Memorandum

CITY OF DALLAS

DATE October 22, 2009

TO Members of the Transportation and Environment Committee
Linda Koop (Chair), Sheffie Kadane (Vice Chair), Jerry Allen, Tennell Atkins, Carolyn R. Davis, Vonciel Jones Hill, Angela Hunt, Delia Jasso, Pauline Medrano, Ron Natinsky,

SUBJECT **Drainage Design Practices Briefing**
Part 1. Overview of Current Drainage and Erosion Control Practices
Part 2. Alternative Technique – Integrated Storm Water Management (iSWM)

Attached is the "Drainage Design Practices" briefing that will be presented to you on October 26, 2009.

Please let me know if you require additional information.

Jill A. Jordan, P.E.
Assistant City Manager

c: The Honorable Mayor and Members of the City Council
Mary K. Suhm, City Manager
Thomas P. Perkins Jr., City Attorney
Deborah Watkins, City Secretary
Craig Kinton, City Auditor
Judge C. Victor Lander, Administrative Judge
Ryan S. Evans, First Assistant City Manager
A.C. Gonzalez, Assistant City Manager
Forest Turner, Assistant City Manager
David K. Cook, Chief Financial Officer
Jeanne Chipperfield, Director, Office of Financial Services
Edward Scott, City Controller
Helena Stevens-Thompson, Assistant to the City Manager
Kelly High, Director, Trinity Watershed Management
Theresa O'Donnell, Director, Sustainable Development and Construction Department

Drainage Design Practices

Part 1. Overview of Current Drainage and Erosion Control Practices

Transportation and Environment Committee

October 26, 2009

Purpose

- Provide an overview of current drainage design criteria
- Review the City's erosion control program
- Discuss how erosion control projects are identified and implemented

Current Drainage Design Criteria

- Since the early 1980's Dallas has led the region in drainage design
- Current drainage system design for development or redevelopment requires:
  - Design standard of 100-year frequency storm events
  - Detention in certain cases (i.e, a change in zoning results in substantially more runoff or outfall capacity inadequate to carry 100 yr frequency event)

Current Drainage Design Criteria (Cont'd)

- Current drainage system design (cont'd) :
  - Drainage analysis based on a fully developed drainage area and existing zoning
  - Assessment of runoff from the site to minimize flood risk to people and property (system capacity)
  - Evaluation of discharge from the site to minimize downstream bank and channel erosion (checking erosive velocity)

Current Drainage Design Criteria (Cont'd)

- Despite existing drainage design criteria, erosion problems continue to occur and further efforts can be made by:
  - Adopting minor technical changes to the city's drainage design manual
  - Considering adoption of the integrated Storm Water Management (iSWM) process on a voluntary basis, which if implemented could help to further reduce erosion

What is Erosion?

- The gradual wearing away of soil by water – a natural process through which streams and rivers are formed over a long period of time
- Erosion occurs in both developed and undeveloped areas – increased development can accelerate erosion until the stream stabilizes

What Causes Erosion?

- Frequent, brief heavy rains resulting in fast flows in creeks generate erosive forces that attack the bottom of the creek bank
  - Big floods are not the primary cause of erosion because they are infrequent
  - Engineering studies have shown that the 1-year storm event has the most destructive erosion impact
- Type of soil
  - Sandy and silty soils are easily eroded
  - Clay soils are more resistant but will form vertical banks
- Most vulnerable areas are creek bends

Why an Erosion Control Program?

