

Pedestrian connectivity is not consistent along Brookswood Boulevard. Along much of the corridor, curbs and sidewalks were constructed by developers during the 1990s housing boom. However, there are also older neighborhoods where curbs and sidewalks were not required. Areas without sidewalks and curbs present pedestrian and bicycle safety concerns. Pedestrian connectivity is particularly inconsistent around the Pinebrook Boulevard area, and sight distance south of Pinebrook Boulevard is compromised by a large dip in the roadway at a sharp turn to the west.

Future improvements to Brookswood Boulevard will occur at Powers Road and at the new intersection created by the Murphy Road crossing project, south of Pinebrook Boulevard. Both intersections on Brookswood Boulevard will include the construction of roundabouts to aid in reducing speeds and conveying the high traffic counts along the corridor.

Mt. Washington Drive

This short section of this street that is served by the bus provides access to the limited business district in Northwest Crossing, a mixed-use neighborhood, and a small portion of the residential neighborhoods in the area.

Mt. Washington Drive is designated a minor arterial, generally providing two traffic lanes and a center median. Mt. Washington Drive traverses around the north and west side of Awbrey Butte, providing residents with access to Newport Avenue/Shevlin Park Road and 3rd Street. Mt. Washington south of the Awbrey Butte neighborhood provides access to Northwest Crossing, and direct access to Century Drive, the major roadway to Mt. Bachelor ski resort and the Cascade Lakes Highway.

There are areas of Mt. Washington Drive that could be further developed, however sewer service is challenging because of the large topographic changes. As discussed in the sanitary sewer section, the North Interceptor is anticipated to aid in alleviating these sewer service challenges.

College Way

College Way is the main access road to COCC, accessible off of Shevlin Park Road/Newport Avenue. During scheduled school days, with classes beginning and ending throughout the day, this roadway is often congested. College Way is designated as a major collector between Shevlin Park Road and the COCC campus, reverting to a local street north of COCC.

The roadway is steep, providing for slippery conditions during winter storms. Steep terrain may constrain future development of vacant lots fronting College Way.

Butler Market Road

Butler Market Road provides access to from the Bend Parkway to properties outside the city limits and to the Bend Municipal Airport. Within city limits, most of this corridor lacks curbs or sidewalks and has two travel lanes with a painted center median. There are some sidewalk improvements in place along the road frontage, but not enough to provide adequate, safe pedestrian connectivity. A wide shoulder on the roadway beyond the striped fog line provides a basic bicycle facility.

Butler Market Road primarily provides access to residential neighborhoods, with limited commercial or industrial businesses. With few controlled intersections, it provides a quick access from the Bend Parkway to northeast Bend and its connector streets.

As the UGB expands, this corridor has the potential for significant development due to close proximately to the Bend Municipal Airport and hospital services.

Wells Acres Road

Wells Acres Road provides access from Butler Market Road to 27th Street, running parallel to Butler Market Road and passing Mt. View High School. The roadway lacks paint striping and has residential driveway access throughout the corridor. Though it is a wide street, it does not meet standards for collector streets or have traffic control measures.

East of 27th Street, Wells Acres Road continues as a local street within residential neighborhoods. The road terminates at Eagle Road, near the edge of the City limits. Future development opportunities are available east of Eagle Road; most parcels along Wells Acres Road are already developed as residential lots.

There is good sidewalk and pedestrian connectivity within the residential neighborhood along the corridor. Although there is no designated bicycle lane, bicyclists can comfortably navigate the wide road.

Robal Road

Located on Bend's north side, this short corridor connects Highway 20 to Highway 97. Robal Road extends east beyond Highway 97, and is used as a lower volume commercial business access road. West of Highway 97, where there is existing bus service, the Target shopping complex and Cascade Village shopping mall front the corridor. It is fully curbed with a curbed median fronting the Target shopping complex, reverting to a painted median west to Highway 20.

Sidewalks are in place between Highway 97 and the western edge of Cascade Village shopping mall, but there is no pedestrian connectivity beyond the shopping center to Highway 20.

Cooley Road

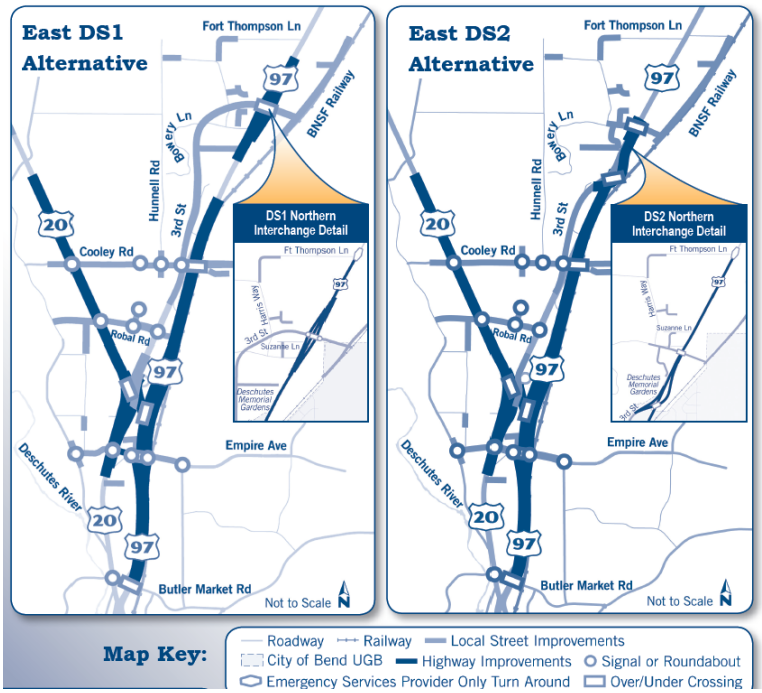
Like Robal Road, Cooley Road provides access from Highway 20 to Highway 97, with a two-lane roadway and sections of curbed median east of Hunnell Road.

East of Highway 97, Cooley Road conveys traffic to existing residential neighborhoods and two schools, also turning south to provide good accessibility to Bend businesses and the hospital.

With development of Juniper Ridge, Cooley Road will become a busy corridor for businesses, residences and potentially a University. Due to current peak traffic congestion along Highway 97, ODOT has required future improvements to occur to the Highway 97 corridor as a condition of development. Development of Juniper Ridge also depends on resolving sewer service constraints

(North Interceptor, to be discussed below). Traffic improvements are needed to improve on/off ramp access to Cooley Road and prevent traffic delays along the Highway 97 corridor. Final designs are currently the subject of City of Bend and ODOT workshops. Figure C-2 illustrates the current proposed alternatives.

Figure B-2 Highway 97 Alternatives



Reed Market Road

Reed Market Road is designated a major arterial. It provides full accessibility from west Bend to east Bend and is one of the city's busiest corridors. It has few controlled intersections, allowing quick transport to residential neighborhoods and a limited number of commercial businesses.

Reed Market connects to Century Drive in west Bend, turning into Mt. Washington Drive. On the east side of Bend, it terminates at 27th Street, ending near the city limits. Most of the corridor is built out, therefore new development is limited until city limits are extended east and Reed Market is extended.

Reed Market Road has several safety and traffic issues, listed from Century Drive going east:

- **Roundabout at Reed Market Road and Brookswood Boulevard**: This roundabout is at or near capacity during peak hour traffic. Traffic backups occur in all directions during the morning and evening commute times. With the steep terrain on either side of the roundabout, expanding the intersection to a multilane roundabout would be difficult and costly.

- **Access to and from the Bend Parkway**: This area, particularly on the east side of the overpass at the off ramp, is a high accident area. Congestion on Reed Market Road makes it difficult to turn left, especially with limited site distance over the overpass.
- **3rd Street and Reed Market Road intersection**: This intersection is a signalized intersection that often fails during peak hour traffic. It is not uncommon that turning movements onto Reed Market Road from 3rd Street do not have adequate time to clear the intersection during a single signal cycle.
- **Burlington Northern Railroad crossing east of American Lane**: When a train crosses the corridor, traffic backs up almost to 3rd Street to the west and 27th Street to the east. This is problematic for emergency vehicles that need to respond quickly to an emergency, and also in providing timely traffic for vehicular traffic along the corridor.
- **Limited site distance near Fargo Lane**: This section of Reed Market Road has dips where site distance is obscured to oncoming vehicles.

West of 3rd Street there are full sidewalks and curbs and designated bike lanes in the roadway. There are limited curbs and sidewalks on Reed Market Road east of 3rd Street, creating a hazardous situation for pedestrian and bicycle traffic, with multiple collisions involving vehicle and pedestrians or bicycles occurring annually.

In 2011 a bond measure was passed to pay for improvements to Reed Market Road, including installation of medians with turn pockets and installation of curbs, bike lanes, and sidewalks. The American Lane Bride, west of 15th Street, will also be removed and reconstructed to enhance traffic accessibility from American Lane and Brosterhous Road to Reed Market Road. Other improvements to this corridor include a railroad overcrossing and two lane roundabouts at the intersections of 15th Street and 3rd Street. The railroad overcrossing and 3rd Street improvements were not part of the bond measure funds but are included in future master plan improvements for the corridor.

27th Street

Knott Road, a minor arterial in southeast Bend, turns into 27th Street north of the Deschutes County solid waste disposal site. This corridor provides fast access between southeast and northeast Bend, terminating at Butler Market Road.

- **South of Highway 20**: The roadway is generally a two lane roadway, widening at major intersections to provide turn pockets. The road begins to widen north of Bear Creek Road, providing four travel lanes and a center median. There is limited presence of sidewalks or curbs; the corridor is not conducive to safe pedestrian or bicycle travel. The roadway is generally elevated above adjacent properties, requiring fill to be placed to widen the roadway or install sidewalk and curb. 27th Street abuts the city limit for much of its length, making development contingent on a future expansion of the UGB. Sewer will be available with installation of the Southeast Interceptor (SEI), described in the Sanitary Sewer portion of this report.
- **North of Highway 20**: North of Highway 20, 27th Street maintains four lanes of traffic and a center median, narrowing again north of Neff Road and the hospital access. The roadway widens again to add a center median near Mt. View High School. Sidewalk and curb is generally present along 27th Street from Highway 20 to Butler Market. Most of the corridor north of Highway 20 is built out with medical facilities and residential properties.

Future Improvements: During installation of the SEI, 27th Street will need to be reconstructed because of the deep sewer installation anticipated between Reed Market Road and Butler Market Road.

Empire Road

Empire Road provides access to many north Bend commercial and industrial businesses, residential neighborhoods and State and local agency offices (including ODOT, Department of Motor Vehicles, State Police, and Deschutes County Jail). This corridor is especially congested because of its on/off ramps to the Bend Parkway.

Future Improvements: In the future this roadway is expected to extend east, connecting to the intersection at 27th Street and Butler Road. These improvements will include the installation of multiple roundabouts, one at 18th Street and one on 27th Street. The reason for these improvements is to provide a direct truck access route from the Bend Parkway to Highway 20. Currently freight traffic relies on 3rd Street to Greenwood Boulevard to travel east on Highway 20. With the extension of Empire Road, freight traffic on 3rd Street can be reduced or eliminated.

Comment [JA2]: RAB at Empire/18th is part of the GO Bond projects. http://bendoregon.gov/modules/showdocument.aspx?documentid=6986

APPENDIX C

Public Facilities: Water System

Appendix C Public Facilities: Water System

Note: The material in this appendix supplements the information provided in the Public Facilities section of the main report.

Figure C-1 Water Service Providers

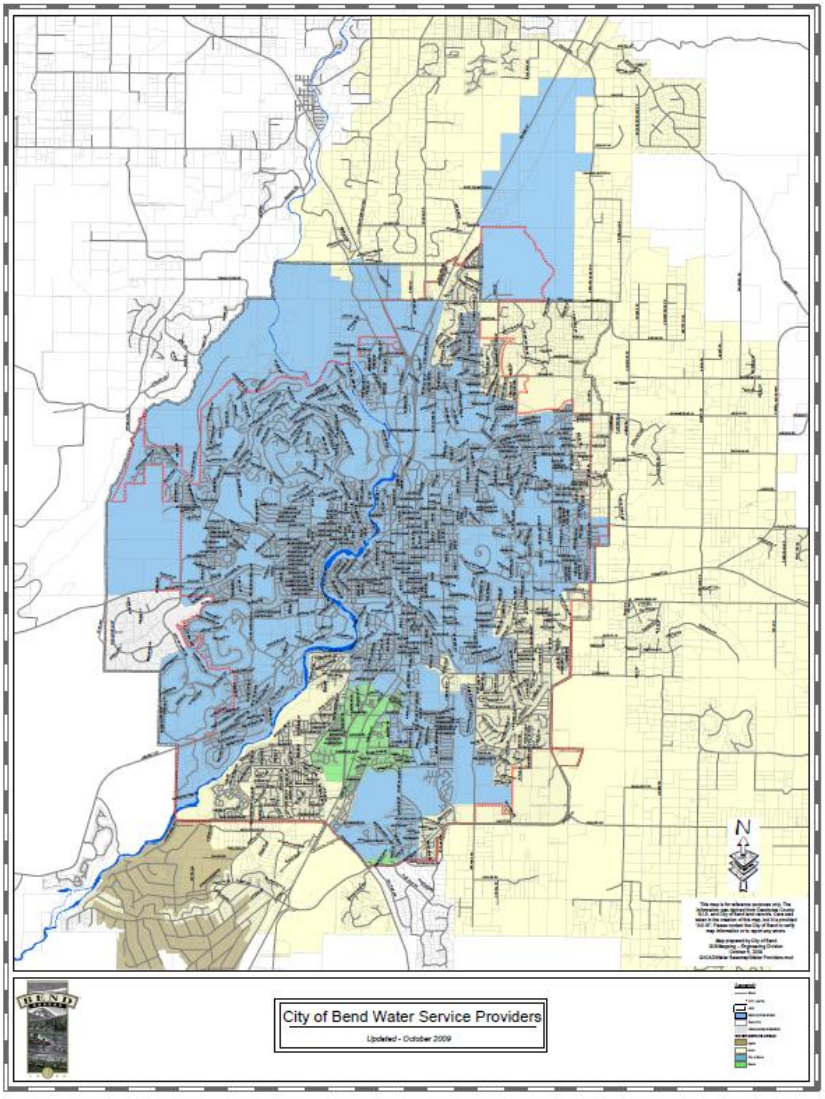
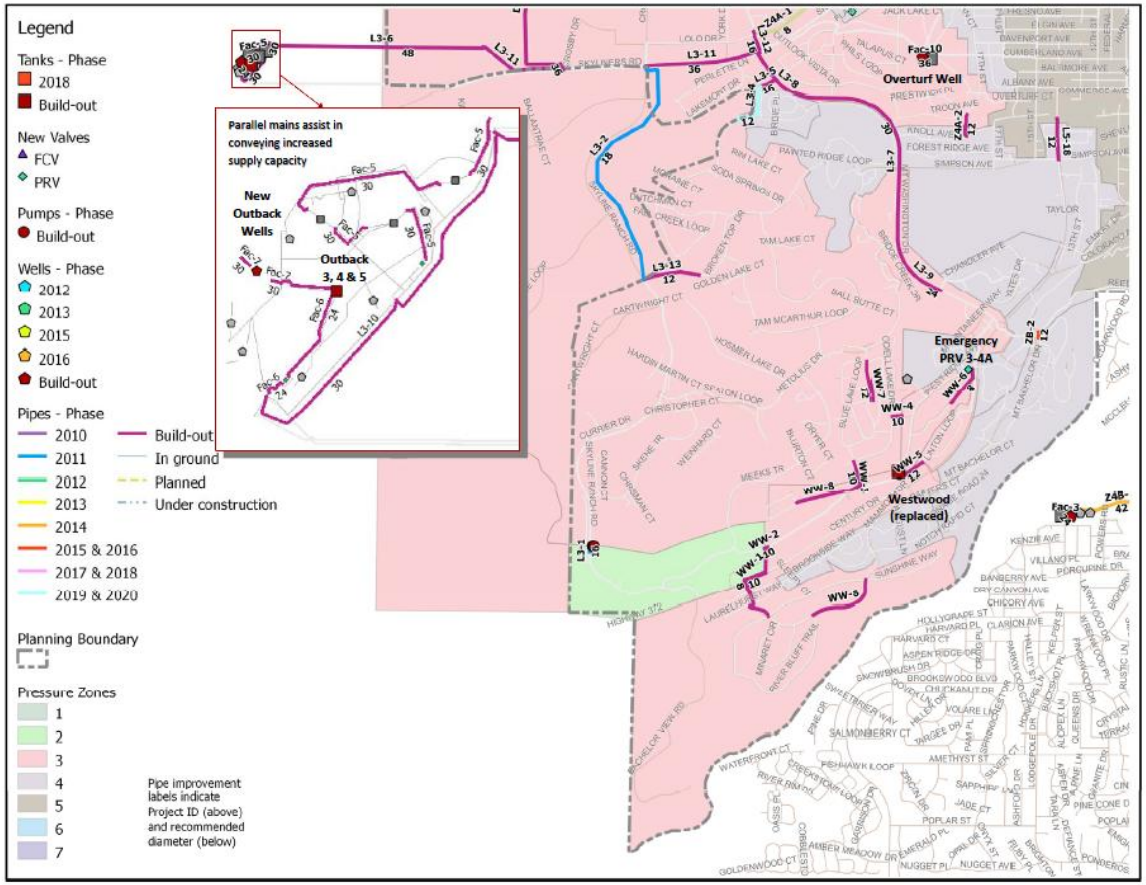
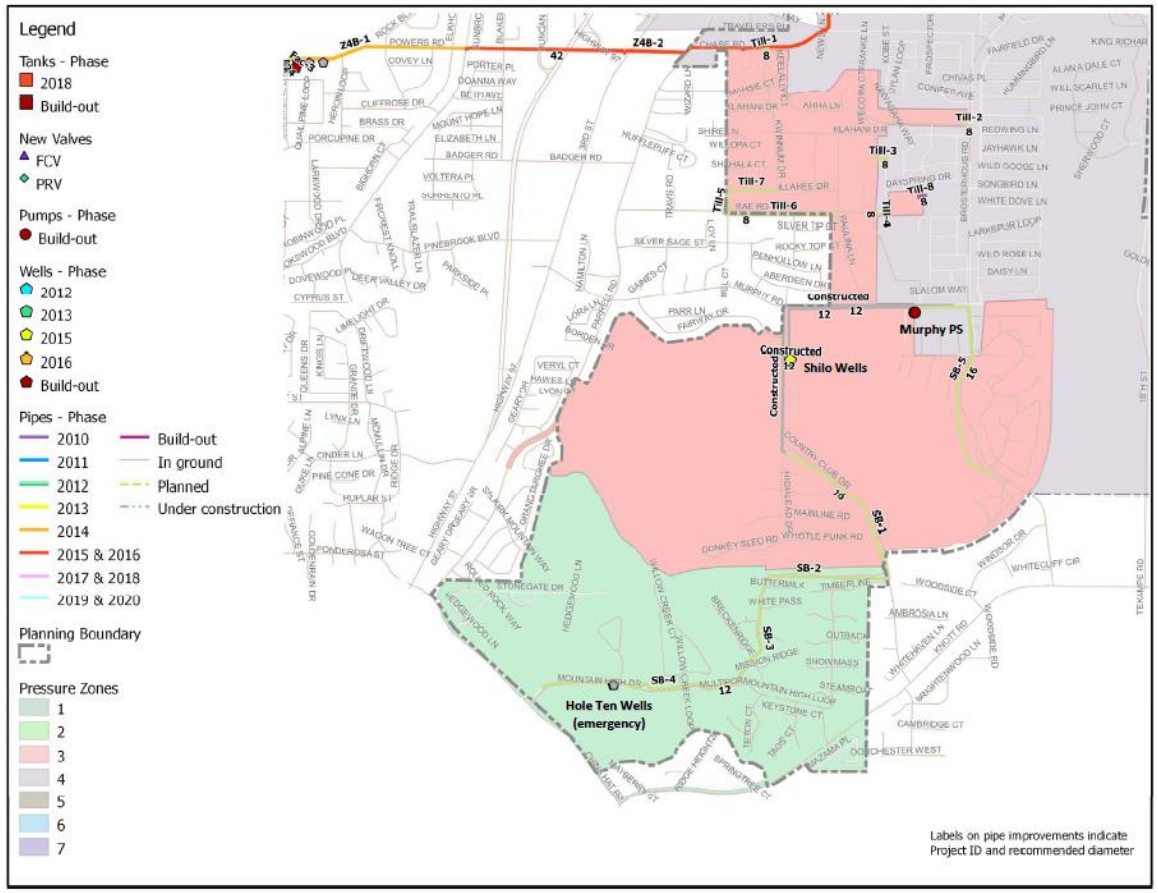


Figure C-2a Southwest area: Outback, Tetherow, Westwood Improvements



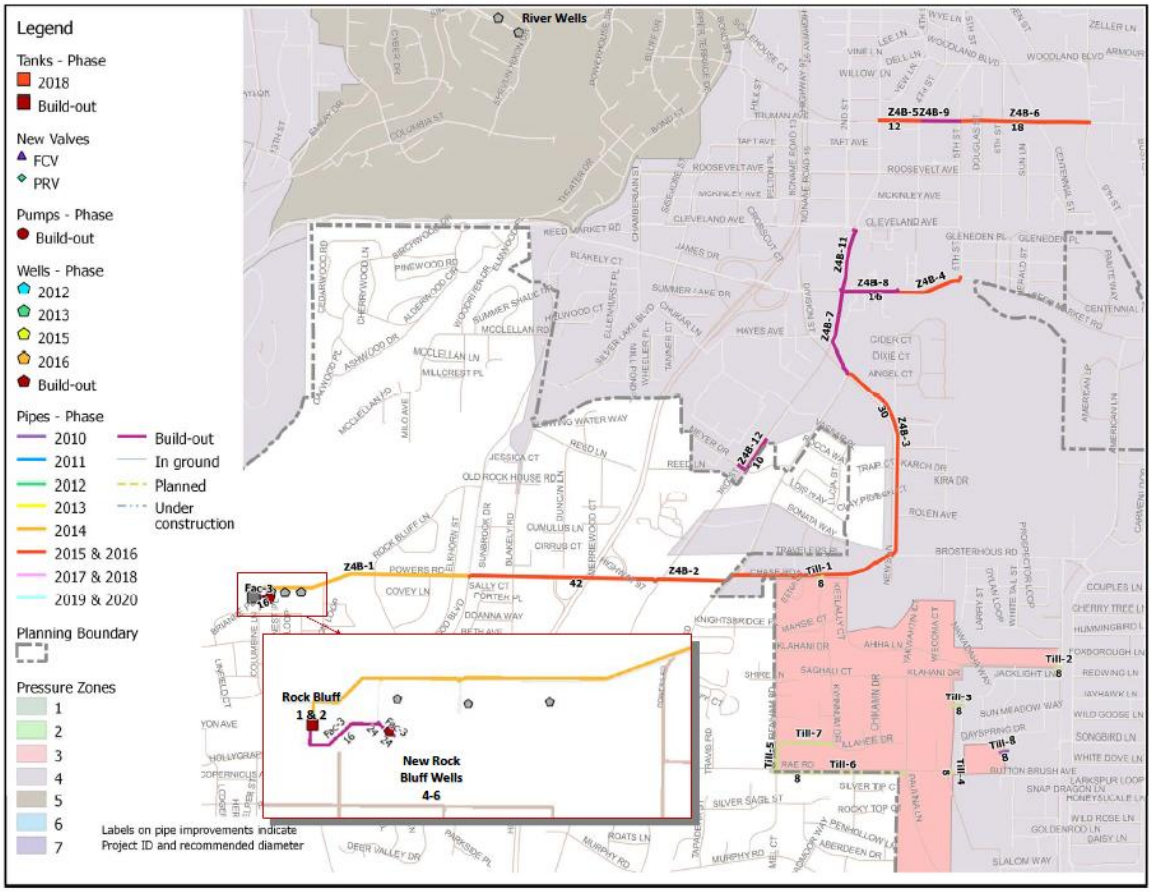
Source: City of Bend, Water Master Plan 2011

