

The Truckee Meadows

Regional Stormwater Quality Management Program

Low Impact Development Handbook

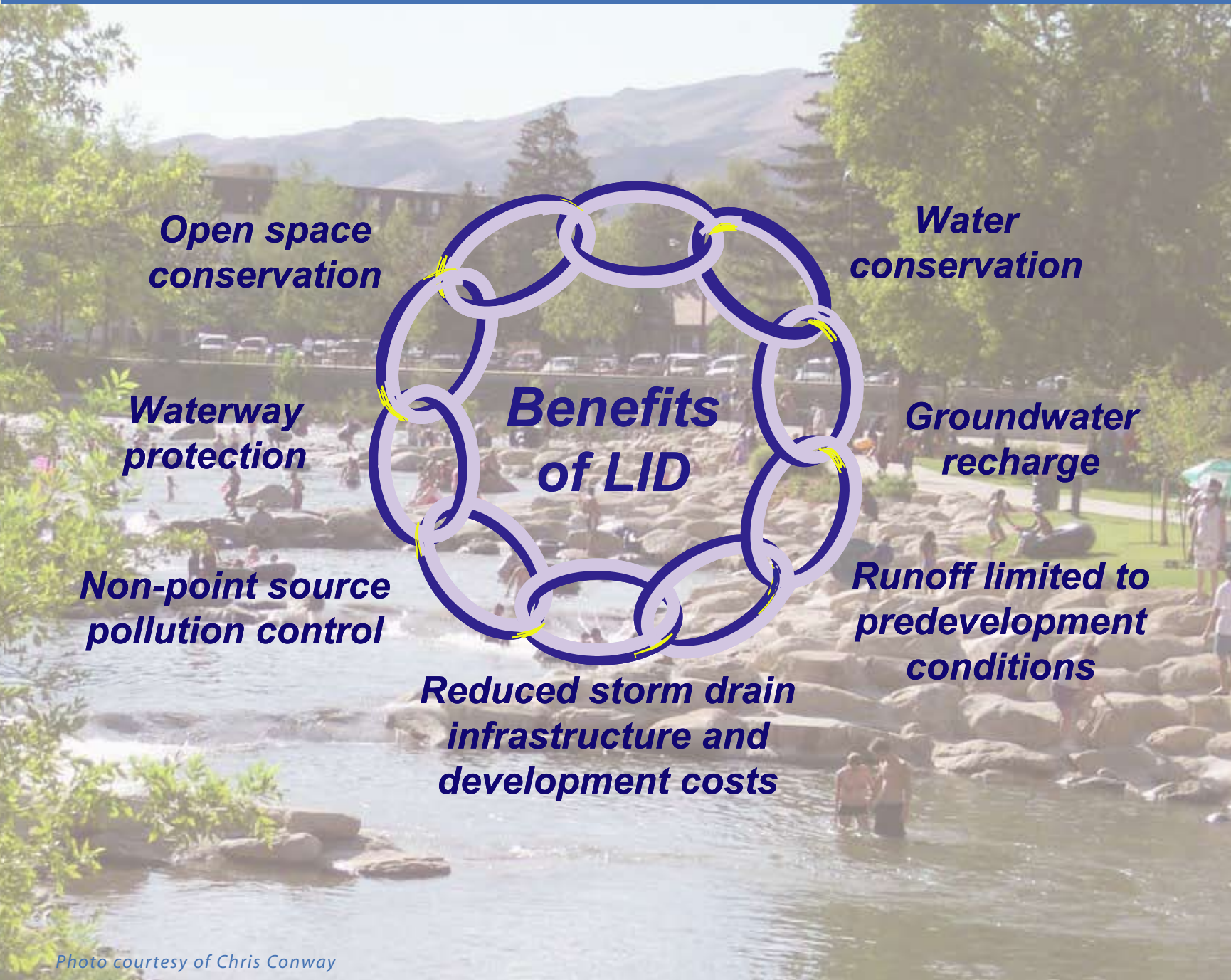


Photo courtesy of Chris Conway

Truckee Meadows Low Impact Development Handbook

Kennedy/Jenks Consultants
August 2007



**TRUCKEE MEADOWS
LOW IMPACT DEVELOPMENT HANDBOOK**

**Guidance on LID Practices
for New Development and Redevelopment**

Prepared For:

City of Reno

City of Sparks

Washoe County

Regional Water Planning Commission

Nevada Division of Environmental Protection

Prepared By:

Kennedy/Jenks Consultants

August 2007

Table of Contents

List of Appendices..... ii

Acknowledgements.....iii

Section 1: Introduction

1.0 Purpose and Organization of the LID Handbook 1-1
1.1 Development History of the LID Handbook 1-3
1.2 NPDES Storm Water Permit Regulations 1-5
1.3 Storm Water Quality Management..... 1-6
1.4 LID, Smart Growth and Sustainable Development 1-7
1.5 The Truckee Meadows Regional Plan 1-8
1.6 Program Area..... 1-9
1.7 Related Handbooks and Manuals 1-9
1.8 Updates and Revisions 1-10
1.9 Comments and Distribution..... 1-10
1.10 Disclaimer 1-11
1.11 References and Additional Resource Information..... 1-11

Section 2: Regional Policies and Procedures

2.0 Preface..... 2-1
2.1 Overview 2-1
2.2 Background 2-2
2.3 Plan Review and Permitting Process 2-3
2.4 Infiltration Testing..... 2-4
2.5 Development Categories..... 2-5
2.6 Construction Inspection..... 2-7
2.7 Tracking and Maintenance Notification 2-7
2.8 Operation and Maintenance 2-8
2.9 Inspection and Enforcement 2-8
2.10 Training and Education 2-9
2.11 References..... 2-11

Section 3: LID Practices

3.0 Bioretention Systems 3-1
3.0.0 Landscape Detention 3-4
3.0.1 Tree Box Filters 3-10
3.0.2 Storm Water Planters..... 3-12
3.1 Swales and Buffer Strips..... 3-15
3.2 Porous Paving Systems 3-22
3.2.0 Porous Concrete and Asphalt 3-23
3.2.1 Permeable Pavers..... 3-27
3.3 Rainwater Catchment Systems..... 3-31
3.4 Green Roofs..... 3-37
3.5 LID Site Design 3-44

	3.5.0	LID Parking Lot Design	3-47
	3.5.1	LID Street and Road Design	3-51
	3.5.2	LID Driveway Design.....	3-55
	3.5.3	LID Sidewalks and Bike Paths	3-59
3.6		Additional LID Strategies.....	3-63
	3.6.0	Impervious Surface Reduction and Disconnection	3-64
	3.6.1	Soil Amendments	3-68
	3.6.2	Roof Leader Disconnection.....	3-70
	3.6.3	Pollution Prevention and Good Housekeeping	3-72
	3.6.4	Storm Water Education	3-75
3.7		Related Structural Controls	3-76
	3.7.0	Extended Detention Basins.....	3-77
	3.7.1	Infiltration Trenches and Basins.....	3-80
	3.7.2	Storm Water Ponds and Wetlands	3-86
3.8		LID Design Considerations	3-91
	3.8.0	Introduction	3-91
	3.8.1	Groundwater Contamination	3-91
	3.8.2	Storm Water in Crawl Spaces	3-92
	3.8.3	Mosquito Breeding	3-93
	3.8.4	References and Additional Resource Information.....	3-94

List of Appendices

- A NRCS Soil Survey Maps of the Truckee Meadows
- B Groundwater Recharge and Stream Buffer Zones
- C Codes and Ordinances that Support LID
- D Example Access and Maintenance Agreement

Acknowledgements

The Truckee Meadows Low Impact Development (LID) Handbook was prepared for the Cities of Reno and Sparks and Washoe County under the guidance of Truckee Meadows Storm Water Permit Coordinating Committee (SWPCC). The SWPCC members are:

Terri Svetich, P.E., Committee Chair
City of Reno, Sanitary Engineering

Baron Caronite, P.E.
City of Reno, Community Development

Shawn Gooch, P.E.
City of Sparks, Flood Control

John Martini, P.E.
City of Sparks, Community Development

Kimble Corbridge, P.E., CFM
Washoe County, Engineering

Don Mahin, P.E.
Washoe County, Water Resources

Susan Ball Rothe, City of Reno
Deputy City Attorney

The Nevada Division of Environmental Protection (NDEP) and the Regional Water Planning Commission (RWPC) provided funding for development of the LID Handbook.