- To protect principal structures from creek bank erosion
  - Principal structures include homes, garages, streets, alleys and bridges
- Erosion projects are often too costly for residential property owners to implement

City Policy Regarding Erosion Projects

- City will fully fund erosion control projects when there is a clear and visible threat to a principal structure
- City will consider participation with the adjacent property owner in a project in which structures are not threatened
  - To date, City has never undertaken a cost-sharing project

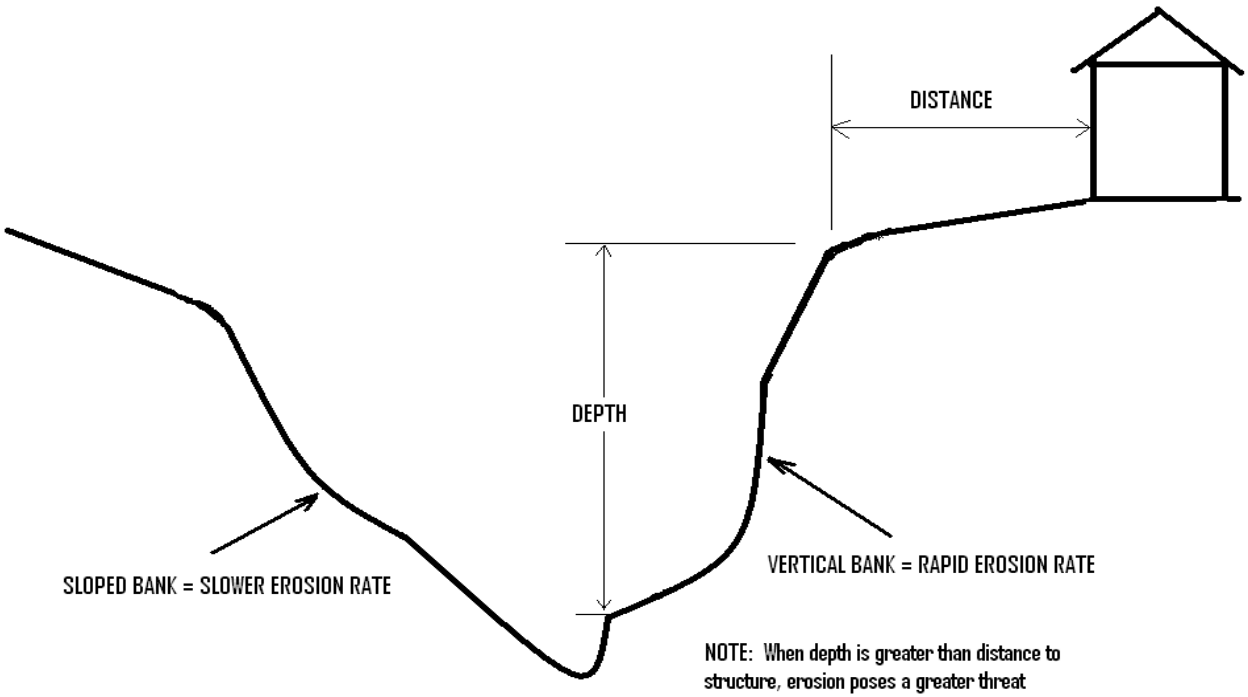
How are Erosion Control Projects Identified?

- Citizens, council or staff identify a potential erosion control project site
- Staff performs an investigation which includes:
  - Site inspection, measurements and engineering calculations
- Site is rated, prioritized and added to the needs inventory to be considered for funding in a future bond program
  - Current needs inventory includes 93 projects estimated at $19M (see Appendix A)

Erosion Rating Criteria

- Distance from principal structure to edge of creek, and depth of creek
- Rate of creek bank loss
- Cost of project and number of structures to be protected
- Type of threat (house threatened as opposed to yard erosion, for example)
- See Appendix B for detailed rating points

Erosion Diagram



Types of Threats

- Type I: Threat to principal structures such as homes, garages, streets, alleys and bridges
- Type II: Threat to storage buildings, pools, other structures
- Type III: Threat to fences, yards and privately owned retaining walls

Type I Erosion

Sandy soil, near vertical bank (10 ft. from house)