Figure C-2b Southeast Area: South Bend Water System Improvements



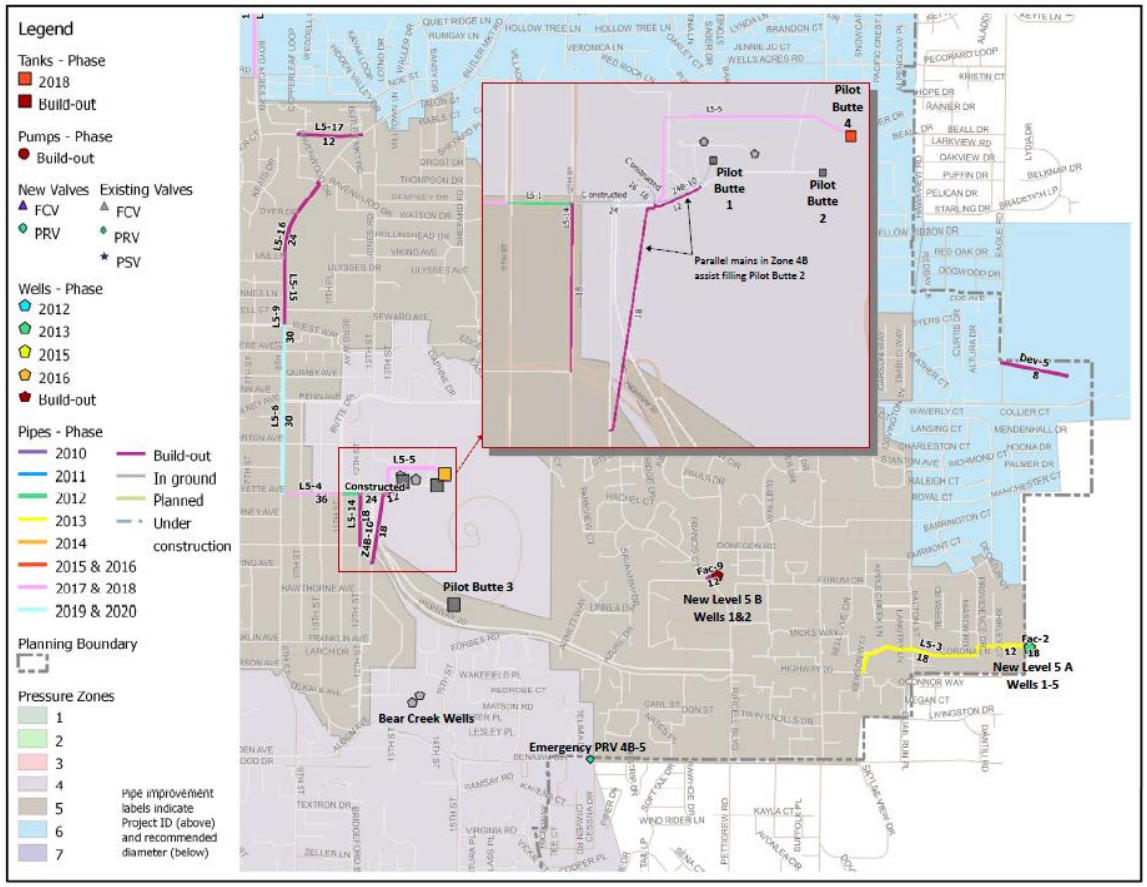
City of Bend, Water Master Plan 2011

Figure C-2c Zone 4B, Rock Bluff Water System Improvements



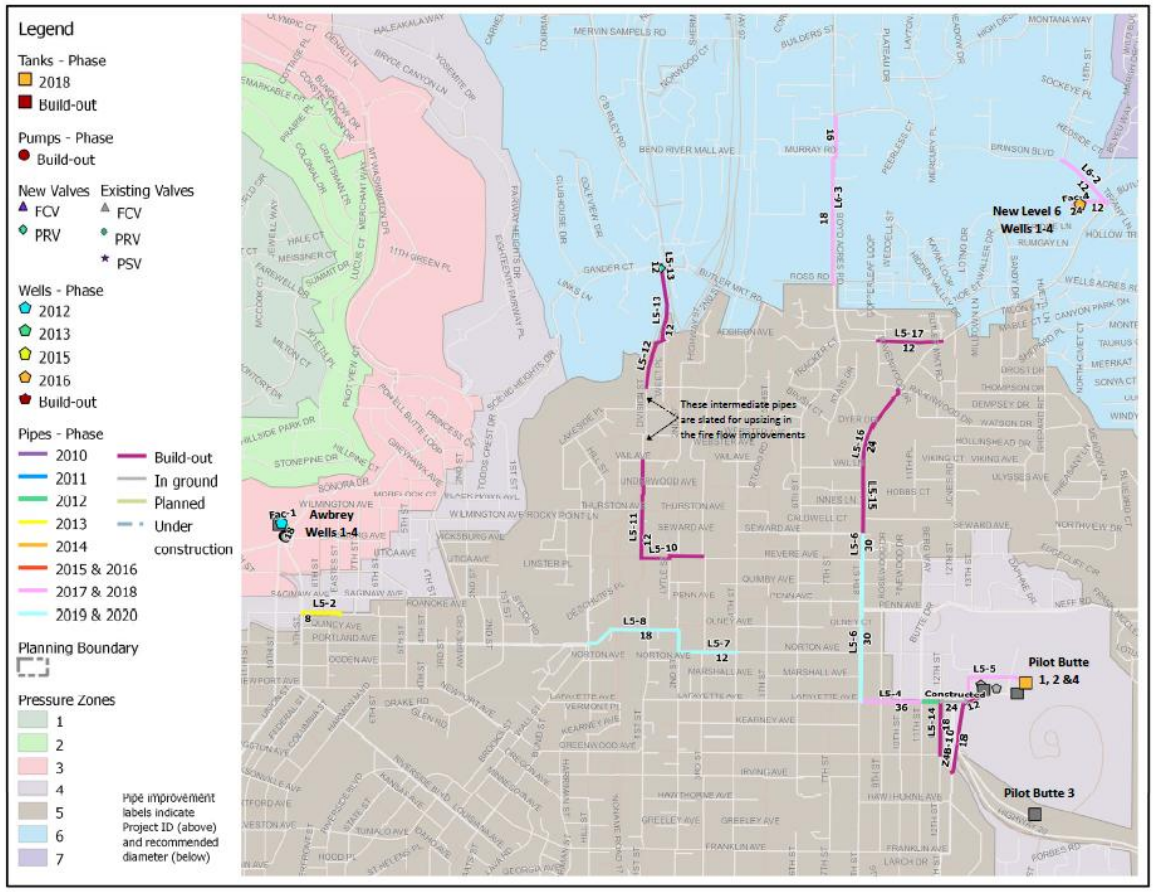
City of Bend, Water Master Plan 2011

Figure C-2d: Level 5 East Water System Improvements



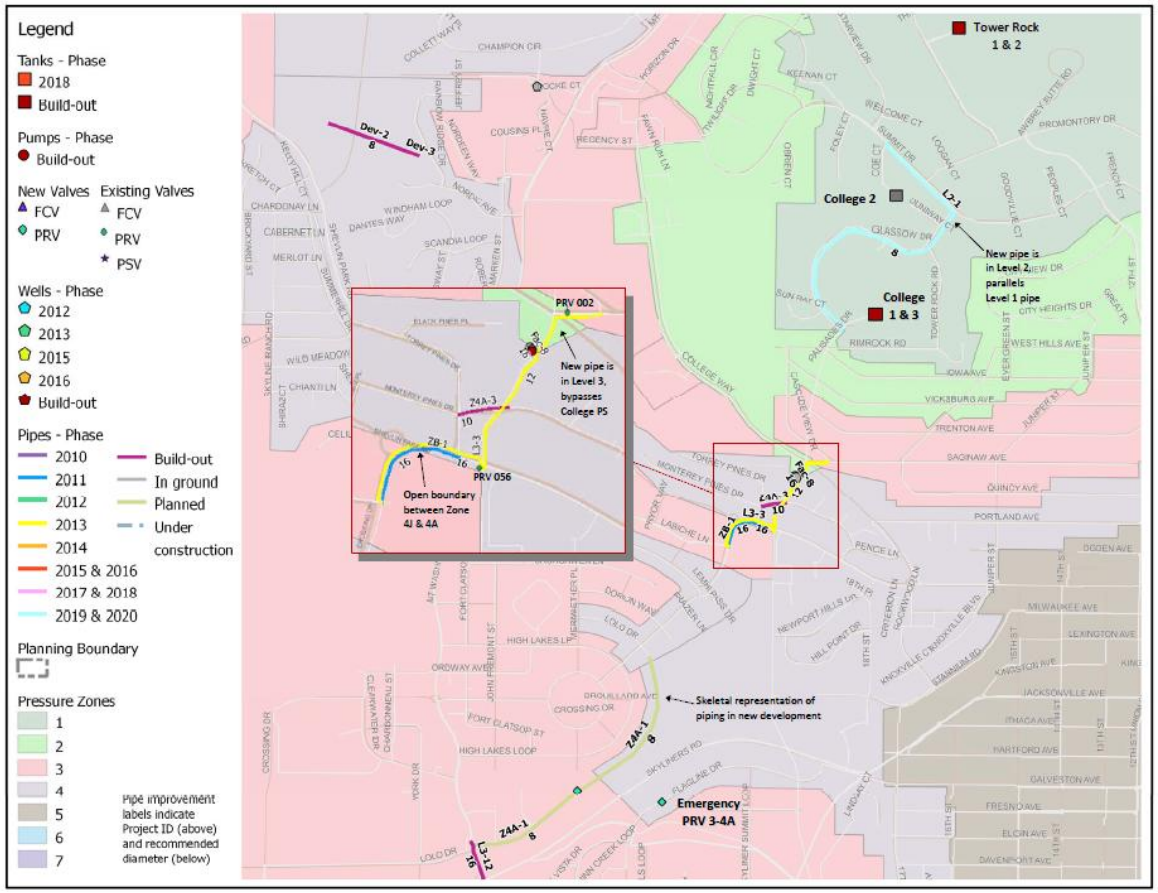
City of Bend, Water Master Plan 2011

Figure C-2e Level 5 West and Level 5 Water System Improvements



City of Bend, Water Master Plan 2011

Figure C-2f Awbrey Butte Water System Improvements



City of Bend, Water Master Plan 2011

APPENDIX D

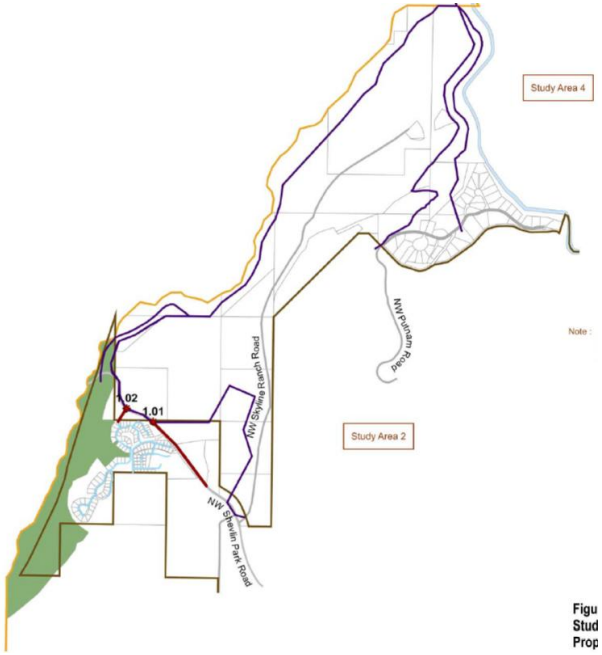
Public Facilities: Sanitary Sewer System

Appendix D Public Facilities: Sanitary Sewer System

Note: The material in this appendix supplements the information provided in the Public Facilities section of the main report.

Figure D-1 CSMP Study Area 1 (Northwest Bend)

(a) Areas of sewer improvement projects



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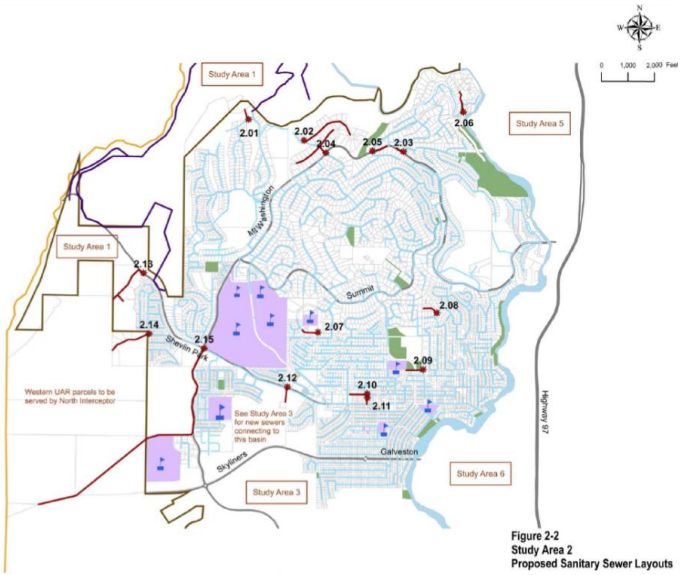
Because this sewer basin is small, it was not modeled for deficiencies.

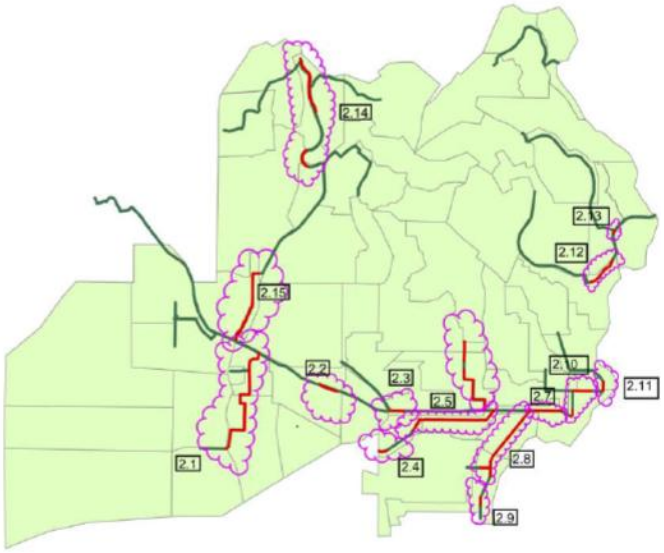
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-2 CSMP Study Area 2 (West Bend)

(a) Areas of sewer improvement projects



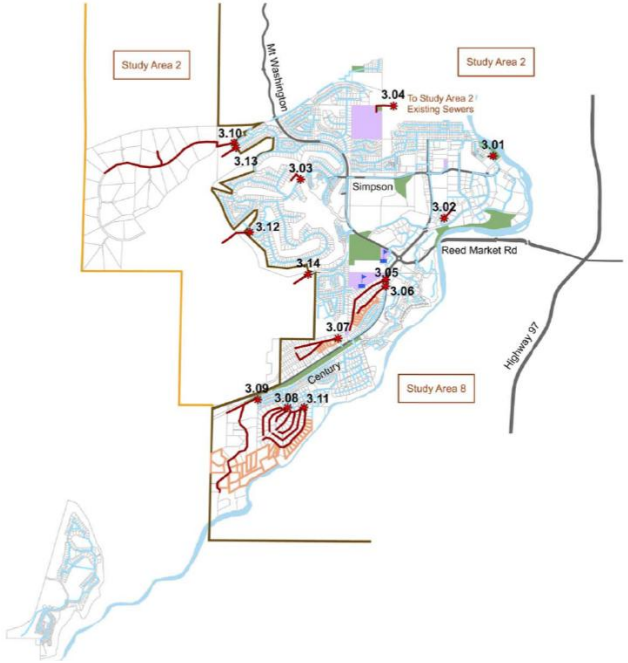
(b) Areas of sewer deficiency (analysis performed in 2007)



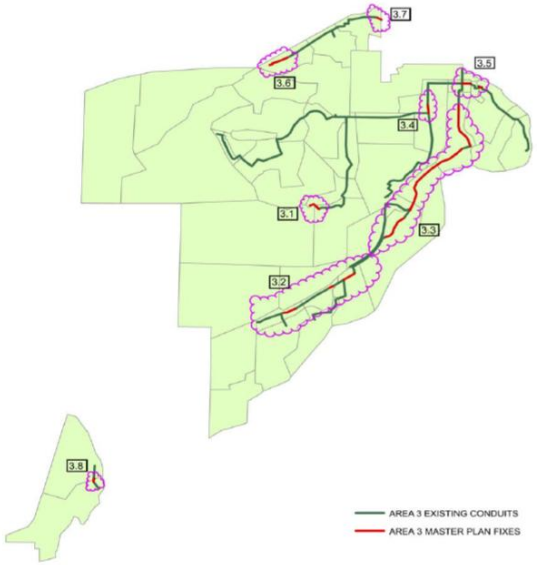
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-3 CSMP Study Area 3 (Southwest Bend)

(a) Areas of sewer improvement projects



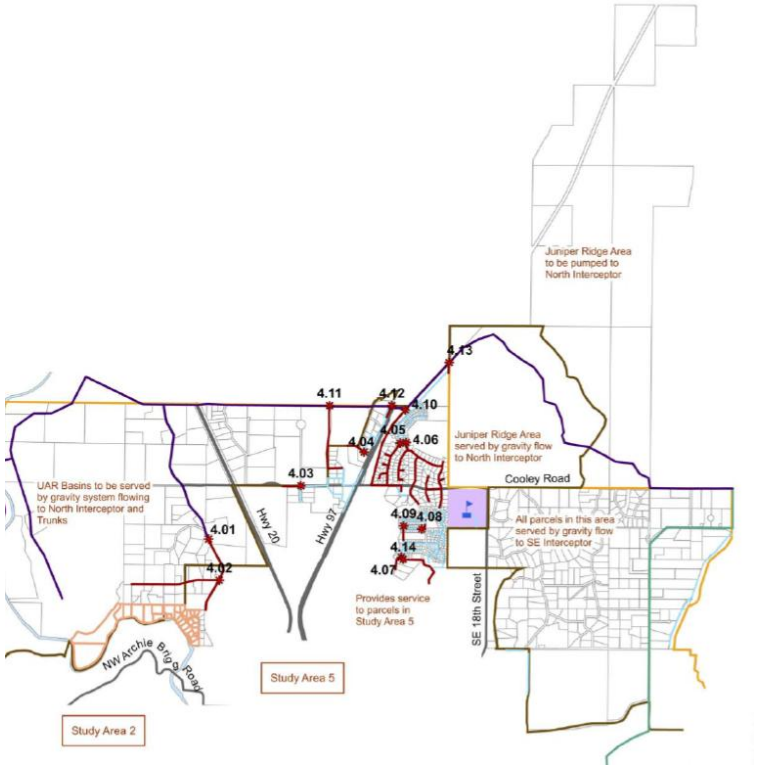
(b) Areas of sewer deficiency (analysis performed in 2007)



Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-4 CSMP Study Area 4 (North Bend)

(a) Areas of sewer improvement projects

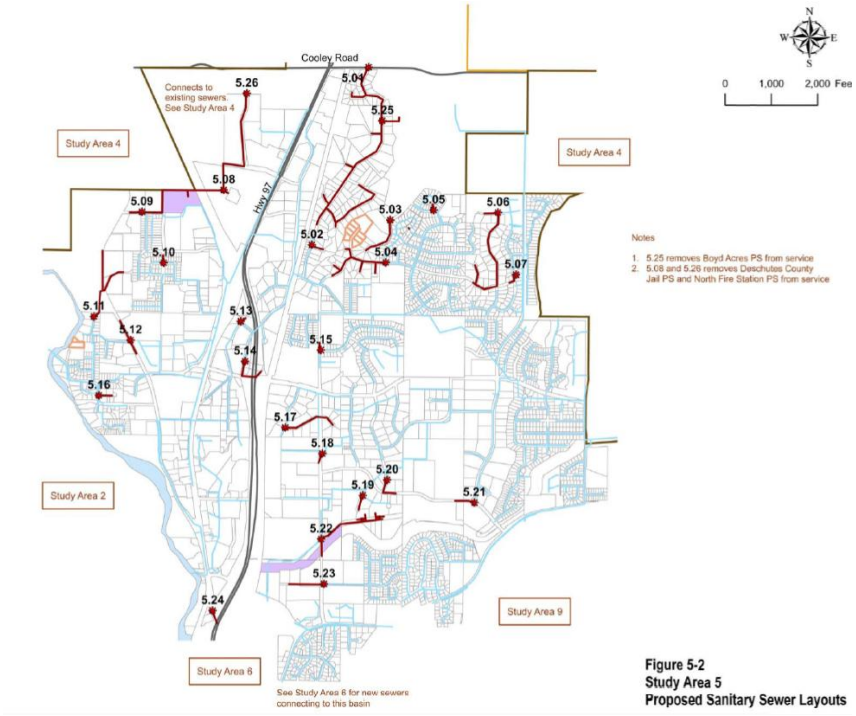


No existing or future deficiencies were found in this study area when the analysis was performed in 2007. Deficiencies were not expected because the model anticipated future flows being handled by the North Interceptor.

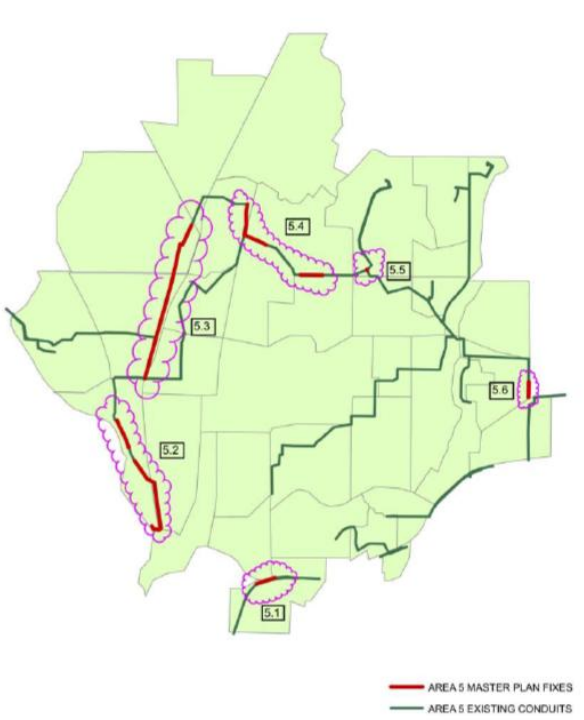
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-5 CSMP Study Area 5 (North Bend)

(a) Areas of sewer improvement projects



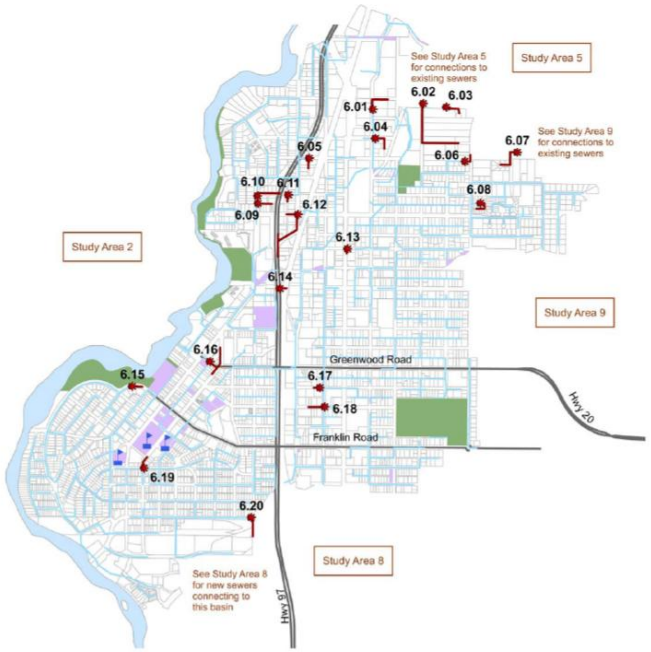
(b) Areas of sewer deficiency (analysis performed in 2007)



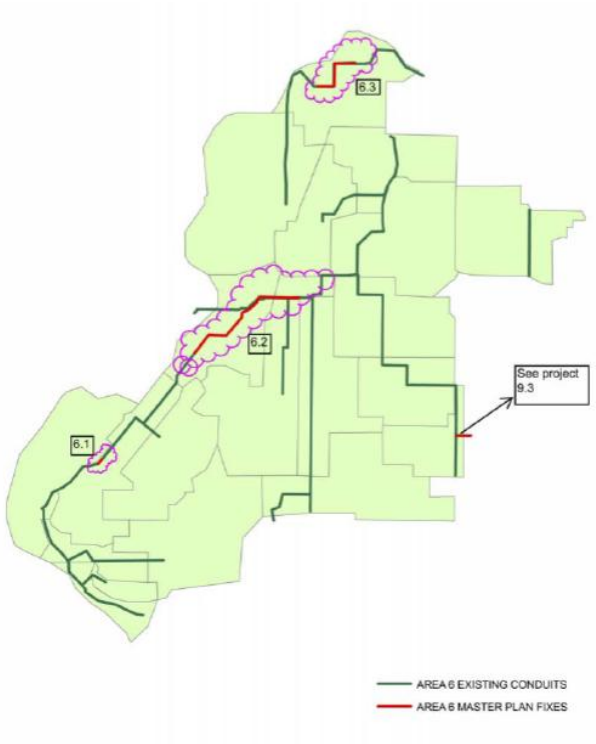
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-6 CSMP Study Area 6 (Central Bend)

(a) Areas of sewer improvement projects



(b) Areas of sewer deficiency (analysis performed in 2007)



Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-7 CSMP Study Area 7 (Southeast Bend)

(a) Areas of sewer improvement projects

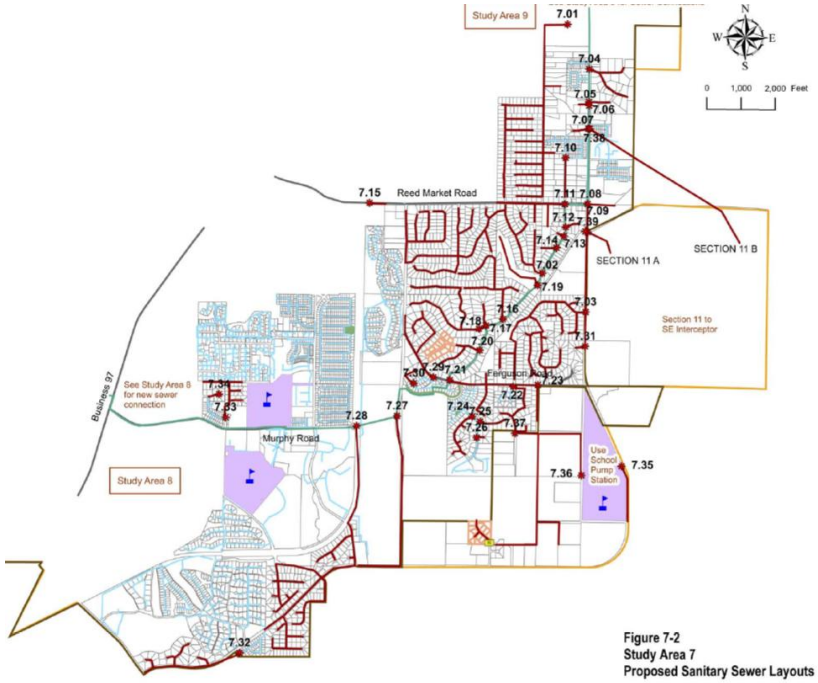


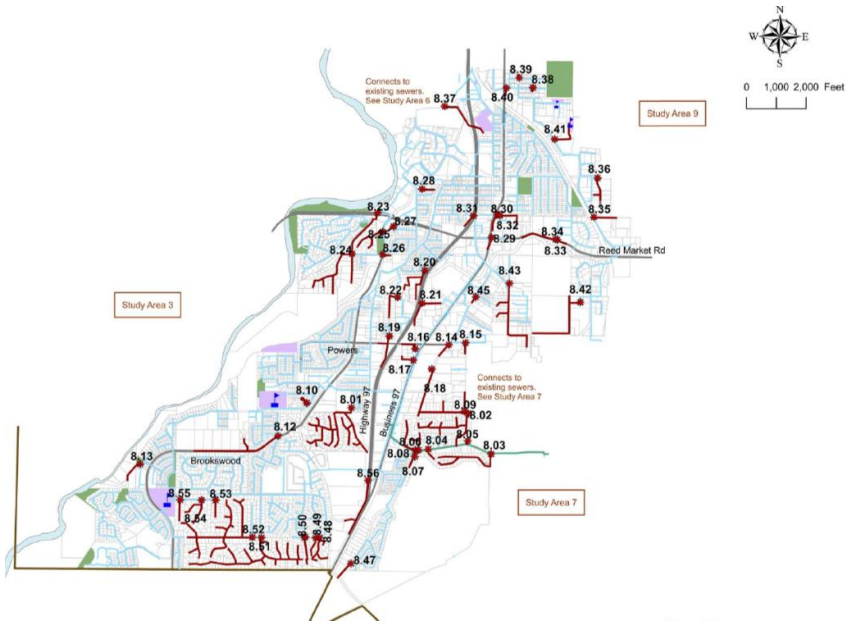
Figure 7-2
Study Area 7
Proposed Sanitary Sewer Layouts

No existing or future deficiencies were found in this study area when the analysis was performed in 2007. Deficiencies were not expected because the model anticipated future flows being handled by the Southeast Interceptor.

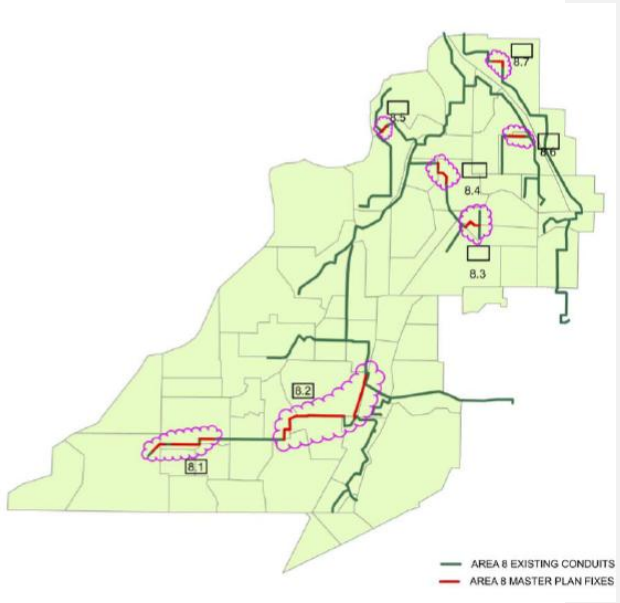
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-8 CSMP Study area 8 (South Bend)

(a) Areas of sewer improvement projects



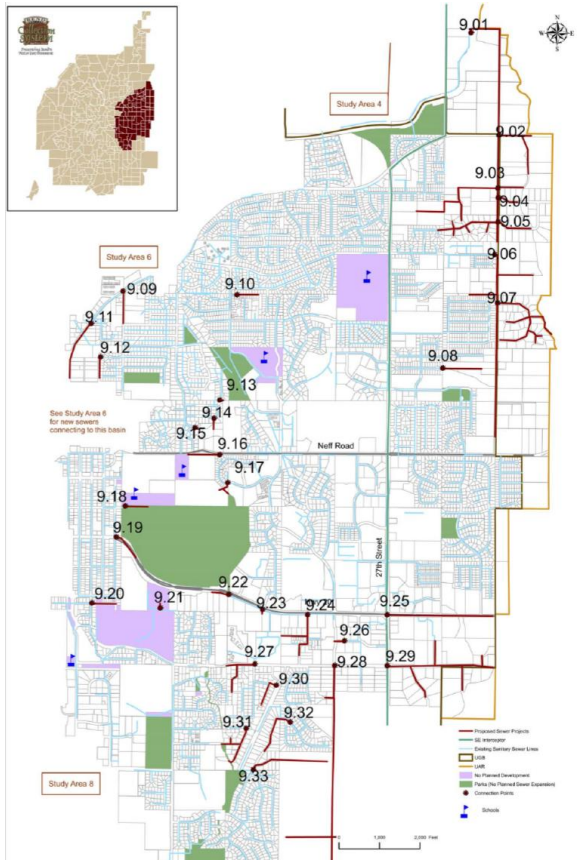
(b) Areas of sewer deficiency (analysis performed in 2007)



Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-9 CSMP Study Area 9 (East Bend)

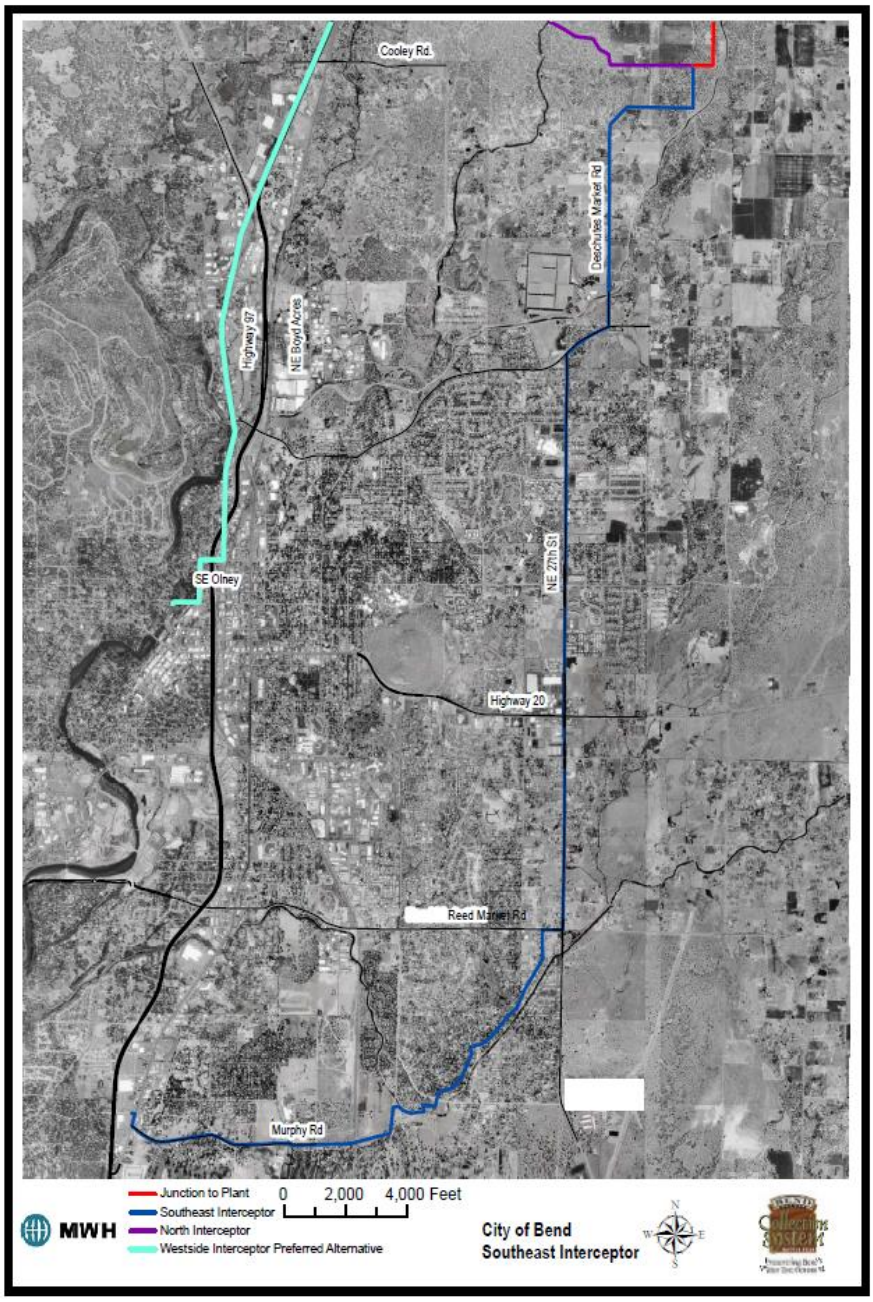
(a) Areas of sewer improvement projects



(b) Area of existing / future sewer deficiencies (Analysis performed in 2007)