Special thanks to Mike Widmer with Washoe County, Water Resources who led the development of the Watershed Management and Protection Plan for Tributaries to the Truckee River in 2003. Mr. Widmer recognized there was a need to continue watershed protection efforts in the Truckee Meadows. Consequently, he pursued and obtained funding from the NDEP and the RWPC, which enabled the development of this LID Handbook.

Special thanks also to Susan Donaldson, Ph.D., with University of Nevada Cooperative Extension. Ms. Donaldson led the development of the Nonpoint Education for Municipal Officials (NEMO) program, which provided public workshops on local water quality issues for local planning officials, advisory boards, engineers, landscape professionals, and others. The NEMO workshops highlighted the need to develop strategies to reduce nonpoint sources of water pollution, such as LID practices to treat storm water runoff from urban areas. Ms. Donaldson also provided significant input with the content of this LID Handbook.

Recommended regional planning policies and procedures for implementing and maintaining structural controls and LID practices in the Truckee Meadows were developed by a stakeholder group known as the Professional Advisory Group (PAG). The PAG members are:

Barron Caronite, P.E., City of Reno, Community Development

Bill Thomas, P.E., Summit Engineering

Bob Lissner, Lifestyle Homes

Erik Ringelberg, Pyramid Lake Fisheries/RWPC

Harry Fahnestock, Western Turf/Nevada Landscape Association/RWPC

John Martini, P.E., City of Sparks, Community Development

Karl Matzol, Matrix Engineering/Barker Coleman Homes

Mark Gookin, P.E., Wood Rogers

Matt Smith, Q&D Construction/Associated General Contractors

Sam Chacon, P.E., C & M Engineering
Sharon Kvas, AICP, Washoe County, Community Development
Tom Heck, City of Reno, Operations and Maintenance
Tony Abreu, Silver Star Communities/Builders Association of Northern Nevada

Others who attended the public SWPCC meetings and PAG workshops and were involved in the review and development of the LID Handbook include the following:

Aiguo Xu, Ph.D., P.E., WRC Engineering
Alan Felker, City of Reno, Community Development
Audrey Tedore, Innerwest Advertising
Bach McClure, P.E., WRC Engineering
Chris Ennes, Nevada Department of Transportation
Chris Robinson, P.E., City of Reno, Community Development
Cliff Lawson, P.E., Nevada Division of Environmental Protection
Dan Martini, Johnny On the Spot
Denton Peters, P.E., City of Reno, Community Development
Erich Strunge, City of Reno, Public Works, Maintenance
Gail Prockish, Washoe County, Water Resources
Gary Robertson, Frehner Construction Co / Aggregate Industries
Gil Ellis, City of Reno, Environmental Control
Glen Daily, P.E., City of Reno, Public Works Department
James Pehrson, City of Reno, Community Development
Jeff Jesch, CPESC, Hillside Design & Construction
Jim Arden, P.E., Washoe Storey Conservation District
Jim Shaffer, Washoe County District Health Department
Jim Smitherman, Washoe County, Water Resources
Judy Pipkin, Johnny on the Spot
Kevin Dick, UNR – Nevada Small Business Development Center
Lee Carson, City of Sparks, Environmental Control
Mahmood Azad, P.E., City of Reno
Mark Gookin, P.E., Wood Rodgers
Mark Hausner, Washoe Storey Conservation District
Pat Birchall, City of Reno, Community Development
Penny Oteri, City of Reno, Environmental Control
Rich Gephart, U.S. Army Corps of Engineers
Robert Speck, Nevada Division of Environmental Protection
Ryan Bird, Sierra Pacific Power Company
Ryan Kushman, TEC Engineering
Samuel Chacon, P.E., C & M Engineering
Susan Hood, Washoe County, Water Resources
Toby Ebens, City of Sparks, Environmental Control
Tom Heck, City of Reno, Operations and Maintenance

The Truckee Meadows LID Handbook was prepared by Kennedy/Jenks Consultants (Project No. 037023.00) under an Agreement with the City of Reno. The following staff at Kennedy/Jenks Consultants were responsible for preparing this handbook: Chris Conway, CPSWQ, Lynn Orphan, P.E., Jeanette Dubois, Chris Johnson, Christine Kirick, Matt Setty, Drea Traeumer, Katherine Orphan and Pat Hamilton.