Type I Erosion

Creek erosion near top of bank and near home

Type I Erosion

Near vertical bank

Type I Erosion

Slope failure near top of bank

Type III Erosion

Vertical bank with undercutting present

Typical Erosion Solution

- Gabion Retaining Wall
  - Wire baskets laced together, filled with stones

2006 Bond Program Project

Typical Erosion Solution

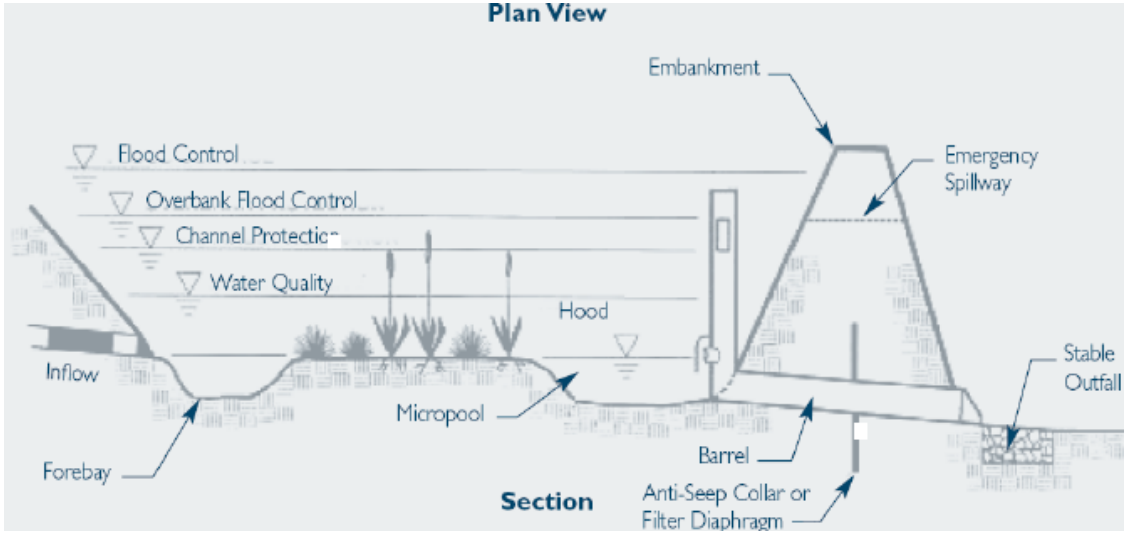
2006 Bond Program Project

Erosion Control Solution (cont'd)

- Gabion Wall Advantages
  - More cost-effective than concrete retaining wall
  - Flexible & conforms to creek bank
  - A typical project 100 feet long by 15 feet high costs approximately $80,000

Further actions to lessen erosion

- Consider making minor technical changes to the city's drainage design manual
  - Review erosive velocities of the 1-year storm, as well as the 100-year storm
    - Since 1-year storms might be more erosive, this needs to be considered in drainage design
  - If detention basins are required, use a multi-stage outlet to restrict discharge



Further actions to lessen erosion (cont'd)

- Consider including these minor technical changes in the integrated Storm Water Management (iSWM) process, which if implemented could help to further reduce erosion

Appendices

Appendix A – Needs Inventory

- By Council District
- By Rank Order

Appendix B – Criteria for Rating Each Project

Appendix C – Bond Program Funding History

Appendix D – What Other Cities Do

Appendix A – Needs Inventory By Council District

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
1	Clarendon 3435	Type I	67.39	22	$97,000
				Total CD 1	**$97,000**
3	Deep HIll Circle 2671, 2675, 2679, 2683	Type I	71.06	15	$484,000
3	Kiesthill Drive 3431	Type I	68.02	18	$195,000
3	Blue Ridge 3721	Type I	67.78	20	$108,000
3	Ohio W. 412, 416	Type I	67.47	21	$81,000
3	Holliday 3445 & 3449	Type I	67.22	24	$162,000
3	Pyka 3918	Type I	62.97	28	$164,000
3	Cripple Creek 3744-3750-3758	Type I	53.2	50	$240,000
3	Stevens Wood Court 914	Type I	50.7	54	$72,000
3	Stevens Wood Court 902	Type I	49.1	61	$60,000
3	Stevens Wood Court 906	Type I	48.1	71	$80,000
3	Boulder Drive 4120	Type II	44.4	73	$37,000
3	Boulder 4207	Type III	44.1	77	$60,000
3	Deep Hill Circle 2625, 2641, 2663, 2667, 2687, 2691	Type III	30.38	91	$773,000
				Total CD 3	**$2,516,000**