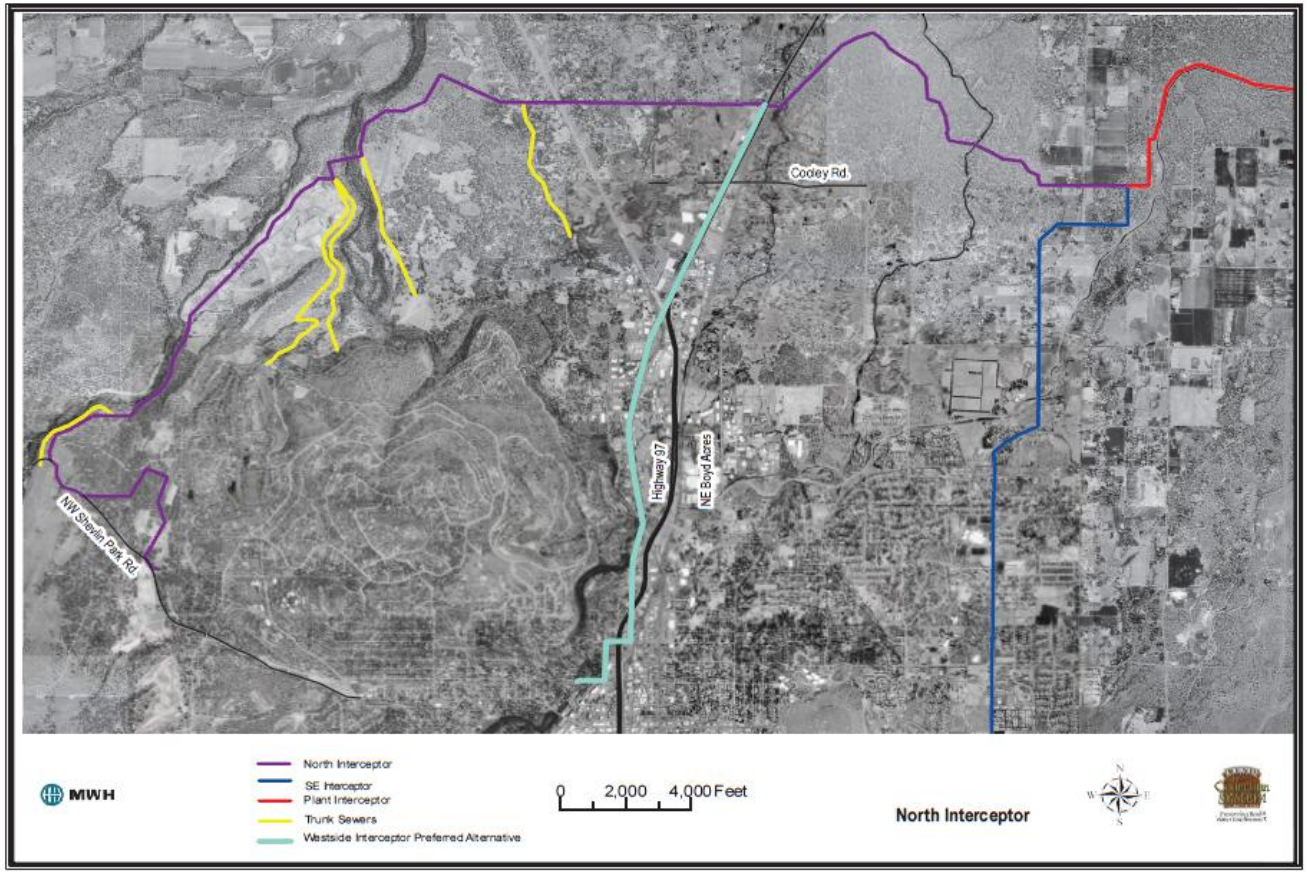
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-10 Southeast Interceptor (SEI)



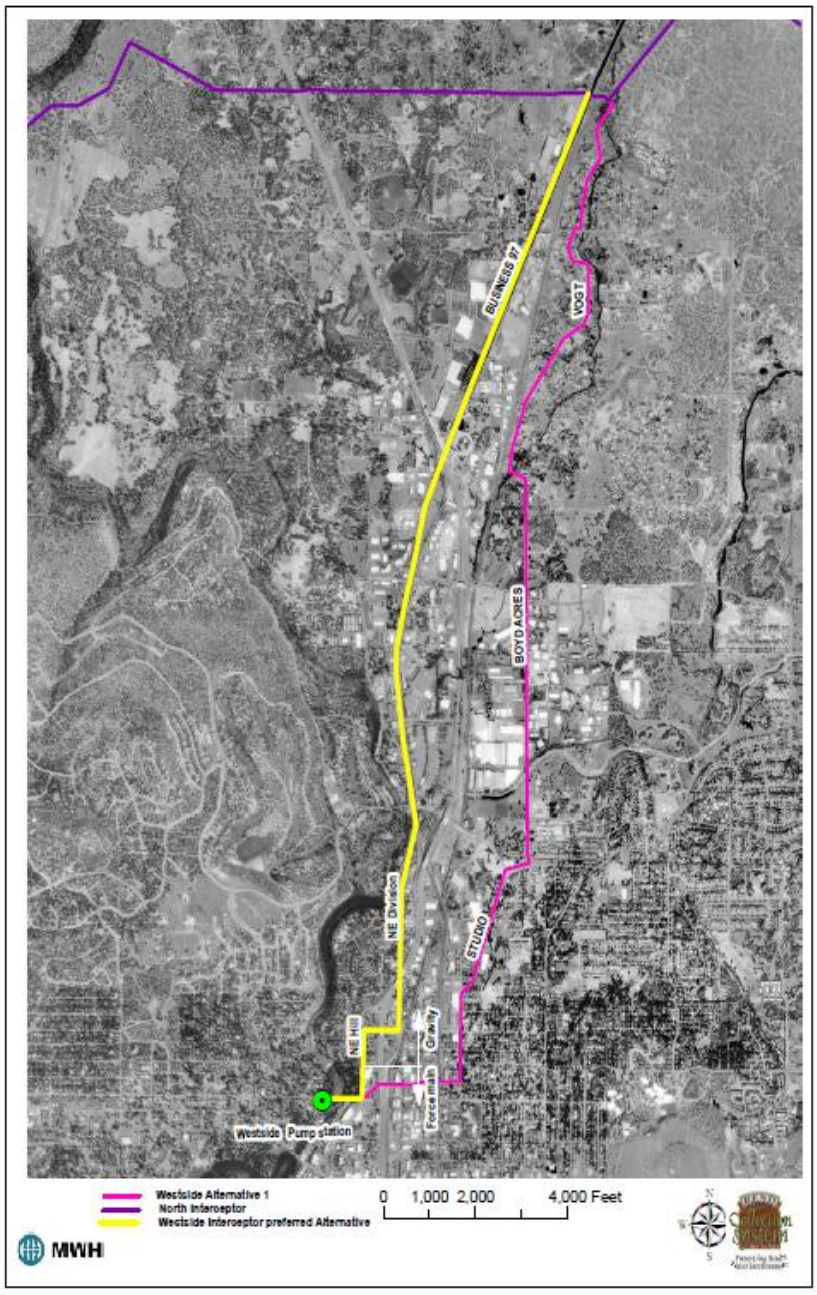
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-11 North Interceptor (NEI)



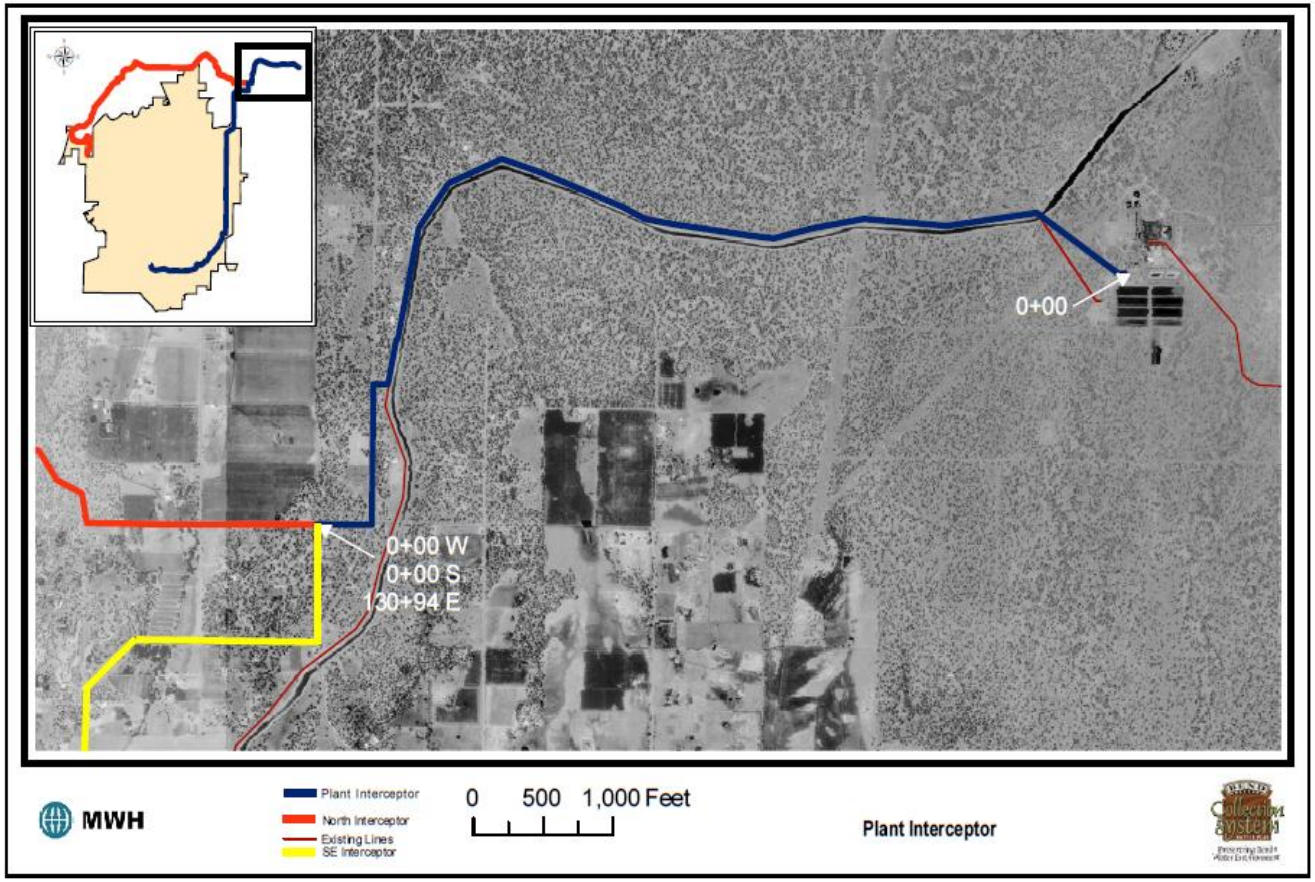
Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-12 Westside Interceptor (WI)



Source: City of Bend, Collector Sewer Master Plan, 2007

Figure D-13 Plant Interceptor (PPI)



Source: City of Bend, Collector Sewer Master Plan, 2007

APPENDIX E

Stormwater Disposal System

Appendix E Stormwater Disposal System

Note: The material in this appendix supplements the information provided in the Public Facilities section of the main report.

Figure E-1 Drywell / UIC

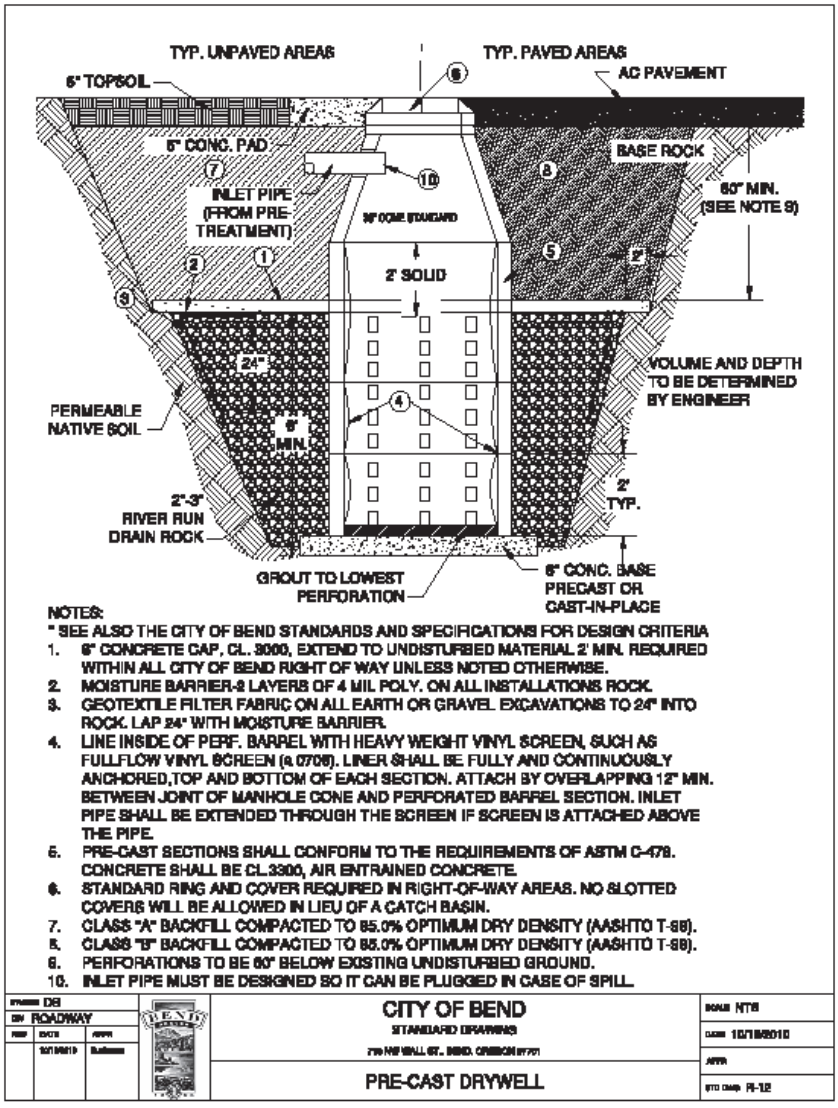
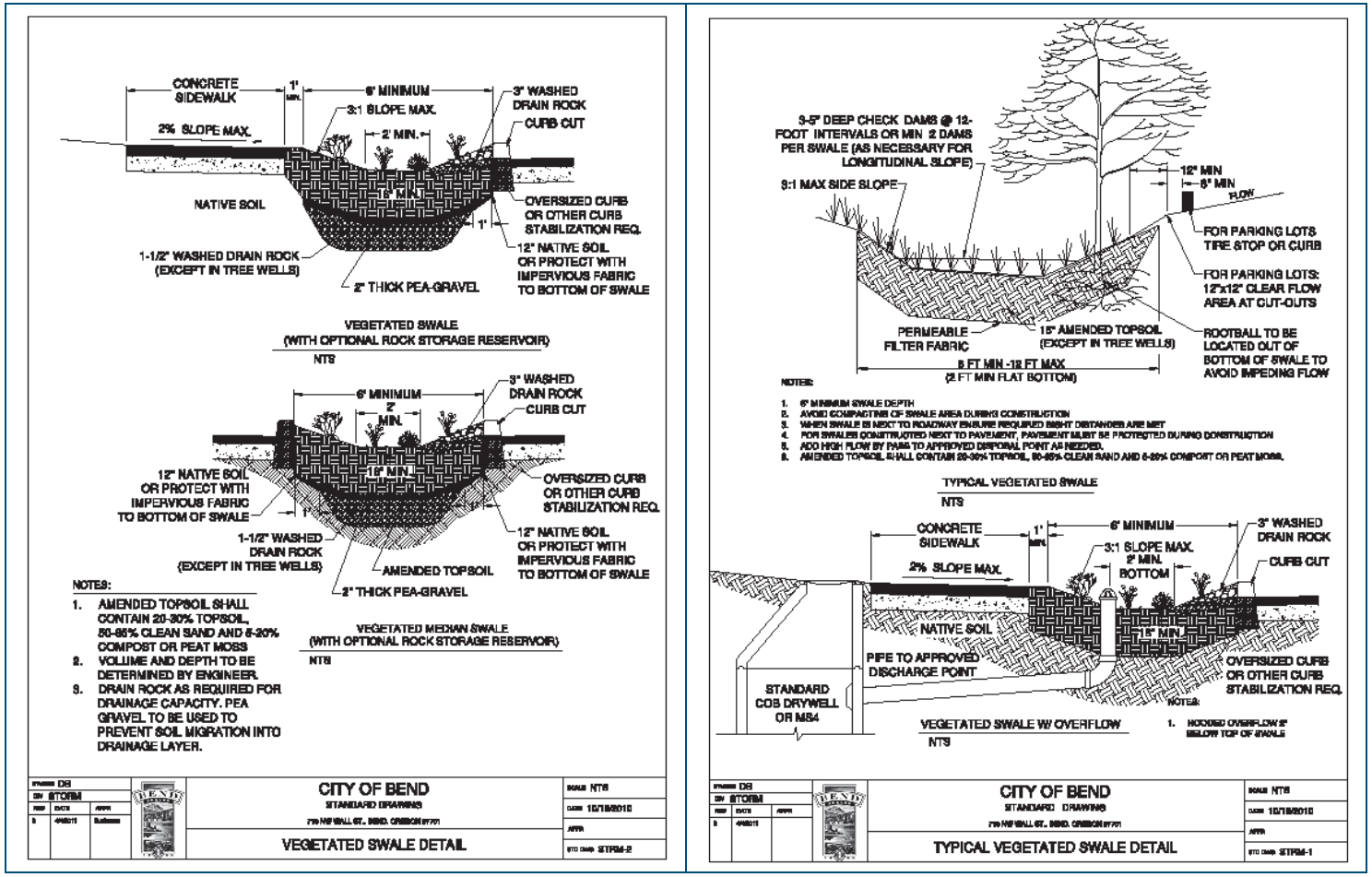


Figure E-2 Infiltration Basins / Swales



Bend Metropolitan Planning Organization

PUBLIC TRANSIT PLAN AND TRANSIT CORRIDOR LAND USE ASSESSMENT

Existing Conditions

February 2012 – DRAFT

DKS Associates
TRANSPORTATION SOLUTIONS

otak

NELSON
NYGAARD

This project is partially funded by a grant from the Transportation and Growth Management (TGM) Program, a joint program of the Oregon Department of Transportation and the Oregon Department of Land Conservation and Development. This TGM grant is financed, in part, by federal Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), local government, and State of Oregon funds.

Table of Contents

Table of Figures

ACRONYMS

ADA	Americans with Disabilities Act
APC	Automatic Passenger Counter
APTA	American Public Transit Association
APTS	Advanced Public Transportation Systems
AoA	Administration on Aging
AT	Assistive Technology
ATP	Accessible Transportation Program
AVL	Automatic Vehicle Location
BRT	Bus Rapid Transit
CET	Cascades East Transit
CAD	Computer Aided Dispatch
CASD	Computer Aided Scheduling and Dispatch
COIC	Central Oregon Intergovernmental Council
CMAQ	Congestion Mitigation and Air Quality
DAR	Dial-A-Ride
DMU	Diesel Multiple-Unit Car
DOT	Department of Transportation
DR/DRT	Demand Response Transportation (paratransit)
E&D	Elderly and Disabled
EMS	Emergency Medical Services
FHWA	Federal Highway Administration (also FHA)
FR	Fixed Route
FTA	Federal Transit Administration
GIS	Geographic Information System
GP	General Public (related to FTA 5311 Funds)
GPS	Global Position Systems (typically satellites)
HCT	High Capacity Transit
HOV	High-Occupancy Vehicle
ITP	Individual Trip Planner
ITS	Intelligent Transportation Systems
JARC	Job Access Reverse Commute
LOS	Level of Service

MAAP	Mobility Awareness and Assistance Program
MDT/MDC	Mobile Data Terminal/Mobile Data Computer
MPO	Metropolitan Planning Organization
NTD	National Transit Database
OCS	Overhead Contact System
ODOT	Oregon Department of Transportation
O-D	Origin-Destination
PDA	Personal Data Assistant
POP	Proof-of-Payment
ROW	Right-of-Way
RTAP	Regional Transportation Assistance Program
	Rural Transportation Assistance Program (state and federal programs)
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SOV	Single Occupant Vehicle
SPD	Seniors and People with Disabilities (formerly SDSD)
STP	Surface Transportation Programs
STIP	Surface Transportation Improvement Projects
TAC	Technical Advisory Committee
TDD	Telecommunications Device for the Deaf
TDM	Transportation Demand Management
TMA	Transportation Management Association
TMC	Traffic Management Center
TMV	Transit Maintenance Vehicle
TPR	Oregon Transportation Planning Rule
TOD	Transit-Oriented Development
TSM	Transportation System Management
TSP	Transit Signal Priority
TSP	Transportation System Plans
TTY	Text Telephone
TVM	Ticket Vending Machine
VMT	Vehicle Miles of Travel

EXISTING CONDITIONS

INTRODUCTION AND PROJECT BACKGROUND

This memorandum is an initial element in the Bend Metropolitan Planning Organization (BMPO) Public Transit Plan (PTP) and Transit Corridor Land Use Assessment. It describes and assesses demographics, transit system characteristics, land use, and public facilities within BMPO boundaries, with an emphasis on established Cascades East Transit (CET) bus service corridors within the City of Bend (City). Figure 1 illustrates the BMPO boundaries (Bend Urban Growth Boundary) in relation to Bend city limits and existing public transit service, including both local fixed-route service and regional Community Connector service. Dial-A-Ride service currently operates within Bend city limits.

The Existing Conditions memorandum provides the foundation for the project, whose purpose is to examine existing and future public transportation needs and will result in two products:

- A Public Transit Plan (PTP) that can be adopted as an element of the BMPO Metropolitan Transportation Plan (MTP) and the City of Bend Transportation System Plan (TSP).
- A Future Opportunities Memo, an assessment that will identify opportunities for land use changes that can support public transit within BMPO boundaries and steps to implement those changes. This memo will inform future land use planning in Bend, in particular as it relates to the Land Conservation and Development Commission's partial acknowledgement/remand of the City of Bend's proposed Urban Growth Boundary (UGB) expansion in 2010.

Project Goals

The initial goals for the PTP are listed below; specific goals and objectives for public transit in Bend will be developed as part of this study in close consultation with the Technical Advisory Committee (TAC) for the project.

- **To prepare for future community growth, and economic and demographic change.** The City currently benefits from the existence of fixed route service, complementary paratransit service, and community-connector shuttles. The Plan will enable a strategic approach to meeting land use, infrastructure, and funding requirements, thereby enhancing system efficiency and effectiveness.
- **To identify the conditions and thresholds that will allow for expanded fixed route transit**, including opportunities for new service models and systems (e.g. bus rapid transit).
- **To develop a broad, flexible public transit plan (PTP)**. The PTP will include route corridors, transit stop locations, and facilities for interconnecting to regional public transit systems. The PTP will assess opportunities for alternate delivery systems (current

system is a hub-spoke system), including the feasibility of bus rapid transit. The Plan will be flexible to allow for unforeseen future community conditions.

- **To identify partnership opportunities.** There are multiple public transit providers in the Central Oregon region, as well as businesses with workforce transportation needs and organizations that represent populations that rely on public transit for personal mobility. The project should engage these entities to ensure an efficient, affordable and reliable transit service can be developed and maintained.

Organization of this Document

This document is structured into several primary sections:

- **Planning Context:** This section briefly reviews previous planning efforts relevant to this project.
- **Community Profile and Demographics**: This section provides a brief overview of the Bend area and presents demographic and land use trends that impact transit demand.
- **Land Use and Transit Overview**: This section provides an overview of existing land use in Bend and existing transit services.
- **Transit System Policies, Usage, and Performance**: This section provides additional details related to transit service in Bend.
- **Community Survey Results**: This section will be added at a later date and will present results of the online community survey currently underway.
- **Land Use and Transit Assessment**: This section discusses existing land use along existing transit corridors and reviews planned land uses in Bend.
- **Public Facilities and Services**. This section discusses key public facilities, including Roadway, Water, Sanitary Sewer, Stormwater, and Water systems, and identifies limitations associated with these systems. Supplemental discussion or maps related to these topics is provided in Appendices B through E.

Additional material is provided in several technical appendices:

- **Appendix A**: Bus Fleet Inventory and Capital Finance Plan
- **Appendix B**: Public Facilities: Roadways. This appendix provides an additional assessment of roadway conditions.
- **Appendix C**: Public Facilities: Water System. This appendix provides additional maps illustrating water system improvements.
- **Appendix D**: Public Facilities: Sanitary Sewer System. This appendix provides additional maps illustrating sanitary sewer system deficiencies and improvements.
- **Appendix E**: Public Facilities: Stormwater Disposal System. This appendix provides additional detail on stormwater facility types.

Figure 1 Study and Transit Overview

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PLANNING CONTEXT

This section provides a brief overview of several important planning documents that have been completed or updated in recent years as well as current initiatives that have direct relevance to the PTP, related to transit and transportation services, land use, and public facilities. The Department of Land Conservation and Development (DLCD) remand of the City of Bend Urban Growth Boundary (UGB) expansion proposal is summarized, with the relevant sections of other key planning documents highlighted in Figure 2.

City of Bend Urban Growth Boundary (UGB) Expansion Proposal

State of Oregon planning rules require all cities to have a 20-year supply of land for housing and employment in their urban growth boundary. The City of Bend began the process to demonstrate the need for the UGB expansion in 2004, including a coordinated population forecast done in partnership with Deschutes County, followed by three years of technical work to determine the buildable lands inventory, housing needs analysis, economic opportunities analysis, and public facilities (water, sewer, transportation) planning. Extensive public meetings were held between 2007 and 2008 to gather public comment on the UGB expansion.

In 2009, the City of Bend submitted a proposal to the Department of Land Conservation and Development (DLCD) to expand the City's UGB by 8,462 acres to accommodate projected population growth and needed land for housing and employment. After formal DLCD review and over a year of objections and comments from the public, the Bend UGB expansion proposal was partially remanded back to the City on November 2, 2010, outlining what the City has to do to obtain final approval of the UGB expansion. In January 2011, the Bend City Council formed the Remand Task Force to act as the official review body to assist in addressing the issues raised in the acknowledged UGB remand order. Issues include further analysis of the sewer and water service in the UGB, an update to the buildable lands inventory, and further transportation costs and impacts analysis. The Future Opportunities Memo (one of two deliverables from this project) will inform these future land use planning efforts.

Figure 2 Summary of Relevant Planning Documents

Plan	Sponsoring Agency	Planning Period	Regulatory Framework	Description	Relevant Sections
Bend MPO Metropolitan Transportation Plan (MTP) (2007) [1]	Bend Metropolitan Planning Organization	2007-2030; updated every 5 years	Federal SAFETEA-LU; Oregon TPR	MTP is the regional transportation plan to meet the region's 20-year projected transportation needs based on population and employment projections. Transportation projects are detailed in the Bend Metropolitan Transportation Improvement Program (MTIP).	**MTP Ch. 19** Funding Analysis (Table 19-22 Summary of Transit Funding; **MTP Appendix G** Future Public Transportation System; **Bend MPO 2012-2015 MTIP** Table 3 Programmed Projects by Agency

Plan	Sponsoring Agency	Planning Period	Regulatory Framework	Description	Relevant Sections
Bend Area General Plan (1998) [2]	City of Bend	1995-2020	Statewide Planning Rules	The Bend Area General Plan serves as the city's growth management plan. The Plan provides goals and policies to guide public investment, protect and preserve the natural environment, set the direction for economic growth, and accommodate projected jobs, housing, and transportation demands.	**Ch. 7** Transportation includes **Section 6.9.1** Transportation and Land Use that outlines objectives, policies, & benchmarks to support land use patterns that support fewer vehicle trips.
City of Bend Transportation System Plan (TSP) (2000) [3]	City of Bend	2000-2020	Oregon Transportation Planning Rule (TPR)	The Bend TSP guides the development of the transportation system to meet the forecasted needs of the region to 2020. Strategies address streets, bicycle and pedestrian infrastructure, public transit services, and overall transportation needs analysis.	**Ch. 3** Current Transportation Conditions; **Ch. 4** Transportation Needs Analysis; **Ch. 6** Transportation System Plan; **Ch. 7** Transportation System Implementation
Water & Sewer Public Facility Plans (2011) [4]	City of Bend		Statewide Planning Goal 11, Public Facilities	Goal 11 requires cities to develop public facilities and services plan to serve as a framework for urban and rural development; the plan will be adopted as part of the City's general plan.	Details provided in the Public Facilities section of this memo.
Murphy Crossing Refinement Plan (2006) [5]	City of Bend in partnership with ODOT			The purpose of the Plan is to implement a network of streets consistent with the City's TSP. The Plan outlines the permitted land uses, development standards, frontage types, and street design types for development in the Murphy Corridor between 3rd Street and 15th Street.	**Section C.** outlines permitted land uses; **Section F.** provides street design types
Juniper Ridge Special Plan Area [6]	City of Bend in partnership with ODOT		TPR	The City and ODOT entered into an intergovernmental agreement to limit vehicle trips from Juniper Ridge and make specified transportation improvements in the area. The agreement allows the first 300 acres of Juniper Ridge to be developed.	

Plan	Sponsoring Agency	Planning Period	Regulatory Framework	Description	Relevant Sections
Central Area Plan [7]	City of Bend			Guides land use, urban design, and transportation in downtown Bend and surrounding neighborhoods; intended to guide and catalyze future growth and private/public investment.	
City of Bend UGB Expansion Proposal (2009) [8]	City of Bend	n/a	State Planning Rules	See discussion above.	

Sources: (1) Metropolitan Transportation Plan, http://www.ci.bend.or.us/index.aspx?page=124; (2) Bend General Plan, http://www.ci.bend.or.us/index.aspx?page=634; (3) Bend Transportation System Plan, https://scholarsbank.uoregon.edu/xmlui/handle/1794/3223; (4) Water and Sewer Public Facility Plan, http://bendoregon.gov/index.aspx?page=737; (5) Murphy Crossing Refinement Area, http://bendoregon.gov/index.aspx?page=770; (6) Juniper Ridge Special Plan Area, http://bendoregon.gov/modules/showdocument.aspx?documentid=2478; (7) Central Plan Area, http://www.bendoregon.gov/index.aspx?page=783; (8) UGB Expansion, http://www.bend.or.us/index.aspx?page=613.

COMMUNITY PROFILE AND DEMOGRAPHICS

Community Profile

The city of Bend is the fifth largest metropolitan area in Oregon and the largest city east of the Cascades, with a population of 76,639 in 2010. Bend comprises nearly 50% of the total population of Deschutes County. Bend grew rapidly in the 1990s and early-to-mid 2000s, however the housing downturn significantly affected housing values and employment, particularly construction jobs. Employment is not projected to return to a level near its 2007 peak until 2020.

Bend is home to Central Oregon Community College (COCC). COCC enrollment has grown significantly in recent years. The number of students enrolled full-time increased from 3,133 in 2006-07 to 6,436 in 2010-11—an increase of 105%. The Oregon Status University (OSU) Cascades Campus is co-located with COCC and offers four-year and master's degrees. It has also grown significantly and has 678 students as of the Fall 2011 term.

Located on the eastern edge of the Cascade Range along the Deschutes River, Bend is a hub for recreation with a relatively dry, high desert climate year-round. Tourism, including the Mt. Bachelor ski resort, and health care are major economic sectors. Emerging industries include software development, bioscience, craft brewing, and recreational and outdoor equipment.

Demographic Characteristics

This section reviews current demographic information for the Bend area, with particular focus on key population segments that typically have the greatest need for public transit services. The density of people, jobs, and services are major determinants of transit demand. The segments analyzed include:

- Seniors and youth population
- Persons with disabilities (not mapped[1])
- Low-income households
- Households without Access to a Vehicle
- Minority Households
- Persons with limited English speaking skills

It should be noted that each of these analyses defines transit markets based on a single characteristic, thus some individuals will be included in one or more demographic group. For example, an older adult who is also disabled and is classified as low-income will be included in three separate demographic groups.

Figure 3 provides a demographic summary of data for the City of Bend and Deschutes River Woods in relation to Deschutes County (equivalent to the boundary of the Bend Metropolitan Area) and Oregon. In addition, the density maps provided in Figure 5 through Figure 11 illustrate the distribution and concentration of these demographic groups in the Bend area. The demographic data is from the 2010 U.S. Census data or the American Community Survey.[2]

[1] Due to a change in disability questions starting in 2008, only a 3-year average is available for disability data. Data from the 3-year average is not available at the block group level and is not mapped.

[2] Data from the 2010 U.S. Census is mapped at the block level. Data from the American Community Survey (ACS) used in the summary table is a 5-Year average from 2006-2010, with the exception of disability data, which is from the 3-Year average for 2008-2010. Maps for other demographic

Figure 3 Demographic Summary

Area	Total population [a]	% Youth (persons aged 10-17) [a]	% Seniors: (persons aged 65+) [a]	% Minority [a]	% Low-Income Households [b]	% Persons with a Disability [c]	% Households without a Vehicle [b]	% Population Speaking English Less than "Well" [b]
Oregon	3,831,074	13.9%	10.2%	21.5%	14.0%	13.4%	7.6%	3.6%
Deschutes County	157,733	14.9%	10.5%	11.6%	10.5%	12.8%	4.1%	1.6%
City of Bend	76,639	12.4%	10.1%	12.7%	10.4%	12.0%	5.4%	1.8%
Deschutes River Woods	5,077	8.5%	11.9%	9.9%	5.3%	N/A	1.5%	0.5%

Sources: (a) U.S. Census Bureau, 2010 U.S. Census, Summary File 1: P1, P9, P12. (b) U.S. Census Bureau, American Community Survey, 2006-2010 5-Year Averages: B16004, B25044, C17002. (c) U.S. Census Bureau, American Community Survey, 2008-2010 3-Year Averages: S1810. Due to the change in disability questions in 2008, only a 3-year average is available.

Notes: Minority includes non-white persons of one race and persons of two or more races. Low-income households are those earning below the federal poverty level. Disability is for the civilian non-institutionalized population aged 5 years or older. Population speaking English less than "well" is based on persons aged 5 years or older. Data for Deschutes County is equivalent to data for the Bend Metropolitan Area.

Seniors and Youth

Older adults (65 years and above, shown in Figure 6) and youth (10 to 17 years old, shown in Figure 7) typically use public transportation more frequently than the general population. Older adults often exhibit higher demand for transit as they become less capable or willing to drive themselves, or can no longer afford to own a car on a fixed income. Young people without driver's licenses or those unable to drive need transit service for school and after school activities, part-time jobs, and access to recreation and entertainment particularly during the summer months.[3]

Seniors aged 65 or older account for just over 10% of the Bend population. As shown in Figure 6, the highest densities of seniors aged 65 or older reside east of Pilot Butte State Park and south of the Saint Charles Medical Center. Although there are only a few pockets of relatively dense senior population in Deschutes River Woods, overall the senior population comprises nearly two percentage points more of the population than the city of Bend.

Youth ages 10-17 are much more dispersed across the region than are seniors. Medium-density clusters of youth reside along Brookswood Boulevard in the southwest of the city and along NE Butler Market Road in the northeast of the city.

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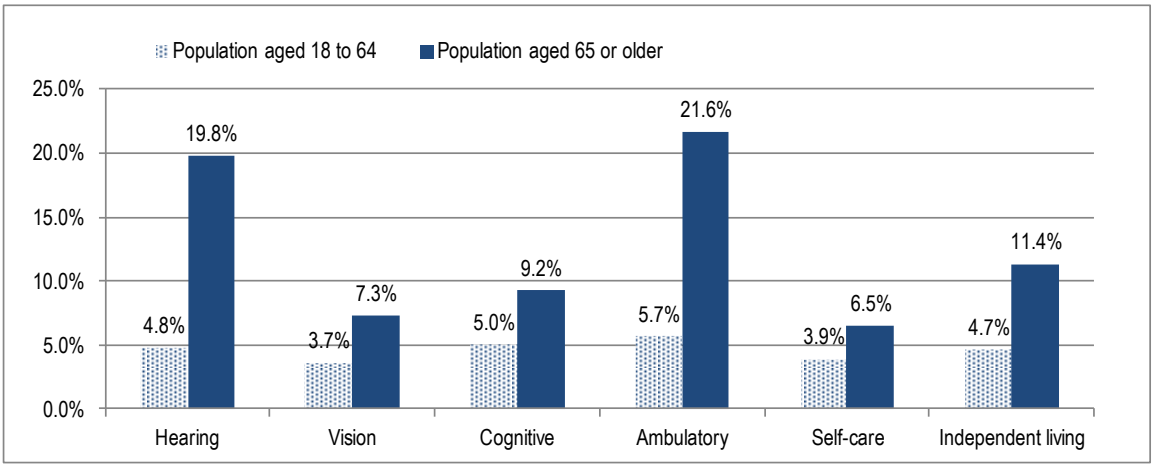
variables were developing using ACS data from the 2005-2009 5-Year average, at the block group level; at the time of analysis 2006-2010 ACS data was not uniformly available at the block group level for all demographic variables.

[3] It should be noted that older adults and youth do not always utilize public transportation in the same ways. For example, older adults tend to use public transportation during the middle of the day for shopping and medical appointments, while youth tend to use public transportation to get to and from school, for after school activities and on weekends. It should also be noted that national trends show that a lower proportion of younger adults are embracing "car culture" – or the need to own their own vehicle – than defined earlier generations.

Persons with Disabilities

Persons with disabilities often are heavily dependent on public transit service. In the city of Bend, 12% of the overall population has one or more disabilities on average between 2008 and 2010, including 9.5% of the population aged 18 to 64 and nearly 36% of the population aged 65 or older. Figure 4 compares the six types of disabilities reported in the American Community Survey (ACS) for adults aged 18-64 and aged 65 and older, and illustrates the increased prevalence of disabilities among older adults. Difficulties with vision, cognitive, ambulatory, and independent living are the most relevant to demand for and ability to use fixed-route buses and/or paratransit. (Note: the American Community Survey does not provide disability data for small geographies).

Figure 4 Types of Disabilities by Age Group, 2008-2010



Source: U.S. Census Bureau, American Community Survey, 2008-2010 3-Year Average: S1810.
Notes: An "ambulatory difficulty" is based on the ACS question, "Does this person have serious difficulty walking or climbing stairs?" An "independent living difficulty" is based on the ACS question, "Because of a physical, mental, or emotional condition, does this person have difficulty doing errands alone such as visiting a doctor's office or shopping?"

Low Income

Over 10% of households in Bend are considered low-income, defined as earning at or below the federal poverty level, which is based on household size. An additional 19% of the population in the city of Bend earns between 100% and 200% of the federal poverty level. As shown in Figure 8, the highest densities of low income residents are concentrated east of the St. Charles Medical Center and south of the Old Mill District. Although the highest density clusters are generally served by transit, portions of moderate density low-income clusters such as south of Reed Market Road are not in close proximity to transit.

Households without Access to a Vehicle

One of the most influential indicators of transit demand is whether a household has access to a car. This indicator may represent households without the economic means of owning a vehicle, as well as households with individuals that choose not to own a car or are unable to drive, such as senior citizens and persons with disabilities.

Over 5% of households in Bend do not have access to a vehicle. Figure 10 shows that the distribution of these households is roughly aligned with the distribution of low-income households shown in Figure 8 and seniors shown in Figure 6.

Minority Population

"Minority" is defined for the purposes of this memo as non-white persons of one race and persons of two or more races. Compared to the state of Oregon (21.5%), the proportion of the minority population in Bend is much lower (12.7%) based on the 2010 Census. Figure 9 shows the distribution of minority households in Bend. The minority population is distributed throughout the city of Bend. Pockets of the minority population are without access to public transit service, particularly those living in southeast Bend east of the Bend Factory Stores and in northeast Bend to the north and east of the Cascade Village Shopping Center.

Persons with Limited English Speaking Skills

Limited English speaking skills is an indicator of the ability for upward economic mobility and correlates closely to income. Thus, this can be another indicator of a household's relative dependency on transit. Roughly 2% of city of Bend residents overall speak English "less than well." The majority of individuals who speak other language consider themselves to speak English well; however, 33% of Spanish language speakers and 20% of those speaking Asian or Pacific Island languages identified themselves as speaking English less than "well." Figure 11 shows that areas with the highest density of population speaking English "less than well" roughly align with the distribution of low-income households.

Figure 5 Population Density, 2010

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Figure 6 Senior (Aged 65 or Older) Population Density, 2010

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Figure 7 Youth (Aged 10 to 17) Population Density, 2010

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Figure 8 Low-Income Household Density, 2005-2009 5-Year Average

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Figure 9 Minority Population Density, 2010

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Figure 10 Density of No Vehicle Households, 2005-2009 5-Year Average

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Figure 11 Density of Population Speaking English Less than "Well", 2005-2009 5-Year Average

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Population and Employment Projections

Figure 12 lists the most recent population projections for Bend and Deschutes County from 2004, which forecast population growth of over 100% for both Bend and the County, an average of slightly more than 4% annually. In contrast, the population estimates from the Portland State University Population Research Center (PRC) were 76,740 for Bend and 157,905 for Deschutes County as of July 1, 2010, approximately 5% lower than the earlier 2010 forecast. (Based on the most recent PRC estimates, Bend grew by 0.2% and Deschutes County grew by 0.6% from 2010 to 2011).

Figure 12 Population Growth Projections, Bend UGB and Deschutes County

Geography	2000	2005	2010	2015	2020	2025	% Change, 2000-2025
Bend UGB	52,800	69,004	81,242	91,158	100,646	109,389	107.2%
Deschutes County	116,600	143,053	166,572	189,443	214,145	240,811	106.5%

Source: Deschutes County Coordinated Population Forecast, 2000-2025, August 25, 2004.

Employment Profile and Projections by Sector

Figure 13 lists current and forecast (2020) employment by industry for Oregon Workforce Region 10, which covers Crook, Deschutes, and Jefferson Counties. Deschutes County comprises about 85% of Region 10 jobs. About 65% of jobs in Deschutes County are located within the Bend UGB. The level of employment is expected to nearly reach peak 2007 levels (84,870 in the Tri-County Region 10 area) by 2020.[4]

[4] Carolyn Eagan (OED Economist for Region 10), Personal Communication, January 2012.

Figure 13 Employment Forecast by Industry, Region 10 (Crook, Deschutes, and Jefferson Counties), 2010-2020

Industry	2010	2020	Change	% Change
Retail/wholesale trade, transportation, and utilities	13,920	16,080	2,160	16%
Educational and health services	10,350	13,190	2,840	27%
Leisure and hospitality	9,960	11,610	1,650	17%
Professional and business services	7,020	8,350	1,330	19%
Manufacturing	5,120	6,200	1,080	21%
Financial activities	4,830	5,380	550	11%
Local government - education	4,800	5,210	410	9%
Local government - non-education	4,340	5,160	820	19%
Construction	3,490	4,130	640	18%
Other services	2,490	2,890	400	16%
State government	1,670	1,780	110	7%
Federal government	1,480	1,380	-100	-7%
Information	1,460	1,710	250	17%
Natural resources and mining	1,230	1,620	390	32%
Total payroll employment	**72,160**	**84,660**	**12,500**	**17%**

Notes: Industry and occupational employment totals are not equal due to rounding. Farm employment is included in natural resources and mining.

Source: Oregon Employment Department (OED)

Figure 14 identifies the top employers in Bend (*Note: Updated data has been requested from OED, and will be added to a revised version of this memorandum).*

Figure 14 Top Employers in Bend

Employer Name	# of Employees (2011)
St. Charles Medical Center	2,978
Les Schwab Tire Center	870 *
Mt. Bachelor	760 **
Wal-Mart	591 *
Bend Memorial Clinic	558
Safeway	545
Fred Meyer	472 *
Opportunity Foundation	420
TRG Customer Solutions	337
JELD-WEN Pozzi Windows and Doors	311
Ray's Grocery Store	292 *
Costco	286
Bank of the Cascades	259
Bend Broadband	255
The Riverhouse	240
Athletic Club of Bend	220
Bend Research	213

Notes: * Regional. ** Represents seasonal high.

Source: Bend Chamber of Commerce. Note: To be updated based on data forthcoming from the Oregon Employment Department.

Current and Projected Population and Employment Density

Figure 15 and Figure 16 illustrate current (2010 Census) and projected (2030) density of population in Bend. The 2030 projection is based on a forecast from 2006.

Similarly, Figure 17 and Figure 18 illustrate the current (2006) and projected (2030) employment density. Although current employment levels are no longer at the 2006 levels, the map nonetheless shows where employment is concentrated in Bend. (The current year map will be updated to reflect 2010 conditions upon receipt of updated data from the Oregon Employment Department).

Figure 15 Population Density, 2010

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Figure 16 Projected Population Density, 2030

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Figure 17 Employment Density, 2006

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Note: To be updated with 2010 data requested from the Oregon Employment Department.

Figure 18 Forecast Employment Density, 2030

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Commuting Patterns

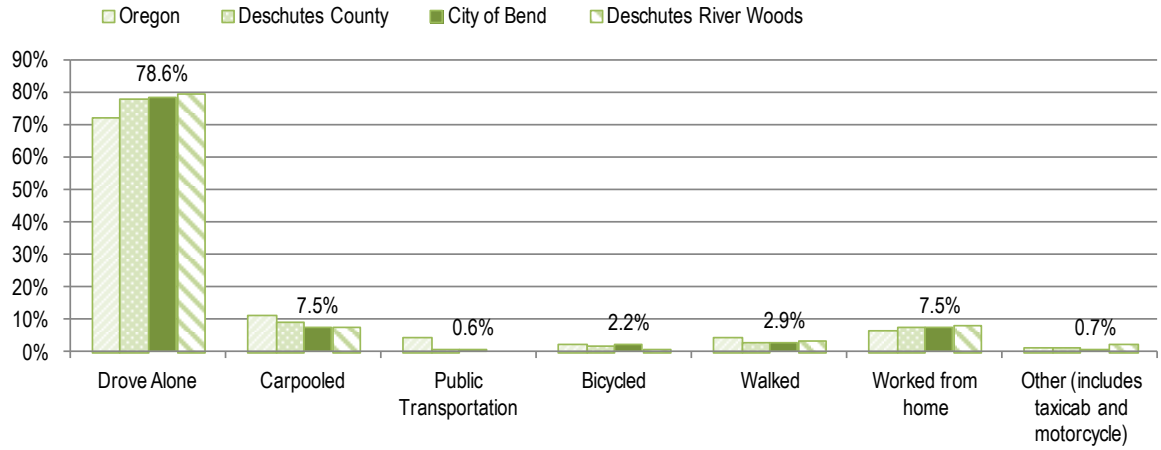
Based on U.S. Census Bureau LEHD (Longitudinal Employer-Household Dynamics) data, of the roughly 36,000 workers in the city of Bend as of 2009, nearly 20,000 (about 55%) lived outside of the city while the remaining 16,000 workers both lived and worked in the city of Bend. About 10,000 residents of the city of Bend worked outside of the city. The maps in Figure 20 and Figure 21 illustrate the work locations of Bend area residents and the home locations of Bend area workers.

Figure 20 (left) illustrates LEHD data that shows the work locations of Bend area residents in 2009, in relation to bus routes in Bend. These locations generally correspond to where existing bus service runs, with the exception of clusters of jobs both south and north of downtown and east of Highway 97 (see inset map). Outside of the Bend area, there are moderate concentrations of residents employed in Redmond, Prineville, and south along Highway 97.

Figure 21 (right) illustrates the home locations of Bend area workers. While the most significant concentrations of home locations within city limits have transit service, the exceptions are in the southeast quadrant of the city and in the northern portion of the city, east and west of Highway 97 (see inset). Outside of city limits, there is no transit service to Deschutes River Woods, in the southwest corner of the Bend MPO boundary. Outside of the Bend area, there are concentrations of home locations in Redmond, south of the city along Highway 97, and in Prineville.

Figure 19 illustrates the mode share, or the percentage of trips made by different forms of transportation, for commuting to work in Bend in relation to the state of Oregon and Deschutes County. Less than 1% of workers age 16 or older residing in Bend commuted to work by public transportation. Over 2% biked to work and nearly 3% walked.

Figure 19 Commute Mode Share, 2006-2010 5-Year Average



Source: American Community Survey, 2006-2010 5-Year Average

Figure 20 Work Locations of Bend Residents, 2009

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Figure 21 Home Locations of Bend Workers, 2009

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LAND USE AND TRANSIT OVERVIEW

The City of Bend has adopted a General Plan (Figure 22), which guides land use and development. The General Plan is implemented primarily by zoning, which is illustrated on the Zoning Map (Figure 23). In addition to land use, the General Plan and Zoning Map also identify an Urban Growth Boundary (UGB), which establish land appropriate for annexation and urban development based upon a 20-year population projection, and an Urban Reserve Boundary, which identifies the long-term expansion needs of the City beyond the 20-year period.

The City of Bend development code describes the characteristics of the land use categories shown on the General Plan and Zoning maps. Broad categories include several types of residential zones; non-residential zones such as commercial or industrial, and mixed-use zones that allow both residential and non-residential uses to be combined on a site. Figure 24 summarizes these categories and the characteristics that determine land use intensity, such as allowed density.

Figure 22 Bend General Plan Map

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Figure 23 Bend Zoning Map

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Figure 24 City of Bend Zoning District Summary

Zone District	Location and Characteristics	Intensity			
		Density Range	Primary Use	Maximum Height	Maximum Lot Coverage
Residential					
UAR Urban Area Reserve	A holding zone for urban development.	1 unit/10 gross acres	Single family detached housing	30 ft	none stated
SR 2 ½ Suburban Low Density Residential	Reflects existing development patterns and the presence of community water systems located on the perimeter of the city intended for urban re-development.	1 unit/2 ½ gross acres	Single family detached housing	30 ft	none stated
RL Low Density Residential	Consists of large urban residential lots that are served with a community water system and DEQ permitted community or municipal sewer systems.	1.1-2.2 units/gross acre	Single family detached housing	30 ft	35%
RS Standard Density Residential	Provide opportunities for a wide variety of residential housing types at the most common residential densities in places where community sewer and water services are available.	2.0-7.3 units/gross acre	Single family detached housing	30 ft	50% for single story homes 35% for all other uses
RM 10 Medium 10 Density Residential	Provide opportunities for manufactured home park development and a variety of single and multi-family residential housing types.	6.0-10.0 units/gross acre	Manufactures homes and attached housing	30 ft	50% for single story homes 35% for all other uses
RM Medium Density Residential	Provide primarily for the development of multiple family residential housing in areas where sewer and water service are available. Provide a transitional use area between other residential districts and other less restrictive areas.	7.3-21.7 units/gross acre	Attached multi-family housing	30 ft for lots created before 1999 35 ft for lots created after 1998	40%
RH High Density Residential	Provide land for primarily high density residential multiple family housing in locations close to shopping and services, transportation and public open space. Provide a transitional use area between other residential districts and other less restrictive areas.	21.7-43 units/gross acre	Attached multi-family housing	45 feet	50%

Zone District	Location and Characteristics	Intensity			
		Density Range	Primary Use	Maximum Height	Maximum Lot Coverage
Commercial					
CBD Central Business District	Encompasses the historic downtown and central business district that has commercial and/or mixed-use development with a storefront character.			35 to 70 ft subject to Sec 2.2.1000	none
CC Convenience Commercial	Adjacent and connected to residential district(s) it is intended to serve. Uses are larger in scale and area than neighborhood commercial uses and provide for frequent shopping and service needs of nearby residents. New CC nodes shall develop as commercial centers rather than a commercial strip and be limited in size up to 5 acres.			35 ft except within 100 ft of the Deschutes River	none
CL Limited Commercial	Provide for a wide range of retail, service, and tourist commercial uses in the community along highways or in new commercial centers.			55 ft except within 100 ft of the Deschutes River	none
CG General Commercial	Provide a broad mixing of commercial uses that have large site requirements, are oriented to the highway and provide services to the traveling public.			55 ft except within 100 ft of the Deschutes River	none
Mixed Use					
ME Mixed Employment District	Provide a broad mix of uses that offer a variety of employment opportunities. Where ME Districts occur on the edge of the city, their function is more transitional in nature providing service commercial businesses and supporting residential uses in an aesthetic mixed environment. When residential units are provided, the units shall be within easy walking distance to the commercial and employment uses.			45 ft	50%

Zone District	Location and Characteristics	Intensity			
		Density Range	Primary Use	Maximum Height	Maximum Lot Coverage
MR Mixed Use Riverfront	Implement the General Plan policies for the creative redevelopment of mill site properties adjacent to the Deschutes River. Allow for a mix of uses that: Provide a variety of employment opportunities and housing types; Foster pedestrian and other non-motor vehicle activity; Ensure functionally coordinated, aesthetically pleasing and cohesive site planning and design; Ensure compatibility of mixed-use development with the surrounding area and minimize off-site impacts associated with the development; and Encourage access to, and enjoyment of, the Deschutes River.			35 ft subject to Sec 2.3.600	none subject to Sec 2.3.600
PO Professional Office	Provide for professional offices in locations near arterial or collector streets and provide a transition of uses between residential areas and other more intensive zones. The zone is intended to create a mix of high density residential housing, office and service commercial developments that are pedestrian oriented and provide a positive contribution to the streetscape.			45 ft	50%
Industrial					
IG General Industrial	Provide for the establishment of light and heavier industrial uses essential to the development of a balanced economic base in an industrial environment with a minimum conflict between industrial uses and non-industrial uses.			50 ft subject to Sec 2.4.600	80%
IL Light Industrial	Provide for heavier commercial and light industrial uses with easy access to collector and arterial streets.			50 ft subject to Sec 2.4.600	80%

Source: Bend Development Code

Transit System Overview

Local Fixed-Route Service

As shown in Figure 25, the existing city-wide fixed route bus system operated by Cascades East Transit (CET) serves developed areas within the Bend City Limits, connecting existing residential areas, employment centers and corridors, shopping areas, schools, and parks. The system consists of seven routes radiating in a "hub and spoke" pattern from the main transit center, Hawthorne Station, located at 3rd Street and Hawthorne Avenue. Figure 26 summarizes the service characteristics of these routes. Routes 1 and 4 operate in both directions along 3rd Street (Highway 97 Business Route), primarily serving commercial and employment activities along this corridor. The other five routes serve a wider variety of land uses, connecting residential neighborhoods with employment, commercial, or activity centers, and supporting daily commuting users. Routes 5 and 6 serve the portion of the city east of Highway 97 while routes 2, 3 and 11 serve portion of the city west of Highway 97.

Service operates on weekdays and Saturdays, with the exception of route 11 that operates on weekdays only. Buses depart from Hawthorne Station every 40 minutes, from about 6:20 am to 6:15 pm on weekdays and slightly reduced hours ("span") of service on Saturdays.

Passenger stops are spaced at intervals ranging from two blocks to approximately one mile, depending on nearby development and potential origins or destinations. Most routes terminate in a one-way loop to extend coverage at the end of each route or to simply turn the bus around. As in illustrated in Figure 27, there are a variety of transit stop amenities, ranging from a simple sign and schedule in a gravel area next to the road (upper right) or sidewalk (upper left) to a fully covered ADA-accessible shelter with benches abutting a paved sidewalk and with a bus pullout (lower left). Hawthorne Station has several shelters, each serving several routes (lower right).). Some covered shelters are incorporated into buildings or other structures adjacent to a bus stop, but are relatively uncommon.

Regional Service

CET Community Connector service provides regional, intercity service with direct connections to La Pine and Redmond. Additional connections within the Tri-County area (Deschutes, Crook, and Jefferson Counties) are available from Redmond.

Recreational/Seasonal Service

Two seasonal, recreational routes serve Mt. Bachelor and provide a river shuttle from mid-June through Labor Day.

Dial-A-Ride

In addition, Dial-A-Ride service is available to persons with disabilities and low-income seniors within the Bend city limits.

Figure 25 Bend Transit Overview

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Figure 26 Bus Service Characteristics

Route # and Name	Days of Operation	Weekday[1,2] Hours of Service (Span)	Frequency or Number of Daily Trips	Fare [3]	Key Destinations/ Connections [4]
Bend Local Service					
1 South 3rd Street	Mon - Sat	6:20 am – 6:15 pm [1]	40 minutes, 100 minutes Saturdays	Zone 1	Bend Factory Outlets
2 Brookswood	Mon – Sat	6:20 am – 6:15 pm [1]	40 minutes, 100 minutes Saturdays	Zone 1	Library, Old Mill District
3 Newport	Mon – Sat	6:20 am – 6:30 pm [2]	40 minutes, 100 minutes Saturdays	Zone 1	COCC/OSU Campus, Summit High School
4 North 3rd Street	Mon – Sat	6:20 am – 6:15 pm [2]	40 minutes, 100 minutes Saturdays	Zone 1	Cascade Village, River Promenade,
5 Wells Acres	Mon – Sat	6:20 am – 6:15 pm [1]	40 minutes, 100 minutes Saturdays	Zone 1	Mountain View High School, St. Charles Medical Center / Bend Memorial Clinic, Forum Shopping Center
6 Bear Creek	Mon - Sat	6:20 am – 6:15 pm [2]	40 minutes, 100 minutes Saturdays	Zone 1	Senior Center, Municipal Court, Bend High School, Worksource Bend
11 Galveston	Weekdays Only	7:20 am – 5:50 pm	40 minutes (no service 9:50 – 11:20 am, 12:30 – 2:40 pm, & 3:50 – 4:40 pm)	Zone 1	Mt. Bachelor Park & Ride, Social Security, Bend Memorial Clinic
Regional Service					
24 Redmond	Mon – Fri	6:00 am – 6:30 pm	4 morning and 4 afternoon round trips (no midday service from 11:10 am – 1:20 pm)	Multi-Zone	Juniper Ridge. From Redmond, connections to Madras, Prineville, Sisters, Warm Springs
30 La Pine	Mon – Fri	5:00 am – 7:40 pm	3 morning and 3 afternoon round trips (no midday service from 10:10 am – 2:45 pm)	Multi-Zone	La Pine Park & Ride (6th & Hwy 97), Wickiup Junction Park & Ride (Burgess Road & Hwy 97)
Seasonal/Recreational Shuttles					
18 Mountain Service (Mt. Bachelor)	Daily during ski season	6:40 am – 5:40 pm	6 trips to Mt. Bachelor (one additional Wed trip) and 5 return trips to Bend.	Zone 5	Mt. Bachelor Park & Ride (SW Columbia between Galveston & Simpson). 2 round trips serve Hawthorne Station.
Ride the River	Fri – Mon, 3rd weekend in June to Labor Day	11:35 am – 6:45 pm	30 minutes	Zone 1	Drake, McCay, and Riverbend Parks

Notes: (1) Saturday service runs from approximately 7:20 am to 5:15 pm. (2) Saturday service runs from approximately 8:00 am to 4:30 pm. (3) Refer to Figure 30 for an overview of the CET fare structure. (4) All routes serve Hawthorne Station.