Appendix A – Needs Inventory By Council District (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
4	Five Mile Pkwy W. 922	Type I	67.8	19	$195,000
4	Danube 1715	Type I	51.8	53	$48,000
				Total CD 4	**$243,000**
5	Poplar Springs Lane	Type I	49.82	57	$236,000
5	Rosemont 7433	Type III	42.8	81	$148,000
5	Putting Green 6637	Type III	36.03	87	$169,000
5	Spring Glen Branch - Redbird Lane to Reynoldst	Type III	27.09	93	$4,325,000
				Total CD 5	**$4,878,000**

Appendix A – Needs Inventory By Council District (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
7	Corinth (S) 218, 11th St. (E) 1611-1615	Type I	70.03	16	$197,000
7	Lakeland 2224	Type I	68.1	17	$180,000
7	El Cerrito 2460	Type I	67.2	25	$52,000
7	Leeshire 2921	Type I	62.87	29	$130,000
7	Hunnicut 8171	Type I	58.32	35	$87,000
7	El Cerrito 2522	Type I	58.2	36	$100,000
7	Wildoak 2488	Type I	58.1	40	$108,000
7	El Cerrito 2420	Type I	58.02	41	$61,000
7	Parkdale Bridge @ White Rock Creek Trib	Type I	55.17	43	$76,000
7	Lakeland Dr. @ Ash Creek	Type I	49.04	62	$85,000
7	Claremont 8023	Type I	48.3	68	$49,000
7	Ripplewood 2828	Type II	34.28	89	$117,000
7	Hollis 6740	Type III	27.3	92	$54,000
				Total CD 7	**$1,296,000**

Appendix A – Needs Inventory By Council District (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
8	Cliffwood 6707 and Blackstone 2617	Type I	71.94	13	$193,000
8	Bonnie View over Five Mile Creek	Type I	62.87	30	$541,000
8	Wixom Lane 835	Type I	58.44	34	$43,000
8	Richwood 6814	Type I	58.2	37	$120,000
8	Richwood 6906	Type I	58.2	38	$140,000
8	Paul Quinn College 3837 Simpson Stuart Rd	Type I	53.93	45	$130,000
8	Glencairn 460	Type I	53.88	46	$69,000
8	Brooklawn 6718	Type I	53.2	48	$140,000
8	Richwood 7014	Type I	53.2	49	$120,000
8	Wixom Lane 861	Type I	49.33	59	$43,000
8	Blackstone 2709	Type I	48.7	63	$80,000
8	Richwood 6806	Type I	48.7	64	$140,000
8	Blackstone 2729	Type I	48.6	66	$80,000
8	Blackstone 2745	Type I	48.3	67	$80,000
8	Matland Dr 2552	Type I	48.16	69	$68,000
8	Blackstone 2625	Type III	44	78	$138,000
8	Richwood 6822	Type III	44	80	$100,000
8	Bainbridge 2733	Type III	38.4	84	$193,000
8	Old Mill 286	Type III	36.45	86	$39,000
8	Morningview 3810 and 3816	Type III	34.78	88	$108,000
				Total CD 8	**$2,565,000**

Appendix A – Needs Inventory By Council District (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
9	Tamarack 1745	Type I	81.1	3	$90,000
9	Twin Creek 9726	Type I	63.71	26	$108,000
9	Sperry St. 3220	Type I	63.2	27	$74,000
9	Kiltartan 1511	Type I	53.98	44	$156,000
9	Springhill 2304, 2310, 2314	Type I	50.13	56	$162,000
9	Peavy Culvert @ Vinemont Channel	Type I	48.14	70	$27,000
9	Peavy Place 2344	Type I	48	72	$65,000
9	Greentree 7111 & 7045	Type III	44.3	75	$195,000
9	Patrick Dr 6722	Type III	40.83	82	$65,000
9	Peavy Road 2015	Type III	40.46	83	$49,000
				Total CD 9	**$991,000**