Figure 27 Typical Transit Stop Types

Source: OTAK

Activity Centers

Figure 28 illustrates major activity centers in Bend in relation to fixed-route bus service and a "network buffer" that illustrates a one-quarter mile walking distance to/from bus stops. Based on this map, transit is within a reasonable walking distance of many major destinations in Bend.

Figure 28 Major Activity Centers

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TRANSIT SYSTEM POLICIES, USAGE, AND PERFORMANCE

This section expands upon the brief overview of the transit system in Bend that was provided in the previous section, including a discussion of transit system performance and the types of trips typically taken on the system.

Fixed-Route Service

Fares

CET uses a zonal fare structure. Trips within Bend require a Zone 1 fare while regional Community Connector trips to/from Bend require a multi-zone fare. Transfers from Bend local service to Community Connector routes require a multi-zone fare. Figure 29 lists current fares for both Zone 1 and multi-zone fares for the available fare media, while Figure 30 provides a map of the fare zones. A single-route full fare costs $1.50 and a full-fare day pass costs $2.50; the average full fare for a round trip would be $1.25 each way.

Discounted fares are available for passengers 60 or older and/or who are disabled. A youth discount is available only on monthly passes; youth is defined as ages six to eighteen. Up to two children aged five years or younger may ride with an adult paying full fare at no charge; additional children must pay full fare. COCC students are offered a discounted monthly pass for $10. Employer pass programs are also available (see "Transportation Demand Management" below).

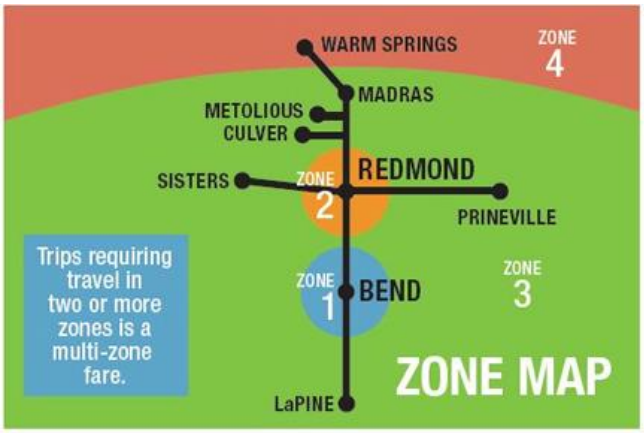
Ride the River service requires a Zone 1 fare. Mountain Line service to Mt. Bachelor operates under a separate fare structure, with an $8 single-ride and $11 round-trip fare. A discounted 14-ride card ($69) and annual pass ($185) are also available. This service is funded by fares as well as an operating contribution from Mt. Bachelor.

Figure 29 CET Fare Structure

Fare Media	Zone 1 Fare (Full / Discounted)	Multi-Zone Fare (Full / Discounted)
Single Route	$1.50 / $0.75	$3.75 / $3.00
Day Pass	$2.50 / $1.75	$6.25 / $5.00
Ticket Book	$12 / $6	$60
Monthly Pass	$30 / $20 Youth or $15 Senior/Disabled	$100

Source: Cascades East Transit

Figure 30 CET Fare Zones



Source: Cascades East Transit, http://www.cascadeseasttransit.com/fares.html

System Performance

Figure 31 illustrates monthly ridership on CET local fixed-route bus service in Bend over the past three calendar years. Monthly ridership has increased from an average of about 28,000 riders per month in calendar year 2009 to over 32,000 in calendar year 2011. Between 25%and 31% of monthly fixed-route riders were seniors or people with disabilities in 2011. Fixed-route productivity, or the number of riders carried per vehicle revenue hour, has increased along with ridership. In addition to riders on regular fixed-routes, seasonal Ride the River service (shown as special services in the chart) attracted nearly 14,000 riders in 2011 and shows an increasing ridership trend.

Figure 31 Monthly Ridership and Productivity, 2009-2011

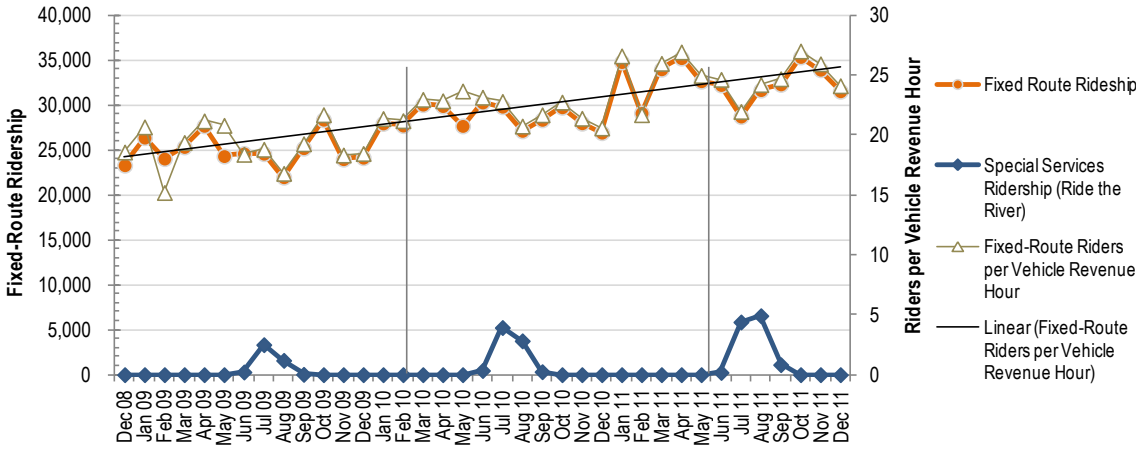


Figure 32 illustrates fixed-route ridership trends for each of the CET routes. Route 3, which serves the COCC and OSU campuses, has the strongest variation in ridership, likely correlated with school sessions and potentially weather. Route 3 and Route 5 both exhibit an increasing ridership trend, particularly over the past 12 months.

Figure 33 shows the productivity, or passengers per vehicle revenue hour, by month for calendar year 2011. Routes 3 and 5 are also the most productive, although productivity on Route 5 dips when COCC is not in session. Route 11 has the lowest productivity of the Bend local routes.

Figure 32 Monthly Ridership by Route, 2009-2011

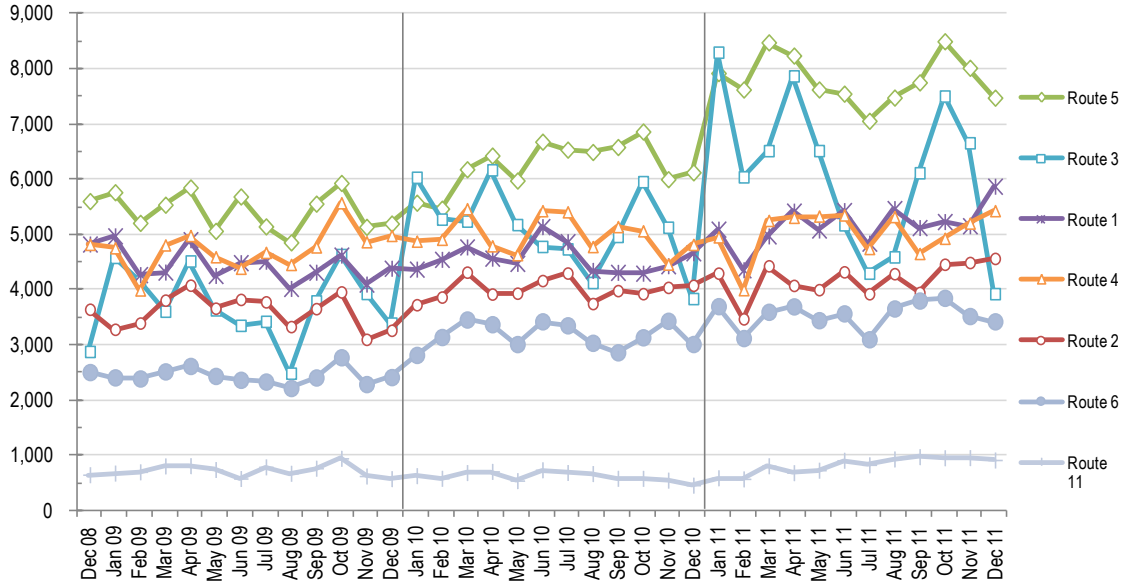
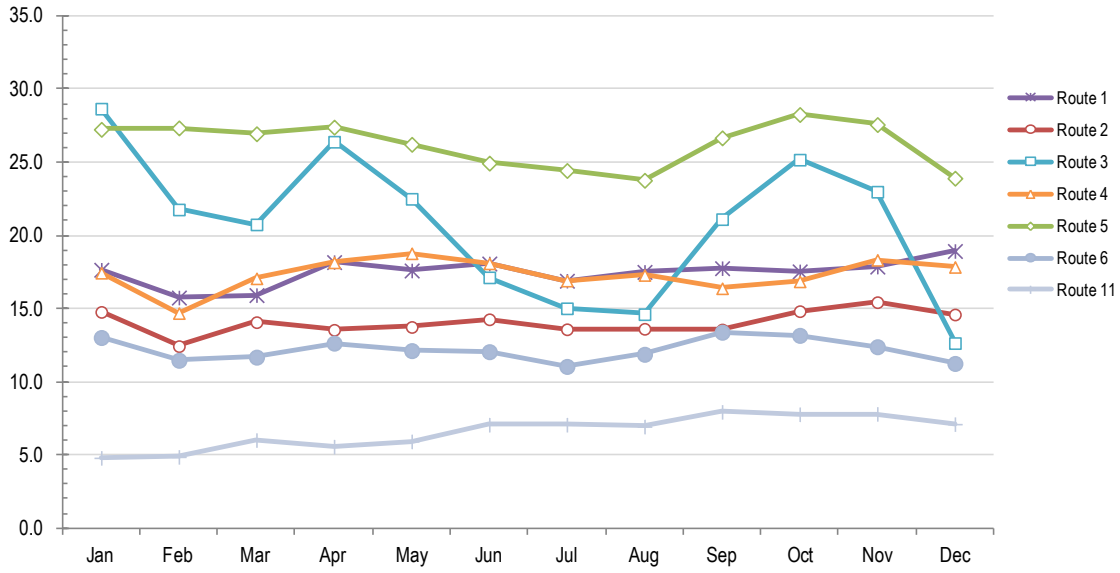


Figure 33 Monthly Productivity by Route, 2011



Based on data from November, 2011, average ridership ranges from about 1,500 to 1,700 riders per weekday and about 400 Saturday riders. Figure 34 illustrates ridership trends by route and day of the week. Route 3 (Newport) serving the COCC campus and Route 5 (Wells Acres) serving St. Charles Medical Center are consistently the highest ridership routes.

Figure 34 Average Ridership by Route and Day, November 1-14, 2011

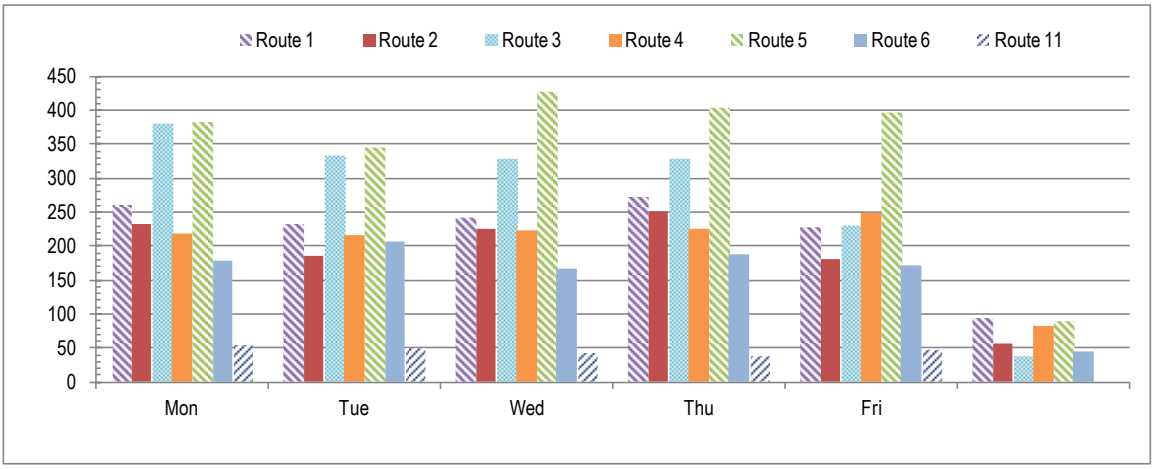
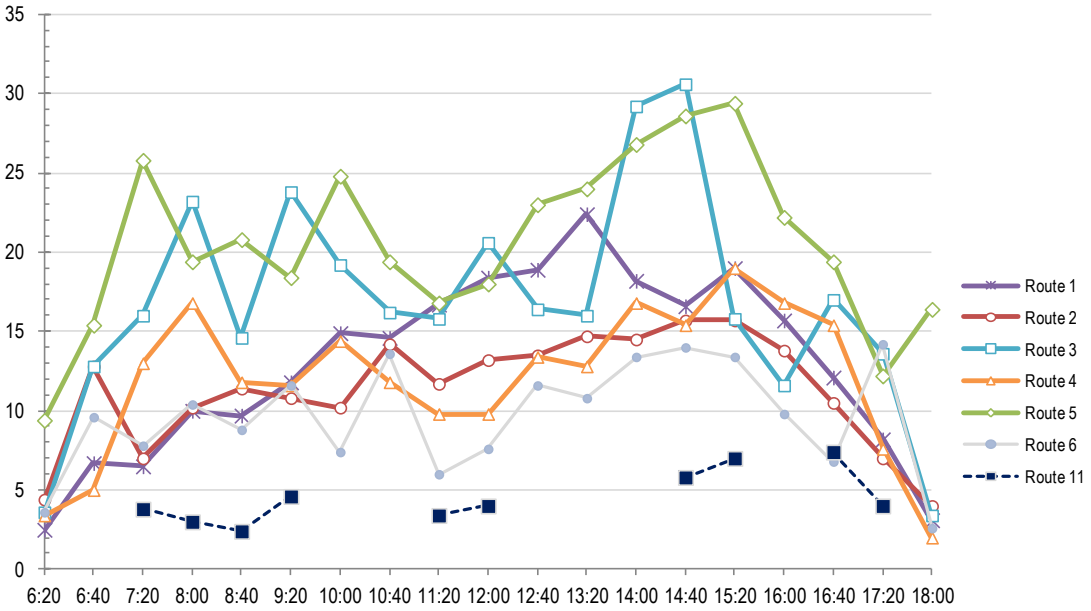


Figure 35 and Figure 36 illustrate ridership over the same period for individual trips on weekdays and Saturdays, respectively. Figure 35 shows that ridership remains consistent even during the midday on most routes, indicating that the system serves non-commute trips. Route 5 (Wells Acres) has stronger ridership on the first and last trips of the day than other routes.

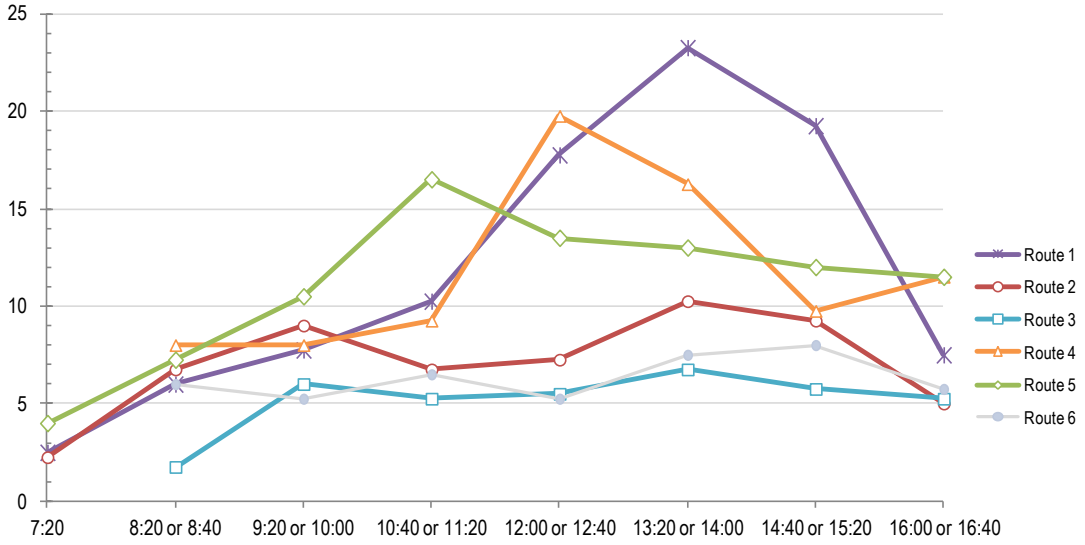
Figure 35 Average Weekday Ridership by Trip, November 1-14, 2011



Source: Data from Cascades East Transit

Routes 1, 2, and 5 start their trips from 7:20 am to 4:40 pm on Saturdays, while Routes 3, 4, and 6 depart from 8:00 am to 4:00 pm. Saturday frequency of service is one hour and 20 minutes. As can be seen in Figure 36, Routes 1, 4, and 5 have the strongest Saturday ridership.

Figure 36 Average Saturday Ridership by Trip, November 2011



Fixed-Route Performance Trends

Figure 37 and Figure 38, based on the National Transit Database (NTD) for fiscal years 2008 to 2010, provide information about performance trends for fixed-route service in Bend. Although the NTD data is not as current as the data provided directly by Cascades East Transit presented earlier in this section through the end of 2011, it is useful for illustrating longer term trends. However, the NTD calculates metrics such as the number of vehicle revenue hours of service[5] differently than CET, therefore caution should be used when comparing metrics such as passengers per vehicle revenue hour between the two data sources.

Based on the NTD data, fixed-route ridership increased by over 43% from 2008 to 2010. Over the same three year period, the efficiency of service improved by 14%, in terms of the number of passengers carried per hour of revenue service provided. Cost efficiency of the fixed route service also improved, as the cost per hour of service declined to about $71 per hour from about $87 per hour in fiscal year 2008. The system also became more cost effective, as the cost per trip served fell from over $6.30 per trip to about $4.50 per trip. The share of operating costs recovered from fares increased from 9% to nearly 11%, although this is still below a benchmark standard of 20%. Accordingly, a smaller subsidy per passenger was required. Finally, the average fare per passenger decreased over the three year period to about $0.50 per passenger, which indicates that many passengers are taking advantage of the discounted fares available on CET.

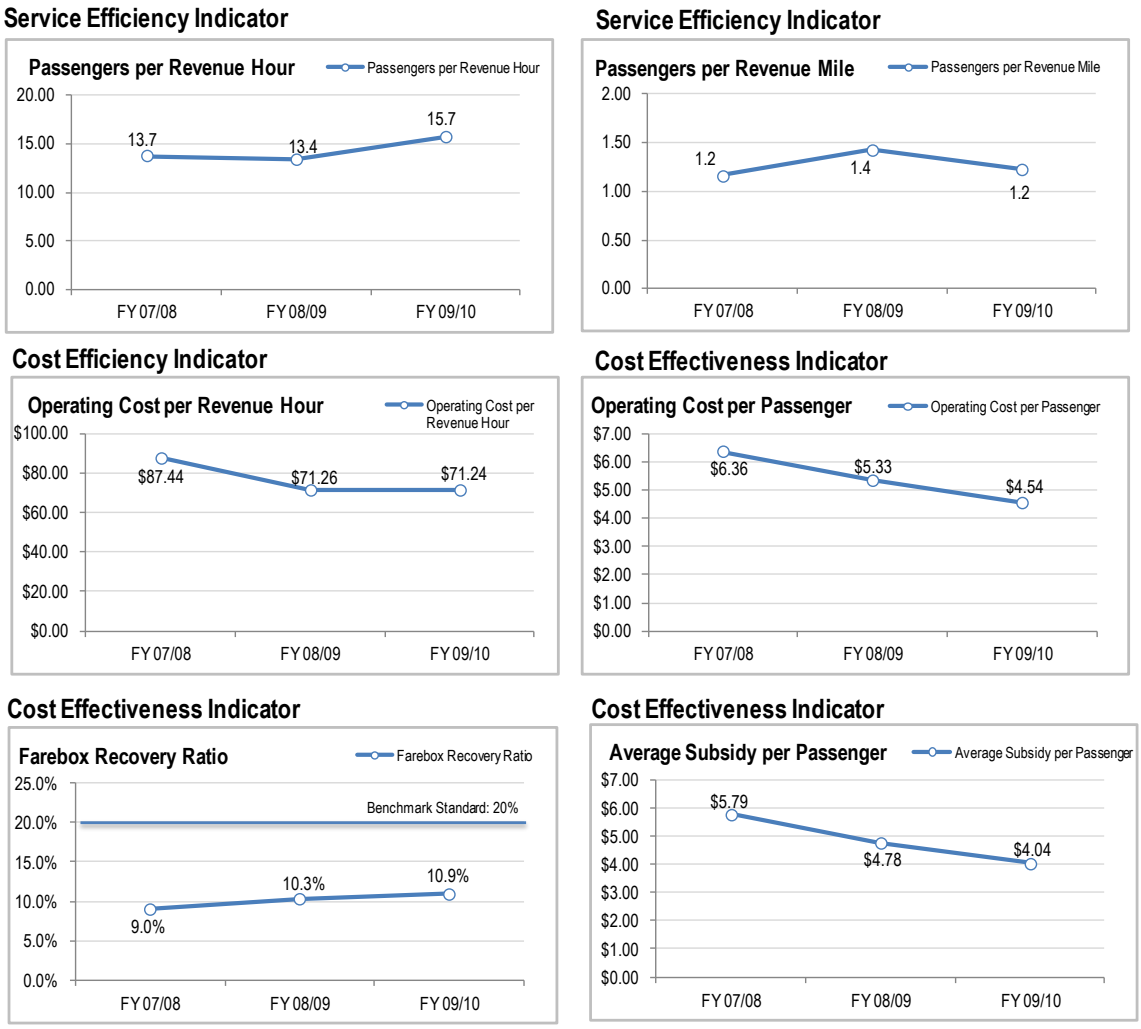
[5] For example, revenue service includes time built into the schedule between trips and layovers, but not the time needed to return to the garage at the end of the day

Figure 37 Bend Local Fixed-Route Performance Data, 2008 – 2010

				Trends		
	FY 07/08	FY 08/09	FY 09/10	FY 07/08 – 08/09	FY 08/09 – 09/10	FY 07/08 – 09-10
Operating Data						
Ridership	229,110	274,084	327,904	19.6%	19.6%	43.1%
Revenue Hours	16,667	20,509	20,902	23.1%	1.9%	25.4%
Revenue Miles	196,682	191,516	266,086	-2.6%	38.9%	35.3%
Operating Costs	$1,457,304	$1,461,465	$1,489,094	0.3%	1.9%	2.2%
Farebox Revenue	$131,679	$151,217	$163,009	14.8%	7.8%	23.8%
Performance Indicators						
Cost Efficiency						
Operating Cost per Revenue Hour	$87.44	$71.26	$71.24	-18.5%	0.0%	-18.5%
Cost Effectiveness						
Operating Cost per Passenger	$6.36	$5.33	$4.54	-16.2%	-14.8%	-28.6%
Farebox Recovery Ratio	9.0%	10.3%	10.9%	14.5%	5.8%	21.1%
Average Fare per Passenger Trip	$0.57	$0.55	$0.50	-4.0%	-9.9%	-13.5%
Average Subsidy per Passenger Trip	$5.79	$4.78	$4.04	-17.4%	-15.4%	-30.1%
Service Efficiency						
Passengers per Revenue Hour	13.75	13.36	15.69	-2.8%	17.4%	14.1%
Passengers per Revenue Mile	1.16	1.43	1.23	22.9%	-13.9%	5.8%

Source: National Transit Database, 2008-2010.

Figure 38 Bend Local Fixed-Route Performance Indicators, 2008-2010



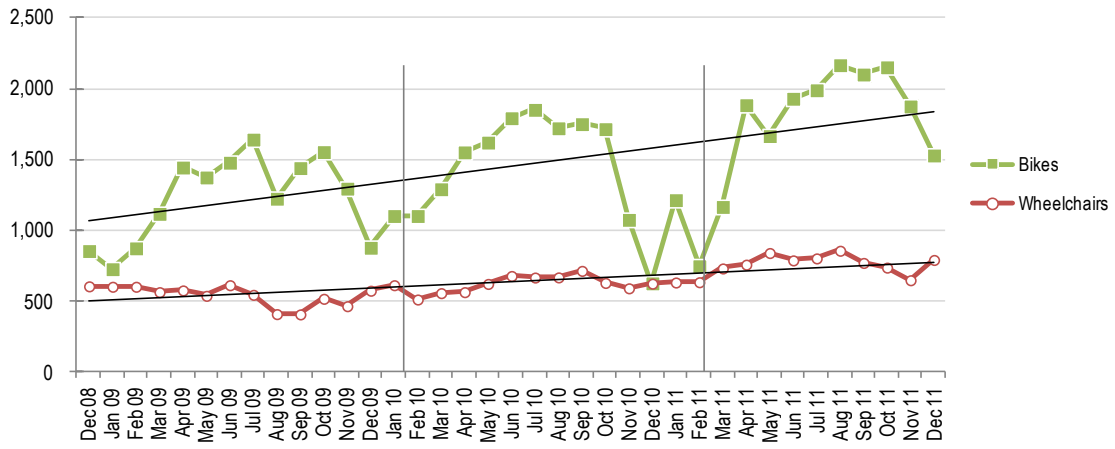
Source: National Transit Database, 2008-2010.

Bicycle and Wheelchair Usage

All CET fixed-route buses have a rack that can carry two bicycles on-board buses. In 2011, an average of 1,700 bikes per month were brought on bus trips in Bend. Figure 39 illustrates a trend of increasing bicycle usage on buses in Bend. Although usage is higher in spring, summer, and fall, the trend applies to all months. Severe weather, such as snow or ice, that creates challenging cycling conditions likely accounts for the variation in bicycle usage between winter months in different years.

Wheelchair usage is not tracked separately between local fixed-route buses and Dial-A-Ride. On average, there were about 750 wheelchair trips per month on fixed-route buses and Dial-A-Ride, as shown in Figure 39.

Figure 39 Bicycle and Wheelchair Usage, 2009-2011



Source: Data from Cascades East Transit

Dial-A-Ride Policies, Usage, and Performance

Dial-A-Ride (DAR) service is provided for individuals with disabilities who cannot ride the fixed-route bus system as well as for low-income seniors. Priority is given to persons with disabilities. Dial-A-Ride operates seven days a week, as detailed in Figure 40, within Bend City limits. The geographic coverage and days/hours of availability exceed the requirements for complementary paratransit service specified by the Americans with Disabilities Act (ADA) of 1991.[6]

Figure 40 Dial-A-Ride Service Characteristics

Days of Operation	Hours of Service (Span)	Scheduling Hours	Peak Vehicles in Service
Seven days a week	Monday - Friday 6:30 am - 6:00 pm Saturday 7:45 am - 5:00 pm Sunday 8:45 am - 3:15 pm	Monday-Friday 7:30 am - 4:30 pm	10

Source: Cascades East Transit

Fares

Fares for DAR service are listed in Figure 41. A full-fare one-way trip costs $2.50, one dollar more than a trip on fixed-route bus service. A 50% discount is available for low-income disabled passengers or low-income seniors (60 and older).

[6] ADA complementary paratransit service requires that door-to-door trips be offered to ADA- eligible customers between origins and destinations located within ¾-mile of regular fixed route transit services. One-way fares are allowed to be up to double the regular one-way fixed route fare for the same trip distance.

Figure 41 Dial-A-Ride Fares

Fare Type	Disabled Full Fare	Disabled Low Income	Senior Low-Income
One-Way-Ride	$2.50	$1.25	$1.25
10-Ride Pass	$25.00	$12.50	$12.50

Source: Cascades East Transit

Eligibility

Policies related to Dial-A-Ride eligibility include:

- Passengers may ride for 30 days while their eligibility application is pending, but not yet approved. For riders with a disability, a medical professional or case manager must complete an assessment of the applicant's functional ability to use to fixed-route bus service.
- Passengers are notified of eligibility approval or denial within 21 days of receipt of the application. Passengers may appeal a denied application.
- Re-certification is required every three years.
- Low-income seniors must be at least 60 years old and provide proof of low-income status.[7]

Scheduling

Reservations may be made for the next day or up to 14 days in advance, but same day rides or changes are not accepted. DAR allows subscription, or regularly scheduled, trips. However such trips are subject to a 30-day waiting period and are reserved on a first-come, first-served basis. A waiting list is maintained for subscription requests that cannot be accommodated.

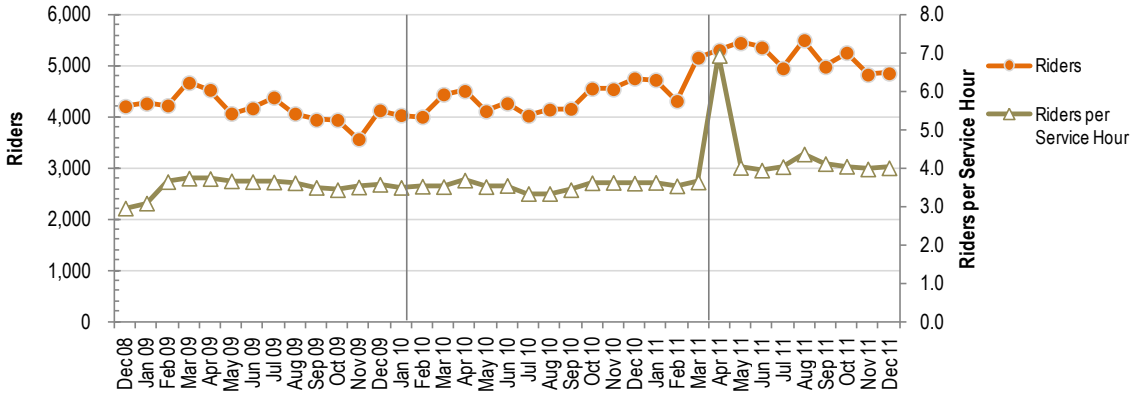
[7] Low-income status can be demonstrated by providing identification or documentation of participation in any of the following federal programs: Oregon Health Plan Medicaid program; Supplemental Security Income (SSI) and Oregon Supplemental Income Program Medical (OSIPM); Food Stamp card; letter from the Federal Public Housing Assistance Program; or Low Income Home Energy Assistance Program (LIHEAP).

Figure 42 Dial-A-Ride Origins and Destinations

This data is being compiled and mapped, and will be included in a future revision of this memo.

Figure 43 illustrates DAR ridership by month for the 2009 to 2011 calendar years (left vertical axis), in relation to productivity, or the number of rides provided per vehicle service hour (right vertical axis). The increase in both ridership and productivity indicates that the service has been able to accommodate ridership growth by more fully utilizing existing capacity.

Figure 43 Monthly Dial-A-Ride Ridership and Productivity, 2009-2011



Source: Data from Cascades East Transit

Figure 44 illustrates statistics for Dial-A-Ride trips and call center calls for 2011—an average of about 5,100 trips and 2,800 call center calls per month. On average, there are about 2,300 subscription trips per month and 1,200 cancellations. Figure 45 shows cancellations as a share of trips taken—an average of 24%. The high rate of cancellations has a significant impact on scheduling; the large number of subscription trips is likely a major contributing factor. Some cancellations are beyond the control of passengers, such as work site closures that affect multiple DAR passengers. It does not appear that there is a high rate of "refused" trips that would encourage passengers to make and then cancel advance reservations (see Figure 46 below).

Figure 44 Dial-A-Ride Trips, Subscriptions, Call Center Calls and Cancellations, 2011

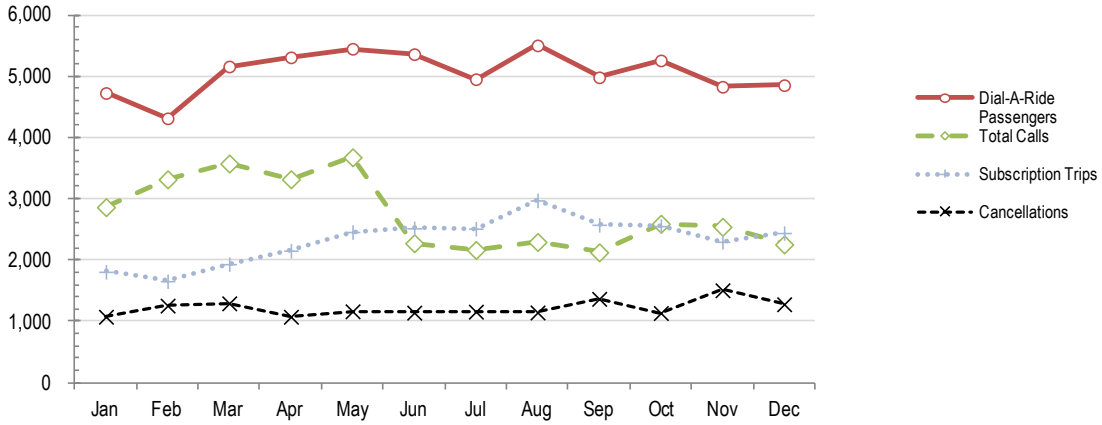
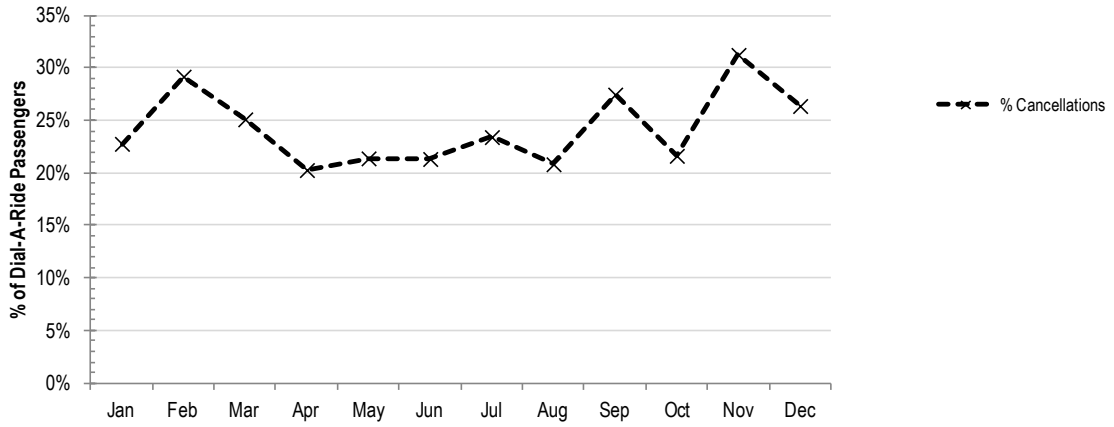
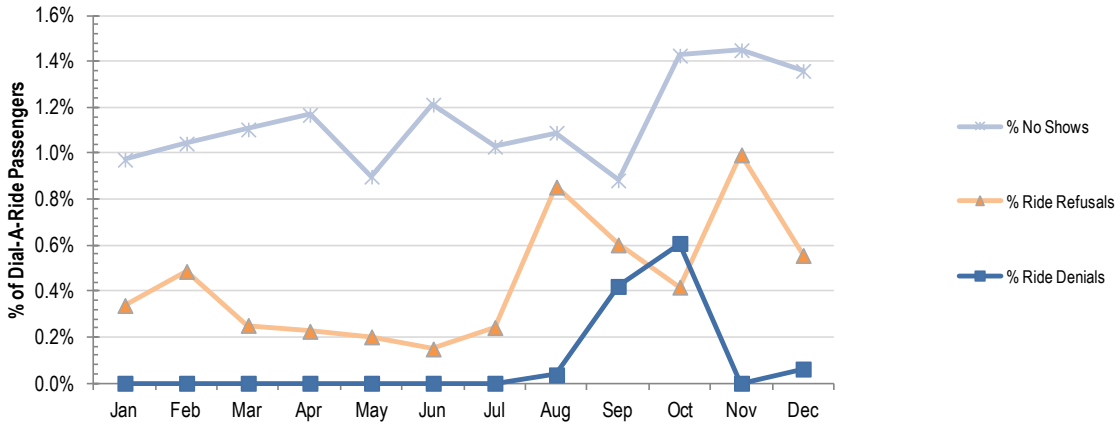


Figure 45 Cancellations as a Percentage of Dial-A-Ride Trips, 2011



On average, slightly over 1% of Dial-A-Ride passengers did not show up for a scheduled trip in 2011 or cancel it over an hour beforehand, as shown in Figure 46. A "refusal" occurs when a passenger refuses an alternate appointment time within an hour of the requested time. Although they are relatively small, refusals were higher (both in absolute numbers and as a percentage of total DAR trips) in the last five months of 2011 than earlier in the year. "Denials," which occur when CET cannot accommodate a trip within an hour of the requested time, were also more prevalent in September and October of 2011, but did not occur or were extremely low in other months. Importantly, there were no denials to ADA-eligible passengers in 2011, i.e., passengers living within a ¾ mile distance of fixed-route bus service in Bend.

Figure 46 Trip Denial and Cancellation Statistics by Month, 2011



Performance Measures

Figure 47 and Figure 48, based on the National Transit Database (NTD) for fiscal years 2008 to 2010, provide information about performance trends for Dial-A-Ride service in Bend. Although the NTD data is not as current as the data provided directly by Cascades East Transit and presented earlier in this section through the end of 2011, it is useful for illustrating longer term trends. However, the NTD calculates metrics such as the number of vehicle revenue hours of service differently than CET, therefore caution should be used when comparing metrics such as passengers per vehicle revenue hour between the two data sources.

This data shows that ridership has decreased by approximately 30% since 2008, when there were over 70,000 annual passengers, to approximately 50,000 annual passengers in both 2009 and 2010. (More recent data from 2011, not yet available through the NTD, show that ridership has since increased to about 60,000 passengers per year). Unlike on fixed route services, a ridership decline on Dial-A-Ride is not necessarily a negative trend as it could indicate that some riders are using the more cost effective fixed route services. Over the 2008-2010 period, the efficiency of service declined slightly, in terms of the number of passengers carried per hour of service provided, potentially due to the lower ridership and/or longer trip distances as the area grows.

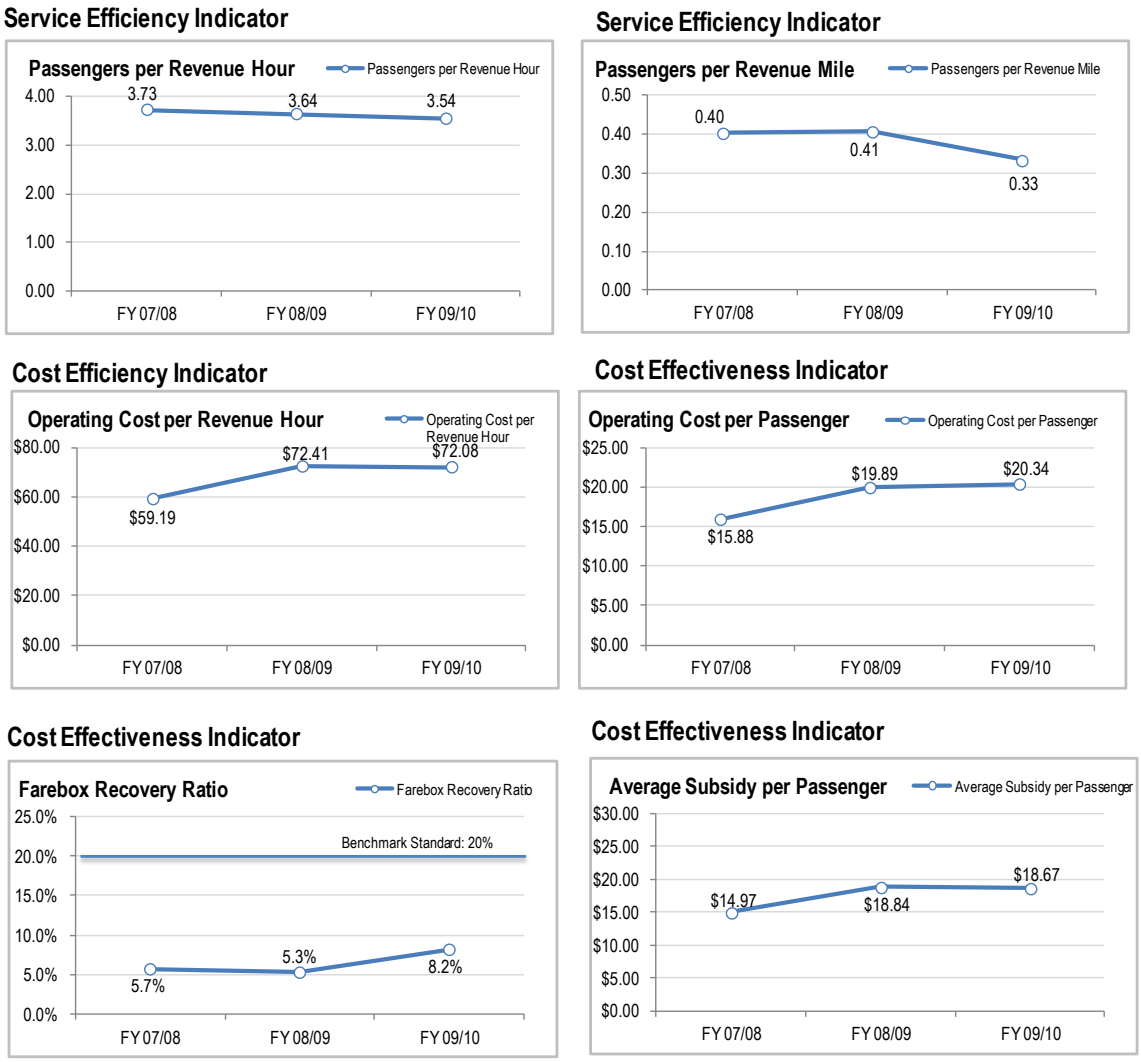
However, the data presented earlier in the section that includes the past 18 months indicates a more recent trend of improving cost efficiency, with productivity in the range of four passengers per hour on Dial-A-Ride service. The cost per hour of service increased to about $72 per hour from about $60 per hour in fiscal year 2008 and the cost per trip served increased from about $16 per trip to about $20 per trip. Absolute operating costs declined by about 10% from 2008-2010. The share of operating costs recovered from fares increased to about 8%, although this is well below a benchmark standard of 20%.

Figure 47 Bend Dial-A-Ride Performance Data, 2008 – 2010

				Trends		
	FY 07/08	FY 08/09	FY 09/10	FY 07/08 – 08/09	FY 08/09 – 09/10	FY 07/08 – 09-10
Operating Data						
Ridership	70,504	51,558	49,524	-26.9%	-3.9%	-29.8%
Revenue Hours	18,915	14,165	13,974	-25.1%	-1.3%	-26.1%
Revenue Miles	174,417	126,356	148,197	-27.6%	17.3%	-15.0%
Operating Costs	1,119,659	1,025,646	1,007,264	-8.4%	-1.8%	-10.0%
Farebox Revenue	64,221	54,425	82,725	-15.3%	52.0%	28.8%
Performance Indicators						
Cost Efficiency						
Operating Cost per Revenue Hour	$59.19	$72.41	$72.08	22.3%	-0.4%	21.8%
Cost Effectiveness						
Operating Cost per Passenger	$15.88	$19.89	$20.34	25.3%	2.2%	28.1%
Farebox Recovery Ratio	5.7%	5.3%	8.2%	-7.5%	54.8%	43.2%
Average Fare per Passenger Trip	$0.91	$1.06	$1.67	15.9%	58.2%	83.4%
Average Subsidy per Passenger Trip	$14.97	$18.84	$18.67	25.8%	-0.9%	24.7%
Service Efficiency						
Passengers per Revenue Hour	3.73	3.64	3.54	-2.4%	-2.6%	-4.9%
Passengers per Revenue Mile	0.40	0.41	0.33	0.9%	-18.1%	-17.3%

Source: National Transit Database, 2008-2010.

Figure 48 Bend Dial-A-Ride Performance Indicators, 2008 – 2010



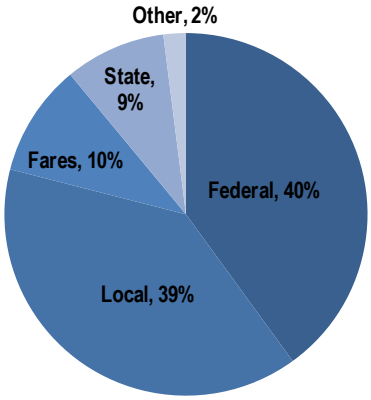
Source: National Transit Database, 2008-2010.

Fixed-Route and Dial-A-Ride Operating Costs and Funding

Operating costs for transit in Bend in fiscal year 2009/2010 were approximately $2.5 million—about $1.5 million for fixed-route service and $1.0 million for Dial-A-Ride. Figure 49 illustrates transit operating funding sources. The City of Bend provides operating funding of over $1 million from its general fund, the largest non-federal revenue source, to meet the requirement for local matching funds for federal section 5307 and 5310 funds.

Figure 50 identifies the operating cost components for Bend fixed-route and Dial-A-Ride service in fiscal year 2009-2010, prior to operations being taken over by Cascades East Transit; these costs, particularly administrative costs, could change significantly.

Figure 49 Operating Funding Sources, FY 2009-2010



Source: National Transit Database, 2010

Figure 50 Bend Transit Operating Costs, FY 2009-2010

Cost Category	Fixed Route	Dial-a-Ride	Notes
Admin Personnel	$64,941	$46,175	
Materials & Services	$ 921,383	$633,373	Includes operations contract
Transfers	$ 198,462	$162,338	Support services
Fuel/Maintenance	$ 239,889	$160,101	Warranty payment subtracted
Facility Operating Costs	$32,341	$21,959	
Scheduling Software	$6,209	$ 4,416	
TOTAL	**$ 1,463,225**	**$ 1,028,362**	**$2,491,587**

Source: Cascades East Transit. In addition, there were city overhead costs of $87,660 for fixed-route and $62,340 for Dial-A-Ride. These costs predate transition of these services from the City of Bend to Cascades East Transit; some costs, particularly administrative costs, could change significantly.

Fleet and Facilities

A detailed listing of the bus fleet for fixed-route and Dial-A-Ride service is listed in Appendix A (Figure A-1). Vehicles are cutaway type vehicles, such as the bus depicted in Figure 51, and model years are primarily from 2007 to 2011. Several vehicles are from 2003, or in one case, 2001 model years.

- Fixed-route buses carry 16 to 27 passengers and generally hold two wheelchairs. All but two buses purchased in 2011 have over 100,000 miles.
- Four Dial-A-Ride vehicles purchased in 2011 carry 18 passengers and two wheelchairs, while several vehicles from 2008 carry eight passengers and two wheelchairs. Most of the Dial-A-Ride vehicles have much lower mileage than the fixed-route buses.

Vehicle purchases are funded as follows. (Note: A detailed Capital Finance plan for fiscal years 2009/2010 through 2013/2014 is included in Appendix A, Figure A-2).

- **Fixed Route:** Fixed route vehicles are funded by direct grants from the FTA under the section 5309 program. This program currently allocates funds for vehicle replacement and bus facilities through the federal annual appropriations process and transportation bill reauthorization process (roughly every 6th year – with appropriations for specific years). In the past, the City of Bend supplied 20% local cash match required for 5309 funding through its general fund, state grants, or other local sources such as advertising revenue. As of 2010, fleet replacement grants were requested using the FTA's State of Good Repair Program.
- **Dial-a-Ride:** Dial-a-Ride vehicles are funded with discretionary grants from the Oregon Department of Transportation (ODOT) – Public Transit Division. The funds for these grants are STP transfer (federal), STF fund (state), JTA fund (state), or passed through 5310 (federal). The local match for these grants is 10.27%. The City of Bend supplies match dollars with General Fund transfers or other local sources such as advertising revenue.
- **Mt. Bachelor Service:** A federal grant was utilized to purchase new vehicles for Mountain Service to Mt. Bachelor in 2011. This service is operated by CET with operating funding from the Mt. Bachelor ski resort.

Hawthorne Station

Hawthorne Station is the transit center for CET local fixed-route bus service and Community Connector routes. It is located on NE Hawthorne Avenue between 3rd and 4th Streets. An adjacent intermodal transfer facility provides connections to other transportation services (see below).

A more detailed discussion of land use around Hawthorne Station is provided in the following section.

Figure 51 CET bus at Hawthorne Station

Source: OTAK

Bus Barn/Maintenance Center

In June 2009, Bend Area Transit (BAT) and City of Bend fleet services moved into a new bus storage and maintenance facility with a 50 year expected lifespan. The facility was built on land previously owned by the City of Bend and was funded primarily by a Connect Oregon I grant provided by the State of Oregon.

Other Transportation Services

Transportation Demand Management (TDM) Programs

- **Commute Options for Central Oregon:** Commute Options is responsible for a variety of programs that encourage use of alternatives to driving alone, including ridesharing, vanpools, walking and bicycling. Commute Options runs an incentive program that provides a $20 gift card from local businesses for every 45 round trip commutes using non-drive alone transportation modes. It also runs the Safe Routes to Schools program in Bend.
- **Pass Programs:** The Central Oregon Intergovernmental Council (COIC), which operates Cascades East Transit service, offers a group employee pass program to organizations with 10 or more employees. A Zone 1 pass is $5 per month per employee and a multi-zone pass is $20 per month per employee. The organization must pay the group fare for all employees who work a day shift (6:00 am to 7:00 pm)

Public and Private Transportation Services and Shuttles

- **Central Oregon Community College (COCC) Shuttle:** COCC operates a free wheelchair-accessible campus shuttle during fall, winter and spring terms from 7:30 am to 8:00 pm. The 12-person bus includes a bike rack.
- **Employee Shuttles:** The Sunriver resort operates two 14-person employee shuttles, making 10 daily trips to Bend and La Pine, serving six stops.[8] Mt. Bachelor employees may ride Route 18 (Mountain Service) at no cost.
- **Social Services Transportation**: Various social services agencies provide transportation services for their clients, in some cases using volunteer drivers. These services are documented in the Deschutes County Coordinated Human Services Transportation Plan (2009; see Appendix C.2 of the CHSTP).
- **Taxis**: Several taxi companies operate within Bend, or between Bend and other cities in Deschutes County, such as Bend City Cab.
- **Airport Shuttles**: Redmond Airport Shuttle provides service from Bend to Redmond Airport, charging $35 to $38 within Bend city limits for one or two passengers. Enviro Shuttle offers a one-way trip from Bend to the airport for $30 and a round trip for $55.

Intercity Transportation

In addition to Community Connector routes operated by CET, several other intercity connections are available in Bend. Services stop at Hawthorne Station, and in some cases, at Bend Lava Lanes. Trips on several of these services can be purchased as part of trips on Amtrak or Greyhound.

- **People Mover:** Operates three round trips per week between Bend and John Day.
- **Eastern Point**: TAC Transportation operates one daily round trip between Bend and Ontario, seven days a week, with connections in Burns and several other destinations along the route.

[8] http://www.bendweekly.com/pdf_version.php?id=624

- **High Desert Point**: TAC Transportation operates on daily round trip between the Amtrak station in Chemult to Redmond, with connections in La Pine, Sunriver and Bend.
- **Central Oregon Breeze**: CAC Transportation operates one daily round trip (two in the peak season) between Bend, Redmond, Portland Airport and Union Station in downtown Portland, with connections at other destinations along the route.
- **Valley Retriever Buslines**: Operates one daily round trip between Bend and Newport, with connections in Salem and Albany (Amtrak).
- **Porter Stage Lines**: Operates one daily round trip between Coos Bay and Bend, with a connection to Amtrak in Eugene.

COMMUNITY SURVEY RESULTS

This section provides information about transit trips and rider characteristics as well as community preferences related to transit. It currently includes results of past transit passenger surveys. The results of several other planned/concurrent surveys will be incorporated into this memo and used to inform development of the PTP. These include:

- An online Community Survey currently underway as part of this project, targeting Bend residents and people who work in Bend. The results will be incorporated into a revised version of this memo in March/April 2012.
- An on-board survey that will be conducted on Bend fixed-route buses as part of the COIC Regional Transit Master Plan (TMP).
- A telephone survey that will be conducted as part of the Regional TMP.

Bend Area Transit On-Board Rider Survey (2007)

Bend Area Transit conducted an on-board rider survey July 30th through August 4th, 2007. Completed surveys were returned by 241 individual riders. Key findings from the survey included the following:

- When asked their reason for riding the bus that day nearly 42% said they rode to get to work or for job seeking, about 18% for shopping, and about 7% for medical appointments. Students comprised 14% of the riders.
- Nearly 60% of riders said they ride the bus because they don't drive or do not have access to a car. Nearly 18% cited convenience and traffic avoidance as a reason for riding and nearly 14% said they rode to save money.
- A fourth of all riders said they ride every day there is BAT service (6 days per week).
- Half of riders who completed a survey were under age 35, and only 5% were at least 65 years old. About 14% of the respondents said they regularly travel with children.
- About 8% of riders bring bikes with them on transit trips.
- About 9% of the surveys were completed in Spanish.
- Nearly 80% of respondents said they would like BAT to offer an annual pass.
- The number one service improvement requested was evening service. The addition of a route to Deschutes River Woods and a generalized request for more routes ranked a distant second and third among requested improvements.

Dial-A-Ride Passenger Survey (2008)

To be added

Bend Community Survey (February – March/April, 2012)

To be added upon completion

COIC Onboard Rider Survey (March, 2012 – tentative)

To be added upon completion

LAND USE AND TRANSIT ASSESSMENT

This section provides a more detailed assessment of land use and transit utilization at the existing transit center, Hawthorne Station, and along individual existing transit routes. It then discusses development/redevelopment potential in Bend generally.

Existing Transit Facilities

Hawthorne Station

The transit center for local CET bus service in Bend is located on NE Hawthorne Avenue between 3rd and 4th Streets. The spine of this commercial area is 3rd Street, the Business Route for Highway 97. Until the Highway 97 bypass (the Bend Parkway) was constructed, 3rd Street was the major north-south route for Bend. Zoning for approximately one block on either side of 3rd Street is CL, Commercial Limited, which allows a wide variety of commercial and light industrial uses. Land use is a mix of auto-oriented commercial outlets, motels, and offices, usually in older buildings and with motor vehicle parking between 3rd Street and the building. Most of the area is developed at a significantly lower intensity than allowed by the CL Zone. Redevelopment would improve the pedestrian environment by requiring conformance with the current Zoning Code, which requires direct pedestrian connections to new buildings and discourages parking between the street and building fronts. There are sidewalks along 3rd Street and the blocks on the east side, but not on the local streets to the west.

One block west of 3rd Street is zoned IL, Industrial Light, which allows a mix of industrial and related commercial uses such as warehousing, wholesale, and distribution of goods and services. Similar to the 3rd Street area, it is generally underdeveloped when compared to what is allowed in the IL Zone. Sidewalks are limited and discontinuous throughout the district.

East of 4th Street and the CL-zoned area is a single-family residential neighborhood in an RS, Residential Urban Standard Density zone. It is fully developed, with little potential for future growth under the current zoning. Another block east on 5th Street, Juniper Park is a heavily used recreation area that contains ball fields, tennis courts, and the Juniper Swim and Fitness Center.

In summary, current development potential in the area near Hawthorne Station is primarily limited to commercial and light industrial redevelopment. However, the Central Area Plan (2007), recommended changes to the City's land use regulations that would affect this area.[9]

Figure 52 Hawthorne Stations and Surrounding Area

Source: City of Bend

[9] http://www.bendoregon.gov/modules/showdocument.aspx?documentid=7010

Existing Transit Corridors

This section provides a route-by-route description of land use along the existing transit corridors in Bend, with a route map that illustrates corridor land use and key activity centers and provides statistics about each route. Figure 53 provides a summary of the statistics that are included on each route map for ¼ and ½ mile walking buffers (distances) around bus stops. One quarter mile is typically accepted as the distance most people are willing to walk to a bus stop. A half mile is generally accepted as the distance that people are willing to walk to very frequent, high quality transit service, such as light rail or bus rapid transit. However, individuals who depend on transit may be willing to walk a longer distance to a bus stop if they have no other option.

Overall, about 24,000 residents or 31% of the city's population live with a one-quarter mile walk of a bus stop. About 60% of the population lives within a half mile of a stop.

Figure 53 Summary Land Use Statistics for Existing Transit Routes

			1/4 mile				1/2 mile			
	# of Stops	Round Trip Route Distance	2010 Pop.	% of Total Pop	Buffer Area (acre)	Density (acre)	2010 Pop.	% of Total Pop	Buffer Area (acre)	Density (acre)
Route 1	22	6.1	2,121	3%	625	3.4	5,118	7%	1,381	3.7
Route 2	38	11.0	5,223	7%	1,153	4.5	10,926	14%	2,571	4.3
Route 3	25	8.4	3,610	5%	941	3.8	8,109	11%	2,039	4.0
Route 4	25	7.9	1,216	2%	667	1.8	3,450	5%	1,534	2.2
Route 5	41	10.7	6,834	9%	1,157	5.9	14,285	19%	2,549	5.6
Route 6	22	7.9	4,364	6%	1,049	4.2	9,217	12%	2,162	4.3
Route 11	29	7.8	2,940	4%	906	3.2	6,476	8%	1,843	3.5
Combined	189	59.9	24,102	31%	5,626	4.3	45,601	60%	10,566	4.3
Citywide			**76,639**	**100%**						

Source: 2010 U.S. Census

Route 1: South 3rd Street

Figure 54 illustrates Route 1 and land uses within ¼ and ½ mile walking distance of Route 1 bus stops. With two small exceptions the route follows 3rd Street south from Hawthorne Station to SE Murphy Road. Two blocks south of Franklin Avenue at the north end of the route the outbound route is directed west to 2nd Street for approximately one-quarter mile, where it provides direct access to several commercial uses to the west, behind a large car dealership on 3rd Street. At the south end of the route there is a loop to the east on Murphy Road to Parrell Road, where it follows Parrell north to Badger Road and then north on 3rd Street, completing its loop to back to the transit terminal.

With the exception of the southern loop to Parrell Road, the route serves 3rd Street and the abutting commercial land. Residential development is generally beyond a one quarter mile walk east of 3rd Street, beyond a convenient walking distance. Zoning between the transit center and Alden Avenue, seven blocks south, is CL. At that point 3rd Street passes under a major freight rail line, so the adjacent industrially-zoned land is inaccessible. South of the railroad underpass to Murphy Road is zoned and developed CG, Commercial General, which allows broader commercial and light industrial uses than the CL Zone, but generally at the same intensity. Virtually all uses are auto-oriented, with little thought given to convenient pedestrian access beyond the basic Zoning Code requirements in place at the time of abutting development. Newer development has occurred along the route, including the Bend Factory Stores and an adjacent small shopping center between Badger and Powers Roads, WalMart and an adjacent Albertsons at Murphy Road, an Audi/Volkswagen/BMW dealership north of Reed Market Road, Fred Meyer at Reed Lane, and Mercedes and Toyota auto dealerships between Reed Lane and Powers Road. A broad range of smaller commercial uses and motels are located along the entire length of 3rd Street. There are, however, several undeveloped, vacant, or underdeveloped parcels that have potential for future development or redevelopment. Most vacant land is located toward the south end of the route, while underdeveloped parcels are scattered throughout.