Appendix A – Needs Inventory By Council District (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
10	Fair Oaks Crossing 8849	Type I	85.23	1	$104,000
10	Jackson Branch Trib. @ Fair Oaks Crossing	Type I	81.26	2	$189,000
10	Skillman 8109	Type I	80.7	4	$143,000
10	Jackson Branch - E. Bank downstream of Royal I	Type I	76.69	5	$227,000
10	Audelia Branch - W. Bank dwnstrm of Whitehurst	Type I	76.67	6	$389,000
10	Langdale 8668	Type I	76.6	7	$130,000
10	Jackson Branch - E. Bank upstream of Whitehurs	Type I	72.27	9	$303,000
10	Audelia Branch - E. Bank dwnstrm of Audelia Bric	Type I	72.17	10	$541,000
10	Greenville Avenue 9226	Type I	72	12	$91,000
10	Jackson Branch - E. Bank downstream of Skillma	Type I	71.37	14	$454,000
10	Jackson Branch - E. Bank upstream of Skillman E	Type I	67.37	23	$389,000
10	Greenville Avenue 9320/Vista View 8915	Type I	62.46	32	$173,000
10	Rocky Branch @ Middle Downs Sites 1, 2, 3, 4	Type I	60.2	33	$583,000
10	Coppertowne 8439	Type I	53.12	52	$59,000
10	Whitehurst Branch Phase 2	Type I	50.58	55	$234,000
10	Summer Glen 9042	Type I	49.5	58	$48,000
10	Jackson Branch - E. Bank below Church Rd.	Type III	30.44	90	$242,000
				Total CD 10	**$4,299,000**

Appendix A – Needs Inventory By Council District (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
11	Spring Valley 8444	Type I	76.2	8	$234,000
11	Spring Grove 13316	Type I	72.17	11	$65,000
11	Kalani 6323	Type I	62.61	31	$69,000
11	Pagewood 10553	Type I	53.6	47	$26,000
11	Northcreek 6700 blk	Type I	48.7	65	$195,000
11	Hill Forest 7200 block	Type II	44.38	74	$60,000
11	Stonehill Drive 6312	Type III	44	79	$60,000
11	Stone Forest 6900 block	Type III	36.7	85	$60,000
				Total CD 11	**$769,000**
12	Squaw Valley 17628	Type I	58.2	39	$80,000
12	Nedra Way 15821 and 15827	Type I	53.18	51	$119,000
12	Brushy Creek Trail 5719	Type III	44.11	76	$117,000
				Total CD 12	**$316,000**
13	Joes Creek - East Fork to Royal, Phase 2	Type I	55.18	42	$1,222,000
13	Betty Jane 10225	Type I	49.2	60	$65,000
				Total CD 13	**$1,287,000**

Appendix A – Needs Inventory By Rank Order

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
10	Fair Oaks Crossing 8849	Type I	85.23	1	$104,000
10	Jackson Branch Trib. @ Fair Oaks Crossing	Type I	81.26	2	$189,000
9	Tamarack 1745	Type I	81.1	3	$90,000
10	Skillman 8109	Type I	80.7	4	$143,000
10	Jackson Branch - E. Bank downstream of Royal Brge	Type I	76.69	5	$227,000
10	Audelia Branch - W. Bank dwnstrm of Whitehurst Brd	Type I	76.67	6	$389,000
10	Langdale 8668	Type I	76.6	7	$130,000
11	Spring Valley 8444	Type I	76.2	8	$234,000
10	Jackson Branch - E. Bank upstream of Whitehurst Br	Type I	72.27	9	$303,000
10	Audelia Branch - E. Bank dwnstrm of Audelia Bridge	Type I	72.17	10	$541,000
11	Spring Grove 13316	Type I	72.17	11	$65,000
10	Greenville Avenue 9226	Type I	72	12	$91,000
8	Cliffwood 6707 and Blackstone 2617	Type I	71.94	13	$193,000
10	Jackson Branch - E. Bank downstream of Skillman Br	Type I	71.37	14	$454,000
3	Deep HIll Circle 2671, 2675, 2679, 2683	Type I	71.06	15	$484,000
7	Corinth (S) 218, 11th St. (E) 1611-1615	Type I	70.03	16	$197,000
7	Lakeland 2224	Type I	68.1	17	$180,000
3	Kiesthill Drive 3431	Type I	68.02	18	$195,000
4	Five Mile Pkwy W. 922	Type I	67.8	19	$195,000

Appendix A – Needs Inventory By Rank Order (cont'd)

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3	Blue Ridge 3721	Type I	67.78	20	$108,000
3	Ohio W. 412, 416	Type I	67.47	21	$81,000
1	Clarendon 3435	Type I	67.39	22	$97,000
10	Jackson Branch - E. Bank upstream of Skillman Brge	Type I	67.37	23	$389,000
3	Holliday 3445 & 3449	Type I	67.22	24	$162,000
7	El Cerrito 2460	Type I	67.2	25	$52,000
9	Twin Creek 9726	Type I	63.71	26	$108,000
9	Sperry St. 3220	Type I	63.2	27	$74,000
3	Pyka 3918	Type I	62.97	28	$164,000
7	Leeshire 2921	Type I	62.87	29	$130,000
8	Bonnie View over Five Mile Creek	Type I	62.87	30	$541,000
11	Kalani 6323	Type I	62.61	31	$69,000
10	Greenville Avenue 9320/Vista View 8915	Type I	62.46	32	$173,000
10	Rocky Branch @ Middle Downs Sites 1, 2, 3, 4	Type I	60.2	33	$583,000
8	Wixom Lane 835	Type I	58.44	34	$43,000
7	Hunnicut 8171	Type I	58.32	35	$87,000
7	El Cerrito 2522	Type I	58.2	36	$100,000
8	Richwood 6814	Type I	58.2	37	$120,000
8	Richwood 6906	Type I	58.2	38	$140,000

Appendix A – Needs Inventory By Rank Order (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
12	Squaw Valley 17628	Type I	58.2	39	$80,000
7	Wildoak 2488	Type I	58.1	40	$108,000
7	El Cerrito 2420	Type I	58.02	41	$61,000
13	Joes Creek - East Fork to Royal, Phase 2	Type I	55.18	42	$1,222,000
7	Parkdale Bridge @ White Rock Creek Trib	Type I	55.17	43	$76,000
9	Kiltartan 1511	Type I	53.98	44	$156,000
8	Paul Quinn College 3837 Simpson Stuart Rd	Type I	53.93	45	$130,000
8	Glencairn 460	Type I	53.88	46	$69,000
11	Pagewood 10553	Type I	53.6	47	$26,000
8	Brooklawn 6718	Type I	53.2	48	$140,000
8	Richwood 7014	Type I	53.2	49	$120,000
3	Cripple Creek 3744-3750-3758	Type I	53.2	50	$240,000
12	Nedra Way 15821 and 15827	Type I	53.18	51	$119,000
10	Coppertowne 8439	Type I	53.12	52	$59,000
4	Danube 1715	Type I	51.8	53	$48,000
3	Stevens Wood Court 914	Type I	50.7	54	$72,000
10	Whitehurst Branch Phase 2	Type I	50.58	55	$234,000
9	Springhill 2304, 2310, 2314	Type I	50.13	56	$162,000
5	Poplar Springs Lane	Type I	49.82	57	$236,000