The southern loop to Parrell Road to the east abuts an RS-zoned older residential neighborhood that is largely developed. At approximately mid-point of the Route, one block east on Wilson Avenue, is Vince Genna Stadium, home of the Bend semi-professional baseball team and a summer activity center.

In summary, Route 1 primarily serves the commercial lands along 3rd Street, and is unlikely to serve both the origin and destination of a transit trip; generally, public transit travel along this route would require a transfer in order to connect a residence to employment, shopping, or services.

Figure 54 Route 1: South 3rd St

Route 2: Brookswood

Figure 55 illustrates Route 2 and land uses within ¼ and ½ mile walking distance of Route 2 bus stops. Route 2 extends west from Hawthorne Station for several blocks along Franklin Avenue until the south edge of the downtown core, where it enters a one-way grid southward on Wall Street until Colorado Avenue, a major east-west connection through Bend. It continues south on the two-way street network (Bond Street and Brookswood Boulevard) to the southern City Limits. It generally parallels Route 1 (approximately one-half mile further west), but its service area is physically separated by the Highway 97 Bypass (Bend Parkway) and serves a different sector of the City.

This route serves the Bend downtown at the northern end, including the downtown core area and Old Mill District, both major employment, commercial, and shopping centers and tourist areas. Separating the two commercial centers is the Bend Historic District, a largely RM Residential Urban Medium Density-zoned area between Idaho and Colorado Avenues. South of the Old Mill District, beginning at Reed Market Road, the route enters a residential area along Brookswood Boulevard to its southern terminus at Elk Meadow Elementary School. Zoning is primarily RS with occasional RM until the southern loop, where it is zoned RL Residential Urban Low Density.

Although numerous lots are identified as undeveloped or underdeveloped in the Historic District, they are primarily older homes on small lots and individual ownership in the residential zone. Because of lot size and ownership patterns, future development is likely to remain similar in size and density to what exists now.

There are a number of undeveloped parcels in or adjacent to the Old Mill District, ranging in size from several thousand square feet to several acres, that have the potential for a wide range of higher density residential, commercial, or mixed use development. Several development proposals have been reviewed by the City, but have not been carried forward because of the economic recession. In addition, the industrial area between the Old Mill District and Highway 97 Bypass, and Colorado and Wilson Avenues, is becoming increasingly isolated from other industrial areas as the Old Mill and the surrounding area develops. It is largely underdeveloped and underutilized. This land holds significant potential for intense mixed use development in the medium to long term, but would require amendments to both the Bend General Plan and Zoning Map.

The residential areas to the south are largely developed on the west side of Brookswood Boulevard, but several vacant lots of up to several acres in size are located to the east along the southern portion of the route.

In summary, Route 2 provides both origins and destinations for commuters, providing direct service to both residential neighborhoods and areas of shopping, services, and employment. This route has potential to directly connect trip origins and destinations without the need for a transfer.

Figure 55 Route 2: Brookswood

Route 3: Newport

Figure 56 illustrates Route 3 and land uses within ¼ and ½ mile walking distance of Route 3 bus stops. This route provides the public transit connection to Central Oregon Community College (COCC) and the Oregon State University Cascades Campus (OSU). From Hawthorne Station the route continues west on Greenwood Avenue along the north edge of the downtown core and crosses the Deschutes River. At that point the roadway becomes Newport Avenue, which continues west to the intersection with College Way, where the route begins its one-way loop with the outbound leg extending westward for a short way on Shevlin Park Road, turning south on NorthWest Crossing Drive into NorthWest Crossing, a newer mixed use neighborhood. After looping through the residential and commercial portions of the neighborhood, including a senior living facility, and grade and high schools, the route continues north on Mount Washington Drive to the OSU and COCC campuses located on College Way. It then connects back to Newport Avenue to reverse the outbound route.

Route 3 primarily serves the northern downtown core, including the Deschutes County Courthouse and commercial business, residential neighborhoods along Newport Avenue, neighborhood commercial areas between 11th and 13th Streets and at the intersection of Newport Avenue, Shevlin Park Road, and College Way, NorthWest Crossing, and the OSU and COCC campuses.

The residential neighborhood north of Newport Avenue has a number of vacant lots, but they are mostly separated from each other and will be developed at single-family residential densities. Northwest Crossing has major residential land available for future development at medium density. Additionally, there is a future phase west of Mt Washington Drive and south of Shevlin Park Road that is approved for mixed residential and industrial use, which would increase employment opportunities at the west end of the route. The college campuses have been expanding and growing in enrollment.

In summary, Route 3 connects the college campuses of OSU and COCC with the downtown, traveling through residential areas in between. Survey work that will be conducted as part of this project and as part of the concurrent Regional Transit Master Plan will help identify whether Route 3 provides direct origin/destination travel for riders without needing to transfer. Route 3 does, however, connect NorthWest Crossing and nearby neighborhoods to the downtown core and shopping, entertainment, and employment. As the industrial and commercial portions of NorthWest Crossing develop more fully, there will be increased opportunities for transit to serve commuters from the city center to the employment in NorthWest Crossing.

Figure 56 Route 3: Newport

Route 4: North 3rd Street

Figure 57 illustrates Route 4 and land uses within ¼ and ½ mile walking distance of Route 4 bus stops. Similar to Route 1, this route serves 3rd Street, the business route for Highway 97, except that it extends north to the Cascade Village Shopping Center near the northern city limits. Routes 1 and 4 cover almost the entire length of this auto-oriented commercial strip, providing public transit access to a major, although dispersed, employment and shopping area. At the southern end next to Hawthorne Station, the route travels through a single-family residential area east of the 3rd Street corridor and past a school before connecting with 3rd Street. The northern route terminus is not a loop as much as a turnaround in the shopping center, although there is a loop through a complex of State offices that includes an ODOT facility the Department of Motor Vehicles (DMV), and maintenance facilities north of Empire Avenue. The Bethlehem Inn (shelter) is along this route just south of Empire Avenue. Other major activity centers include the medium-sized shopping centers Bend River Promenade and Wagner Mall, and the Riverhouse Hotel and Convention Center.

The vacant and developable land pattern for Route 4 is similar to that of Route 1, with scattered underdeveloped land along 3rd Street and vacant parcels toward the northern end.

Route 4 functions much the same as Route 1 in that it serves the CL and CG-zoned lands along 3rd Street, as well as ME land toward the north end of route, and by itself does not serve both origin and destinations along its route. Generally, public transit travel along this route would require a transfer in order to connect a residence to employment, shopping, or services.

Figure 57 Route 4: North 3rd Street

Route 5: Wells Acres

Figure 58 illustrates Route 5 and land uses within ¼ and ½ mile walking distance of Route 5 bus stops. North of Hawthorne Station, Route 5 serves several blocks of commercial development on 3rd Street before moving east to 4th Street, which divides the commercial-zoned development fronting 3rd Street from the residential development east of 4th Street. Five blocks north the route moves to Studio Road and into a mixed density residential area, and extends northeast to Butler Market Road, where it turns east. Land along Butler Market Road is zoned RM and RS, allowing a mix of multi-family and single-family development. At the intersection of Wells Acres and Butler Market Roads the route extends east on Wells Acres Road through a well-established RS-zoned neighborhood to 27th Street, where it turns south and passes Mountain View High School. Past the high school the zoning and development on the east side of 27th is RM Residential Urban Medium Density, while the west side (and a portion of the east side) is within the Medical District Overlay Zone. The Overlay Zone allows medical offices, clinics, and hospitals, and is a major employment and activity center of Bend. The route turns west on Neff Road and begins the one-way loop at the route terminus, passing through the center of the Medical District to Purcell Boulevard where it turns south and extends through a developed RM-zoned multi-family residential neighborhood to Greenwood Avenue and a major commercial district including the Forum Shopping Center (which includes Costco, Whole Foods, Safeway, Office Max, Borders Books, and numerous other shops and fast food restaurants). Turning east on Greenwood, the route extends to 27th, abutting Route 6, which provides access to southeast Bend. At 27th Street it turns south to complete the loop at Neff Road and retraces the outbound route.

There are significant vacant residential parcels along Butler Market Road and 27th Street. The Medical District is also almost half vacant, providing significant opportunity for increased employment in the area.

With significant vacant land in both the residential areas along Butler Market Road and 27th Street, and the Medical District, there is potential for Route 5 ridership growth as development occurs. Because of the land use mix along the route, opportunities to serve both origin and destination functions for transit users without the need to transfer is present now, and will increase in the future.

Figure 58 Route 5: Wells Acres

Route 6: Bear Creek

Figure 59 illustrates Route 6 and land uses within ¼ and ½ mile walking distance of Route 6 bus stops. Along with Route 5, this route provides public transit service to east Bend. From Hawthorne Station it follows Franklin Avenue east to 10th Street, where it turns south to Bear Creek Road. At Don Carlos Street it turns north to Greenwood Avenue, passing through the Dean Swift Refinement Area, a mixed use medium density residential area on the south and a commercial area on the north. The East Bend Public Library is located near the intersection of Dean Swift Road with Greenwood Avenue. At Greenwood Avenue the route goes eastward, paralleling Route 5 until 27th Street, where it turns south and extends to Reed Market Road. The intersection of Greenwood Avenue and 27th Street is zoned and developed CL. The remainder of land along 27th Street is zoned RS on the west side and a mix of RS and RL on the east. The route continues west on Reed Market Road to 15th Street, past the Bend Senior Center. At 15th Street it turns north on 15th to Bear Creek Road, and then crosses Bear Creek Road and travels a short distance north to connect with the Police Station, Municipal Court, Oregon Unemployment and Department of Veterans Affairs offices that front on Greenwood Avenue. The bus turns around in the State of Oregon offices parking lot and retraces its route south to Bear Creek Road, where it turns west back to Franklin Avenue and Hawthorne Station.

Major activity centers along the route include Juniper Park, Juniper Swim and Fitness Center and Bend High School, both west of 8th Street; the State and City offices at 15th Street and Greenwood Avenue; the Bend Senior Center at 15th Street and Reed Market Road; and a commercial area that includes the Forum Shopping Center, along Greenwood Avenue west of 27th Street. There are a number of medium and large vacant parcels along the large eastern loop east of 15th Street that are zoned for a variety of residential densities, providing significant development and ridership potential.

Although Route 6 passes several major activity centers (the senior center and athletic facility) most of the route is through residential neighborhoods. It does provide needed transit to State and City facilities and services, with the exception of along the southern periphery of the Forum Shopping Center where both current and future employment or shopping opportunities are limited. Significant vacant residential land provides increasing ridership opportunities, but with the existing route a transfer would be required to reach major employment or commercial centers. Extending the route to serve not only the present area but also a commercial area (for example, combining Routes 6 and 4 for cross-town travel) may decrease the need for transfers and increase the utility of public transit.

Figure 59 Route 6: Bear Creek

Route 11: Galveston

Figure 60 illustrates Route 11 and land uses within ¼ and ½ mile walking distance of Route 11 bus stops. Route 11 is the seventh transit route serving the City of Bend. From Hawthorne Station, it extends west on Franklin Avenue along the same street as the Route 2 bus service through the south downtown core area to Wall Street. At Wall Street Route 2 turns south, but Route 11 continues west on Riverside Boulevard, which curves southward between Drake Park on the west and a historic residential neighborhood on the east to the intersection with Tumalo Avenue. At that point it turns west and crosses the Deschutes River on the Galveston Bridge and extends up Galveston Avenue to 14th Street, along a CN Commercial Neighborhood-zoned corridor. At 14th Street the route turns south, traveling through an RS neighborhood until Albany Street, where the street name changes to Century Drive. Abutting zones and development become CN on the west and a mix of CN, CG, ME Mixed Employment, and IL on the east. At Simpson Avenue the route turns west up Simpson, along an old landfill site on the south for which a concept plan for mixed use has been presented to the City. The Century Drive Mobile Home Park and an RS and RM neighborhood are to the north. The landfill area is in preliminary stages of planning, so it represents a long-term opportunity for development. At Mt Washington Drive the route loops to the south, passing along the west side of the landfill and, to the west, the Broken Top Planned Unit Development (PUD). Approximately 1,500 feet north of the intersection of Mt Washington Drive and Century Drive the Skyliners Park Sports Complex is located on the west side, followed by the Cascade Middle School and Seven Peaks Charter School. On the east side of Mt Washington Drive is a CL Zone that is partially developed with a variety of businesses and offices. Approximately half of the non-residentially-zoned area is vacant, including parcels of several acres each at the intersection, providing potential for major employment and commercial development in the near term. The route continues southeast past Century Drive to Mt Bachelor Drive, where it turns north and extends to connect with Century Drive in one block. The Bend Athletic Club, the Mt Bachelor Village condominium complex, Touchmark retirement center, Mountain Laurel Lodge (apartments for seniors 55 and older) and adjacent BMC Emergency Care clinic form a major activity center. The route follows Century Drive to the north, where it turns northeast on Colorado and enters a major employment center with mixed uses including a motel, offices, light industrial activities, and warehouse uses. Approximately half of this mixed employment area is vacant, and several buildings are also vacant, so there remain significant near-term development and employment opportunities. At Columbia Street the route turns northward, where it intersects with Simpson Avenue, and then is directed to the west back to the commercial area on Century Drive, where it turns northward and retraces the outbound rout back to the Transit Terminal.

Although the shortest public transit route, Route 11 holds the largest long-term opportunity for ridership gain with the large industrial and commercial area along Colorado and Simpson Avenues, and the potential mixed use area of the landfill. Its route contains a balance of existing commercial and employment land with the downtown core and Galveston Avenue, residential lands along Drake Park adjacent to Galveston Avenue commercial, and along 14th Street, and mixed existing and potential employment uses on the one-way loop at the end of the route. This mix of land uses provides potential for serving rider origins and destinations without the need to transfer from another route.

Figure 60 Route 11: Galveston

Development Potential and Planned Development

This section provides information about redevelopment potential of land in Bend and planned development. Figure 62 illustrates redevelopable/vacant lands based on the City of Bend's Built Land Inventory, in relation to existing transit routes. Figure 63 identifies special districts and overlay zones where development activity is already identified and targeted. Figure 61 identifies additional/specific planned development activity.

Identified opportunity areas that are not currently served by transit include

- Juniper Ridge, an area on the north end of the City, with access to Highway 97, rail, and City utilities, that the City of Bend has identified as a location with large parcels that can help meet the city's long-term needs for industrial land and employment uses.
- Murphy Crossing, along Highway 97 near the south city limits.

In addition, significant areas of residential land use (with or without identified redevelopment potential) that currently lack transit service are in the northwest, northeast, and southeast parts of Bend as well as Deschutes River Woods.

Figure 61 Planned Developments (Table)

Organization	Description	Time Frame
COCC	Expansion of the Bend Campus: 45,000 square foot Health Careers building is scheduled to open late 2011 or early 2012. Renovations are being made to Ochoco Hall's classrooms to help meet the needs of expanding enrollment. Other recently or soon to be completed facilities include a standalone culinary center, a new science building, and the Mazama classroom expansion.[10]	2011-2012
OSU	Recently acquired new location: 650 SW Chandler	Unknown
Bend Park and Recreation	Planned land purchase of Mt Bachelor park and ride lot for a potential indoor swim facility or other recreational facility.	Unknown
ODOT	Expansion/new building on existing location 63085 N Hwy 97 (21000 sq ft new office building)	2012

[10] Economic Development for Central Oregon, 2011 Central Oregon Profile, p. 14; COCC, Construction Projects, http://about.cocc.edu/construction/default.aspx.

Figure 62 Redevelopable and/or Vacant Land

In Word document version, refer to figure in maps PDF / replace page in PDF

Figure 63 Planned Development

In Word document version, refer to figure in maps PDF / replace page in PDF

Potential Transit Corridors

Existing bus routes provide public transit service to existing commercial, employment, and activity destinations throughout the City, and many of the City's developed neighborhoods. Residential areas toward the periphery of the City, however, are often not well served. The ability of land use to support transit may increase in the future as the City expands its boundaries and infill development occurs on vacant or underdeveloped properties. The previous maps presented in this section illustrate currently identified areas of development/redevelopment potential where future expansion of public transit service may be warranted. Linking future residential areas with employment, shopping, and activity centers in an efficient manner will be required if effective public transit service is to be provided.

The focus of the subsequent phase of this study will be to identify and analyze opportunities for public transit service to connect major residential, employment, commercial, and activity areas in a manner that can serve much of Bend residents in an efficient manner. These opportunities may include, but will not be limited to, conceptual transit route options that were developed as part of the City's UGB expansion process (see Figure 64). This assessment will be informed by information in this memorandum and stakeholder/community input (including through the online community survey and public outreach events).

Figure 64 Conceptual Proposed Routes (2008)

PUBLIC FACILITIES AND SERVICES

This section discusses characteristics of existing public facilities in Bend, focused along corridors used by the current bus system. This section is organized as follows:

- **Street system**. Identifies and briefly describes the City's main street systems, highlighting traffic, pedestrian and bicycle deficiencies and future improvements.
- **Water system**. Identifies areas of water system improvements that will allow for future growth in Bend. These improvements include storage tanks, pumps, wells, and piping in order to achieve adequate pressure for fire protection and domestic use.
- **Sanitary sewer system**. Identifies areas of future sewer projects and existing / future system deficiencies. This section describes the City's Interceptor projects and how they will aid in future growth of the basins they will service.
- **Stormwater disposal system**. A description will be provided of how the City's storm water is currently captured and detained. Discussion will explain areas of current system failures and what improvements are anticipated in the near future

For each type of public facility, additional discussion and/or maps are provided in Appendices B through E.

Roadway System

This section provides information on collector and arterial roadways, with an emphasis on streets served by existing transit routes. Figure 66 shows the City of Bend Roadway Systems Plan, which designates streets with a higher classification than "local," which are generally where commercial or industrial centers and destinations that generate transit demand are located. The City of Bend Design Standards[11] provide detail on the City's street construction standards for roadways of different classifications. Section 11.4 (pages 329-332) specifies the relevant pavement standards for transit streets.[12] The standard to which a street is built is a consideration in whether it can accommodate the weight of transit vehicles. Section 3.6.4 (pages 259-261) relates to specifically to transit facilities.

Figure 65 identifies the major roadways used by existing bus routes. The roadways identified as having planned improvements that may accommodate additional capacity and growth. Figure 67 shows the City's Bicycle and Pedestrian System Plan

Appendix B provides a narrative discussion and assessment of roadway conditions and planned improvements, including bicycle and pedestrian conditions.

[11] http://www.bendoregon.gov/index.aspx?page=161

[12] "Pavements that will support a high volume of heavy vehicles and all streets included in the transit classifications (Expressways, Arterials, Major Collectors) shall be designed according to the ODOT Pavement Design Guide (2007), the American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures (1993), and the AASHTO supplement for Rigid Pavement Design & Rigid Pavement Joint Design (1998)."

Figure 65 Existing Transit Streets and Planned Improvements

Street Name	Designation	Bus Routes	Planned Improvements
3rd Street South	Principal Arterial	1	X
3rd Street North	Principal Arterial	4	
Franklin Avenue	Minor Arterial	2, 6, 11	X
Greenwood Ave	Minor Arterial / Principal Arterial	3, 4, 5, 6	X
Newport Ave	Minor Arterial	3	
Shevlin Park Rd	Minor Arterial	3	
Wall Street	Major Collector / Minor Arterial	2	
Bond Street	Major Collector / Minor Arterial	2	
Brookswood Blvd	Minor Arterial	2	X
Mt. Washington Dr	Minor Arterial	3, 11	
Colorado Ave	Minor Arterial	11	
College Drive	Major Collector	3	
Butler Market Rd	Minor Arterial	5	
Wells Acres Rd	Major Collector	5	
Robal Road	Minor Arterial	4	
Reed Market Rd	Major Arterial	6	X
Murphy Road	Major Collector	1	X
27th Street	Major Arterial	5, 6	X
Cooley Rd	Minor Arterial	N/A	X
Empire Ave	Major Arterial	N/A	X

Figure 66 Bend Urban Area Roadway System Plan, 2009

See PDF for map

Figure 67 Bend Urban Area Bicycle and Pedestrian System Plan, 2006

See PDF for map

Water System (Domestic and Fire)

This section aims to provide an abbreviated and simplified understanding of where Bend's water originates and where there currently are system deficiencies. These deficiencies in pressure and storage must be adequately combated to allow growth to those parts of the city.

The City of Bend receives domestic water from four providers, City of Bend, Avion Water District, Agate Water District and Roats Water District. Roats Water District, the smallest water provider in Bend, services south Bend. Avion Water District is a large water service provider, servicing small areas to the south and north within the city limits. Its primary service area is outside the city limits, within the rural areas east of the city. Agate Water District has no customer base within the city limits, servicing properties south of Bend in the Deschutes River Woods community. (Figure C-1 in Appendix C provides a map deliniating the service areas.) This report focuses on the City of Bend water system, as it is currently the primary water provider to most residents within Bend city limits.[13]The City of Bend relies on surface water and ground water for its water system. Currently the City receives its surface water supply from the Bridge Creek watershed, approximately 13 miles from the City limits at the middle fork of Tumalo Creek. This surface water is delivered to the system via the Outback facility[14] where it is disinfected before distribution into the City's water system. Averaged surface water capacity is 11.6 million gallons of water per day (MGD), with availability dependent on irrigation season.

Groundwater originates from nine groundwater facilities with locations spread across the City. Those facilities feed 25 wells which pump from the Deschutes Aquifer. The City estimates groundwater well capacity to be 32.2 MGD, without the Rock Bluff 2 well. There are 15 finished water storage reservoirs and 6 booster pump stations. Within the City limits, there are 7 pressure zones controlled by a large number of pressure reducing valves (PRV's), making it a very complex system.

Deficiencies and Master Plan Improvements

The City of Bend completed a Water Master Plan in February 2011.[15] The City currently has areas of deficencies in the water system, defined in the City's Water System Masterplan as where water system pressures drop before 40 pounds per square inch (psi) during peak water usage. These deficencies range from as low as 3.1 psi at Tetherow to 39.9 psi at Pilot Butte. Figure 68 illustrates the areas that have pressure deficencies.These areas will need to be upgraded to ensure future growth potential is permitted in the future. The City's Masterplan has identified potential watermain improvements to help increase pressures to meet current demands and future buildout (2020), illustrated in Figure 69.

The City also has storage deficiencies. In 2010 a new set of engineering standards and principles was developed. As a result of the new standards, the analysis for determining the City's emergency storage requirements became more stringent, requiring a modest increase in above-ground storage.

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[13] In the future, Avion will serve a significant portion of new development southeast, east, northeast, and north of Bend.

[14] The Outback site is a storage and disinfection facility located in the Tumalo Creek watershed west of Bend that is partially owned by the City of Bend and the Forest Service. From the surface water intake, the water is gravity fed in a pipe about 10 miles long to the Outback site. Water is disinfected here before entering into the water system.

[15] Water Master Plan completed by Optimatics in association with Murray, Smith & Associates, Inc.

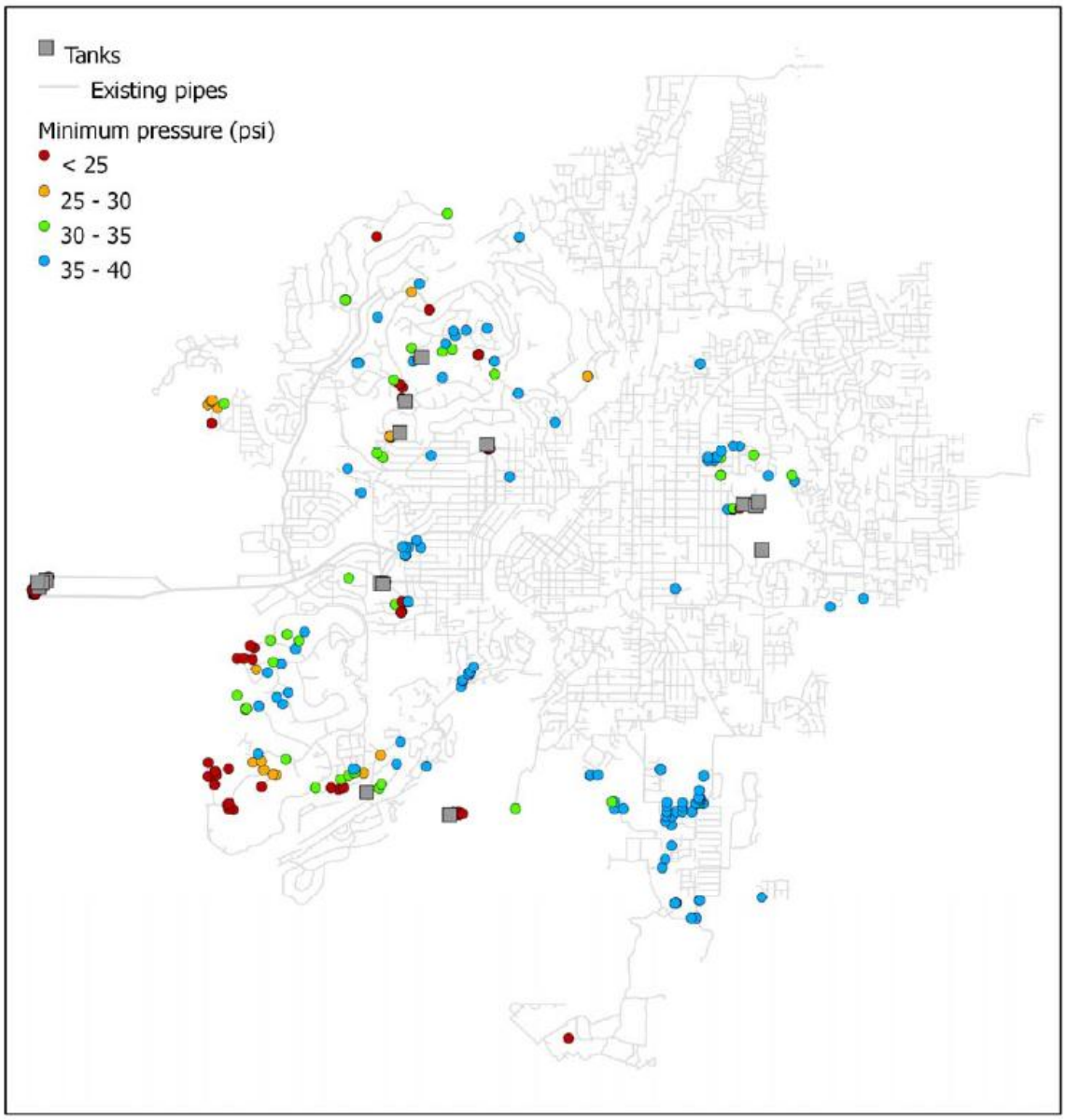
With future demands increasing, additional wells and pumps would be necessary to sustain growth. The proposed solution for servicing the City of Bend now and the future, based on the Water Masterplan (2011), are illustrated in the Masterplan basemap. Figure 70 illustrates buildout improvements and phasing. Maps illustrating additional detail are included in Appendix C (Figure C-2a through C-2f). The phasing of the improvements is important in understanding their relationship to when and where growth will be able to occur.

System Reliability Upgrade

Due to the potential of fire danager in the Tumalo Creek watershed or drought conditions, the surface water is not considered a consistently reliable source of water. The existing pipes were constructed in the 1920s and 1950s and the City is preparing to replace the aging infrastructure.[16] In addition, if a fire were to occur in the watershed, it is feared that the surface water would be too turbid to be usable by the City's current Outback system. Although funding has not yet been identified, the City is considering upgrading the Outback facility with a membrane system for treating the surface water supply and make surface water a more realible source for the City's water system.

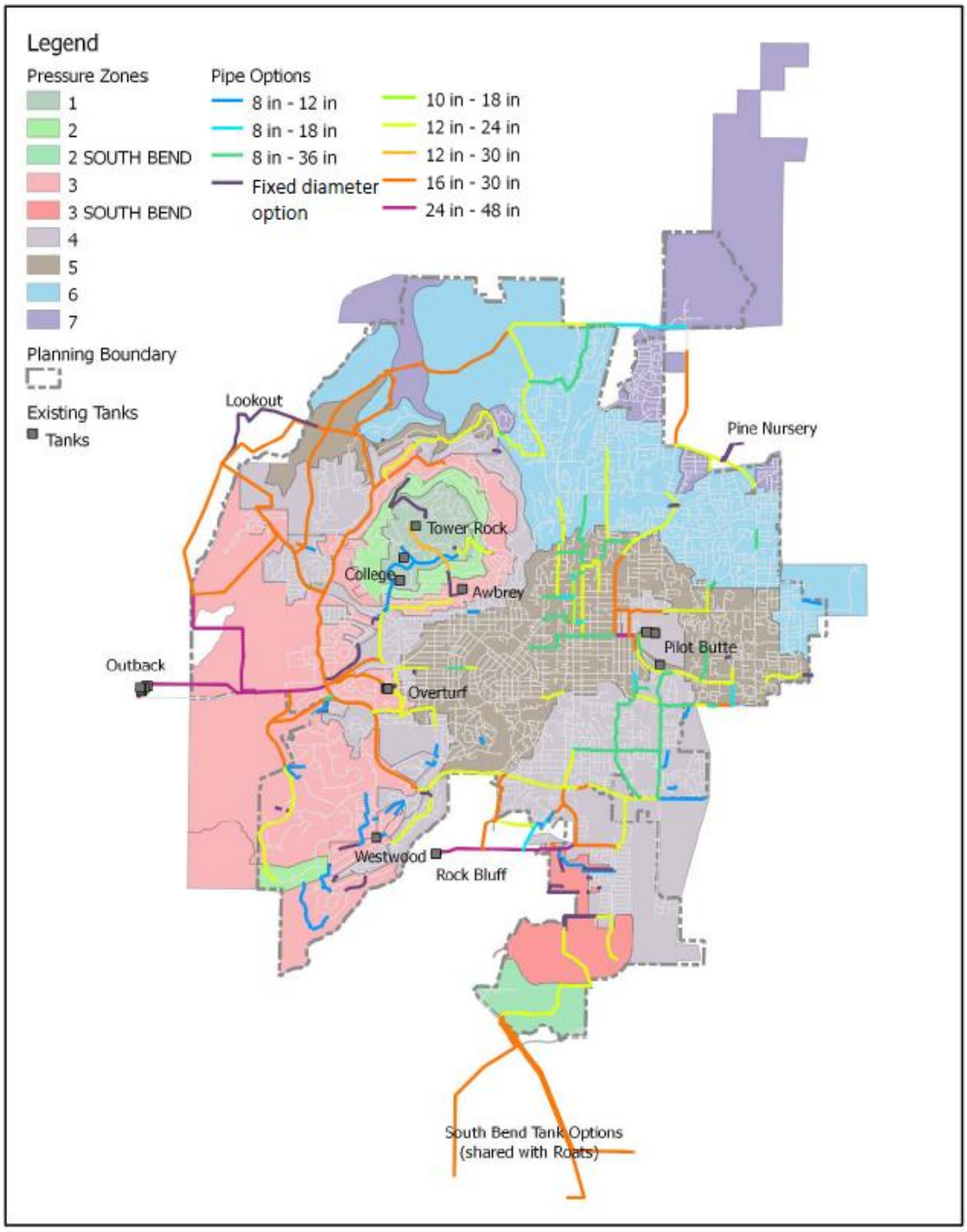
[16] http://bendoregon.gov/index.aspx?page=155

Figure 68 Existing Areas of Pressure Deficiencies



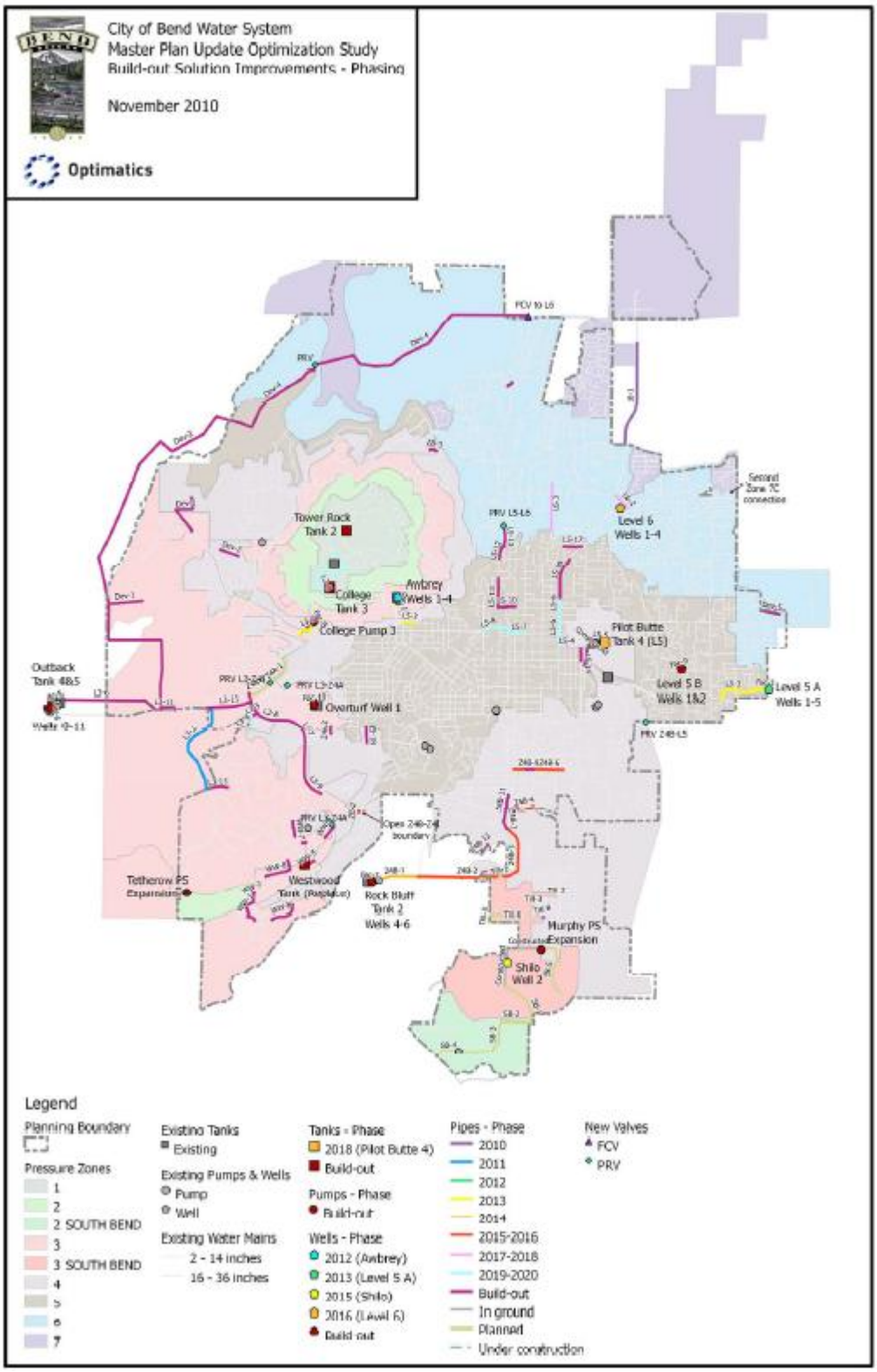
Source: City of Bend Water System Master Plan, 2011

Figure 69 Water Master Plan New Pipelines



Source: City of Bend Water System Master Plan, 2011

Figure 70 Water System Master Plan Phased Improvements



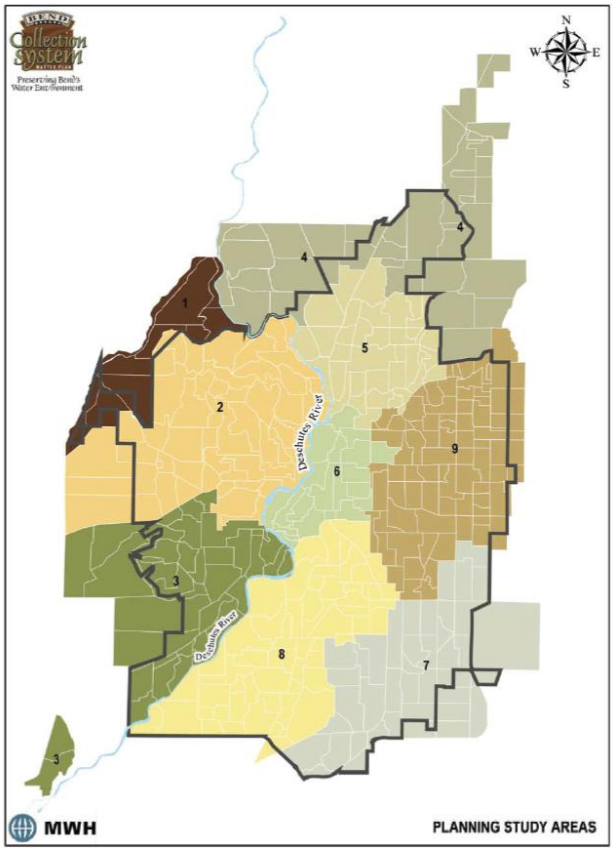
Source: City of Bend Water System Master Plan, 2011

Sanitary Sewer

The sanitary sewer system in Bend flows to a single treatment facility located in northeast Bend, north of the Bend Municipal Airport. Figure 72 provides the City of Bend's sewer base map. As a generalization, much of the sewer flow is directed to the downtown region, the City's core system. This core system is nearing capacity and improvements are necessary to allow for development or redevelopment to occur. These improvements are necessary due to system deficiencies, whether lack of gravity sewer accessibility or existing collector sewers that are undersized to handle the flows they currently receive.

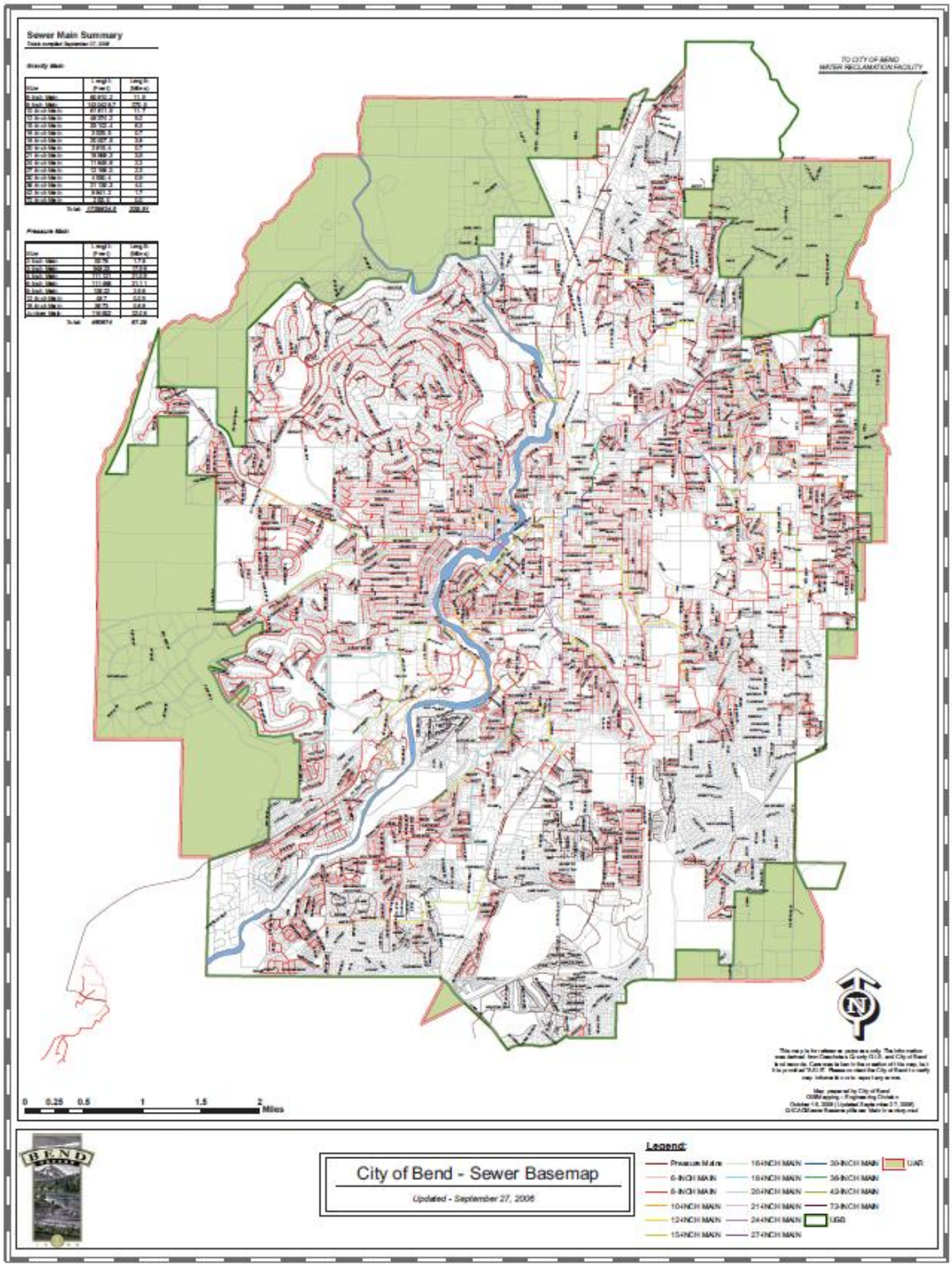
This report focuses on the improvement projects that will significantly improve an area's ability to service the basin, making further development possible. Most of the areas of capacity deficiencies will not be discussed in this report, but are identified in the exhibits provided. These exhibits also identify sewer projects to reduce the number of sewer disposal systems (septic tanks or sand filters) currently in use within the City limits. These exhibits were developed by MWH Americas, Inc. (MWH) as part of the City's Collector Sewer Master Plan (CSMP), approved in 2007. As part of this plan, the City of Bend was divided into nine sewer basins in order to clearly identify sewer deficiencies, as shown in Figure 71. Appendix D includes detailed maps of deficiencies and improvement projects within each of these study areas (see Figures E-1 through E-9).

Figure 71 Sewer Analysis Basins



City of Bend, Collection Sewer Master Plan 2007.

Figure 72 Sewer Basemap, 2006



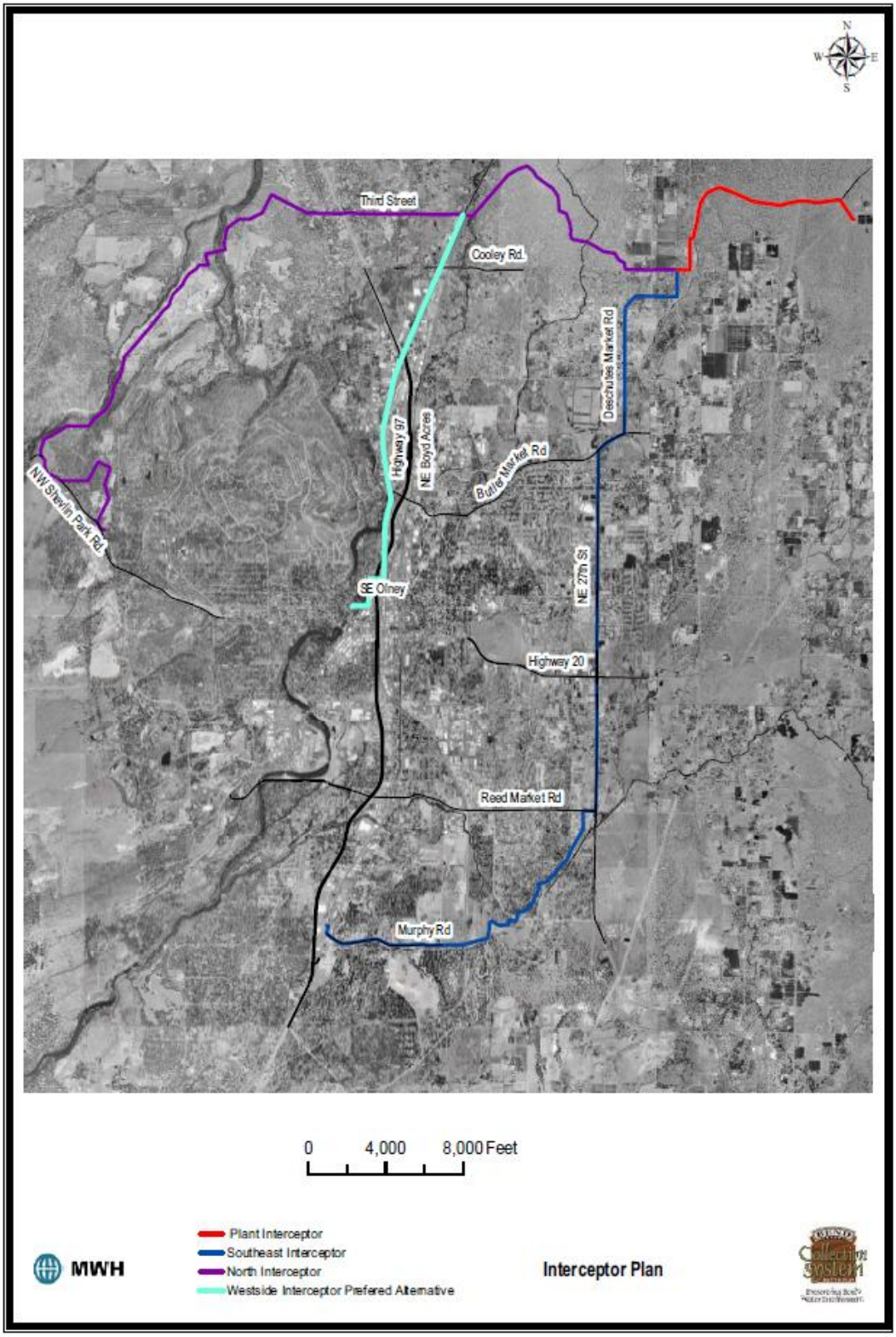
Existing Sewer Pump Stations

In most cases, through good land use and engineering planning shallow gravity systems have been developed to service large sewer basins. However, Bend also relies heavily on pump stations. The primary reason for pump station reliance is because of the high cost of excavation. Most of the City's soil consists of shallow rock formations; therefore in order for a developer to save on construction cost shallow sewer pipe installation is desirable. With all developers installing shallow gravity systems, eventually the properties located the furthest from the City's gravity sewer collector lines do not have adequate depth for gravity sewer and must rely on pump stations for sewer service. One goal of the Interceptor lines is to remove as many of the existing pump stations as possible and limit the number of new pump station. With reduced pump station construction and related pump station capacity concerns, growth potential increases.

Sewer Interceptor Projects

There are four sewer interceptor projects planned for design and construction in the City of Bend (see Figure 73). Individual maps of the projects are provided in Appendix D (see Figures D-10 through D-13). These are long term projects, being developed to service the City with gravity sewer by the installation of large diameter pipe to convey sewer flows from large sewer basins to the City's treatment facility. These four sewer interceptors are referred to as: the Southeast Interceptor (SEI), the North Interceptor (NI), the Westside Interceptor and the Plant Interceptor (also referred to as the Parallel Plant Interceptor, PPI). The purpose of these large diameter sewer mains are to: 1) Remove existing pump stations from service; 2) Provide additional sewer capacity and accessibility to sewer for future growth and development; and 3) Divert sewer flows from areas at or near capacity, particularly in the City's downtown core system. With the exception of the SEI, which has been designed and is being constructed in phases, all of the other Interceptor projects have only had master plan concept designs completed. Final design or construction for the three interceptors that are in the conceptual stages will occur as the economy and growth demand allows.

Figure 73 Sewer Interceptor Projects



Source: City of Bend, Collection Sewer Master Plan 2007

Southeast Interceptor (SEI)

The SEI is a large diameter gravity sewer main that will connect from southeast Bend to northeast Bend flowing through study areas 7, 8 and 9 as defined by the CSMP. Appendix D (see Figure D-10) provides a detailed map of the SEI. Existing sewer mains are being diverted to the SEI to aid capacity concerns. One such main that will be diverted is the Mahogany gravity sewer main that services southwest Bend. The Mahogany sewer main flows from Elk Meadow School south of Pinebrook Boulevard, across the Bend Parkway and into the 3rd Street gravity main. The 3rd Street main conveys flows from the Mahogany sewer main and the pressure force main along Murphy Road, which services a large residential sewer basin, to the City's downtown core system. Diverting flow from the Mahogany line and the Murphy Road corridor will significantly aid the capacity issues in the core system. In additional, the SEI has been designed deep enough to remove the majority of the sewer pump stations in southeast and northeast Bend. The SEI will connect to the City's existing sewer Plant Interceptor near Deschutes Market Road and the North Unit Irrigation Canal, which discharges directly into the treatment facility.

There are vacant properties in southeast Bend that have not been permitted to be developed because of insufficient sewer capacities in the area and lack of sewer accessibility. With the construction of the SEI and the removal of the pump stations, additional residential development will be permitted again. In addition, when the City's UGB expands east of 27th Street, the SEI will allow for continued serviceability to that region.

North Interceptor (NI)

Appendix D (see Figure D-11) provides a detailed map of the NEI. The NI has four objectives:

1. Provide sewer capacity to the Juniper Ridge development area. Juniper Ridge is a future development area in northeast Bend, bringing new industrial and residential development. Development has been slowed in this area because of lack of sewer and transportation capacity issues (discussed in more detail in Appendix B).
2. Provide sewer accessibility to properties along Bend northern city limits, within the UAR boundary between the Deschutes River and Highway 97. This section of the NI will have trunk line sewers extend south to service existing areas. These areas include land around Awbrey Butte and undeveloped or underdeveloped areas west of Highway 97. Future growth north of the City of Bend, when the growth boundary expands, will then also be allowed to connect into the City's system.
3. Provide capacity and sewer access to northwest Bend. Areas around Shevlin Park currently do not have adequate sewer accessibility. The NI will allow development of these areas.
4. Provide sewer service to areas around of the Deschutes River. The Deschutes River canyon is a natural barrier preventing sewer service to the basin. In the NI plan, a large sewer pump station is anticipated to allow gravity sewer to this region, pumping into the NI.

The NI will connect to the Plant Interceptor (future PPI) in northeast Bend at the same location as the SEI.

Westside Interceptor (WI)

Appendix D (see Figure D-12) provides a detailed map of the WI. The WI requires installation of the NI, as it connects into the NI near Highway 97. The purpose of the WI is to intercept flows

from the Westside Pump Station, the Wyndemere Pump Station and Sawyer Park. These areas currently flow into the downtown core system. By redirecting these flows with the WI and NI, the core system will have significantly improved capacity. Two alignments have been conceptually developed for review.

Plant Interceptor (PPI)

Appendix D (see Figure D-13) provides a detailed map of the PPI. Also referred to as the Parallel Plant Interceptor, it is an improvement of the existing sewer main that conveys sewer flows to the treatment facility in northeast Bend. Analysis has been done on the PPI and three different alignments have been developed. Capacity in the existing Plant Interceptor main is sufficient, but needs to be upsized by approximately 2028. The SEI and the NI will connect to the PPI at a common junction located at the southern end of the PPI. With the PPI being conceptual and currently outside the city limits, no further discussion will be made in this report. When the City's UGB expands and this area is rezoned and developed, it is anticipated to have adequate capacity for growth.

Stormwater Disposal

The great majority of Bend's stormwater is captured by catch basins and piped to drywells or Underground Injection Control (UIC) systems. Figure 74 illustrates existing pipe drainage areas and Figure 75 provides an index map of drainage basins illustrating proposed capital improvements.

The City also utilizes infiltration basins / swales. Existing drill holes are utilized but are gradually being removed from service.

UIC's / Drywells

Catch basins located at the street curb are piped into drywells, typically concrete structures with perforation that allow stormwater to infiltrate into the surrounding ground. A typical drywell has a gravel media surrounding the concrete structure that provides for a drywells capacity while stormwater is allowed to infiltrate into the surrounding soils. Since Central Oregon's soils are largely composed of large rock deposits, blasting is usually required in order to allow for excavation for drywell structure installation, as well as to provide micro fractures in the rock that aid in infiltration. Drywells have a limited capacity, so during a large storm event the soils may not be able to infiltrate fast enough, leading to the drywells filling up and occasionally overflowing back onto the street. Overtime drywells fill up with silts that might plug the voids in the gravel media or the rock's micro fractures, reducing infiltration and proper functioning of the drywells. Maintenance, which can include the cleaning of catch basin sumps or the inside of concrete drywell structures of sediments, aids in increasing the life of a drywell. The Department of Environmental Quality (DEQ) presently requires filtration of storm water prior to discharge into a drywell to avoid potentially contaminated stormwater from entering into the soils and ground water. This is done by mechanical filtration where water passes through filter media or by swale filtration prior to overflowing into the drywell structure. Mechanical filtration is usually expensive and requires bi-annual maintenance, or as required by the filter manufacturer. Swale filtration is the preferred form of filtration and will be discussed below. The City of Bend has historically not required filtration of drywells within the right of way, but this requirement has evolved because of DEQ regulations. Figure E-1 (Appendix E) provides the City's of bend's standards for UICs/Drywells.

Drill Holes

Drill holes used to be the preferred method of disposing of storm water because of their inexpensive installation. Unlike drywells, blasting of rock to get a large concrete structure installed underground is not necessary. Though they come in many forms, the most common drill hole is composed for a catch basin where there is a hole in the bottom. The hole is comprised of a well casing where a deep hole was drilled, allowing the storm water to discharge deep into the ground. DEQ would prefer to have drill holes removed, as they could discharge contaminated water into the ground closer to ground water. In some circumstances, drill holes were also used for sanitary sewer waste disposal. New drill holes are no longer permitted.

Infiltration Basins / Swales

These are generally large ponds where vegetation is planted to allow storm water contaminants to be captured through uptake into the plant or sediment trapping prior to storm water infiltration into the ground water. DEQ requires "good soils" to be installed with the vegetation to maintain

healthy plant growth and to increases contaminant removal. Most swales have overflow structures, such as drywells, that capture storm water during large storm events to prevent discharge into streets or buildings. Swales are required to be of sufficient depth and size to provide stormwater filtration before drywell discharge, usually of a capacity equaling a six month storm event before overflowing into a UIC. With the adoption of the City of Bend's new design standards and specifications, swales are the preferred method for treating stormwater. Figure E-2 (Appendix) provides the City's standards for swales.

For more technical information on these stormwater management devices, refer to DEQ regulations or the Central Oregon Stormwater Manual (COSM).

An example of where swales are being used in public right-of-way is on 27th Street north of Highway 20. This section of roadway has an inverted section with a swale in the center median with overflow UIC structures. This was one of the first of its kind in Bend. The new City design standards adopted in 2011 use a similar roadside swale design, with concepts taken from the 27th Street stormwater basin project.

Figure 74 Existing Piped Drainage Areas, 2008

SEE PDF FOR MAP / TO BE INSERTED INTO FINAL MEMO

Figure 75 Proposed Pipeline Capital Improvements, 2008

SEE PDF FOR MAP / TO BE INSERTED INTO FINAL MEMO

Areas of Frequent Flooding

The City of Bend has certain "hot spot" areas where frequent and intense flooding occurs. These areas include the following, which are also highlighted in Figure 77.

Roadway Underpasses: 3rd Street, Franklin Avenue and Greenwood Avenue

The City has three underpasses that are constructed under the Burlington Northern railroad and/or Bend's Highway 97 bypass (the Bend Parkway). All of the underpasses experience flooding during large storm events. There are currently drywells and drill holes at the bottom of the overpasses that capture and infiltrate stormwater. The drywells and drill holes do not work at maximum efficiency due to their age and also accept stormwater from large stormwater basins because they are at a low point. As a result, roadway closures due to flooding in the underpasses is not an uncommon. City maintenance crews are called to pump out the stormwater in order to restore traffic.

In 2010, the City initiated an engineering process to resolve the flooding issues in the 3rd Street underpass. Construction of a pump station is slated for construction in 2012. This pump station will convey storm water out of the underpass into a large swale, where water will be allowed to infiltrate and be treated. This swale will be constructed adjacent to the Bend Parkway. The construction of this pump station is scheduled for the summer of 2012. The improvement plan is shown in Figure 76.

In 2011, the City initiated another engineering process to resolve the flooding issues at the Franklin Street and Greenwood Avenue underpasses. Conceptual solutions have been developed to pump stormwater from the underpasses, discharging west of Wall Street and flowing by gravity into the Deschutes River.

Figure 76 3rd Street Improvement Plan

Source: City of Bend

Archie Briggs Road

Located in northwest Bend, Archie Briggs Road floods during moderate to severe storm events. Stormwater flows down the steep roadway and floods portions of the street, closing traffic lanes. As stormwater depths build, adjacent properties flood. A conceptual solution has been developed to collect and discharge the storm water into the Deschutes River.

West Village Shopping Center and Bend Fire Station

Storm water from West Village Shopping Center (Westside Safeway complex) flows north toward the Ray's Market, then east toward the City of Bend Fire Station. With large storm events, flooding occurs at the Nosler manufacturing building, damaging the structure and property. The reasons for these failures are because of a more impervious soil, likely a hard pan or tuft soils, which infiltrates water slowly. Northwest Bend generally does not have the rocky soils found on Bend's eastside, with the soils in west Bend generally being impervious and problematic for infiltration. Drill holes and drywells in the area can't infiltrate fast enough to prevent flooding. Conceptual solutions include installation of a pipeline that discharges the stormwater to the Deschutes River.

Fairway Heights on Awbrey Butte

Awbrey Butte is a large hillside development in northwest Bend consisting primarily of residential properties. Stormwater flows downhill, usually directed through drainage easements, between home, and sometimes taking detours through residential lots. At Awbrey Butte's northeast hillside is a golf course, where the storm water collects and causes flooding. Conceptual solutions have been developed to capture storm water near structures on and near the golf course, piping the stormwater to a controlled detention facility where it will infiltrate without posing a flooding risk to private properties.

Areas of Northwest Bend near Shevlin Park Road

In the Shevlin Park area of northwest Bend, there are issues with failing UIC's and swales. Similar to the West Village Shopping Center flooding area, the soils do not allow for fast infiltration, causing drywells to overflow during moderate to severe storm events. Studies are ongoing in this area to determine how to adequately resolve flooding issues.

Other areas of Bend have frequent flooding but will not be discussed in depth in this report. Most of these local flooding areas are because of they are old drill holes or drywells, or because of debris or snow/slush (during the winter) blocking catch basin openings. Unlike the hot spot areas discussed, these areas of local flooding don't typically cause property damage but cause inconvenience to vehicle and pedestrian traffic having to veer around puddles or to slow down while driving through standing water.

Figure 77 Selected Frequent Flooding Areas

APPENDICES

Appendix A: Bus Fleet Inventory and Capital Plan
Appendix B: Public Facilities: Roadways
Appendix C: Public Facilities: Water System
Appendix D: Public Facilities: Sanitary Sewer
Appendix E: Public Facilities: Stormwater Disposal System