Appendix A – Needs Inventory By Rank Order (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
10	Summer Glen 9042	Type I	49.5	58	$48,000
8	Wixom Lane 861	Type I	49.33	59	$43,000
13	Betty Jane 10225	Type I	49.2	60	$65,000
3	Stevens Wood Court 902	Type I	49.1	61	$60,000
7	Lakeland Dr. @ Ash Creek	Type I	49.04	62	$85,000
8	Blackstone 2709	Type I	48.7	63	$80,000
8	Richwood 6806	Type I	48.7	64	$140,000
11	Northcreek 6700 blk	Type I	48.7	65	$195,000
8	Blackstone 2729	Type I	48.6	66	$80,000
8	Blackstone 2745	Type I	48.3	67	$80,000
7	Claremont 8023	Type I	48.3	68	$49,000
8	Matland Dr 2552	Type I	48.16	69	$68,000
9	Peavy Culvert @ Vinemont Channel	Type I	48.14	70	$27,000
3	Stevens Wood Court 906	Type I	48.1	71	$80,000
9	Peavy Place 2344	Type I	48	72	$65,000
3	Boulder Drive 4120	Type II	44.4	73	$37,000
11	Hill Forest 7200 block	Type II	44.38	74	$60,000
9	Greentree 7111 & 7045	Type III	44.3	75	$195,000
12	Brushy Creek Trail 5719	Type III	44.11	76	$117,000

Appendix A – Needs Inventory By Rank Order (cont'd)

CD	Project Name	Description - By types of Threat	Score	Ranking	Cost Estimate
3	Boulder 4207	Type III	44.1	77	$60,000
8	Blackstone 2625	Type III	44	78	$138,000
11	Stonehill Drive 6312	Type III	44	79	$60,000
8	Richwood 6822	Type III	44	80	$100,000
5	Rosemont 7433	Type III	42.8	81	$148,000
9	Patrick Dr 6722	Type III	40.83	82	$65,000
9	Peavy Road 2015	Type III	40.46	83	$49,000
8	Bainbridge 2733	Type III	38.4	84	$193,000
11	Stone Forest 6900 block	Type III	36.7	85	$60,000
8	Old Mill 286	Type III	36.45	86	$39,000
5	Putting Green 6637	Type III	36.03	87	$169,000
8	Morningview 3810 and 3816	Type III	34.78	88	$108,000
7	Ripplewood 2828	Type III	34.28	89	$117,000
10	Jackson Branch - E. Bank below Church Rd.	Type III	30.44	90	$242,000
3	Deep Hill Circle 2625, 2641, 2663, 2667, 2687, 2691	Type III	30.38	91	$773,000
7	Hollis 6740	Type III	27.3	92	$54,000
5	Spring Glen Branch - Redbird Lane to Reynoldston	Type III	27.09	93	$4,325,000
				TOTAL	**$19,257,000**

Appendix B – Needs Inventory Criteria for rating each project

- Ratio of distance to depth (0 to 40 points)
- Rate of creek bank loss (5 to 40 points)
- Ratio of cost divided by structures protected (5 to 20 points)
- Type of threat (0 to 15 points)

Appendix C
Bond Program Funding History

- 1995 Bond Program – $6.7M/67 structures
- 1998 Bond Program – $0.7M/12 structures
- 2003 Bond Program – $1.0M/7 structures
- 2006 Bond Program – $9.3M/58 structures

Appendix D - What Other Cities Do

- We surveyed eleven local cities with populations over 100,000
- Fort Worth, Arlington, Irving, Denton, Carrollton, Frisco, and Mesquite currently do not fund private property erosion control
- Four cities have programs that address erosion on private property

Appendix D - What Other Cities Do (cont'd)

- Richardson – Cost-sharing program – Owner pays 50% of total cost
- Plano – Fully funded with Stormwater utility fee
- McKinney – Project performed only if deemed cost effective – Funded through Surface Drainage Utility Fee
- Garland – Cost-sharing program – Owner pays 50% total cost

Drainage Design Practices

Part 2

Alternative Technique-

Integrated Storm Water Management (iSWM)

iSWM (INTEGRATED STORM WATER MANAGEMENT) MANUAL

PURPOSE

- Explain what is iSWM
- Outline recommendations to adopt the iSWM manual so that it can be used to design drainage facilities as part of public and private sector development projects

BACKGROUND

- Traditionally, in development projects and street designs, engineers have focused only on the quantity of storm water (i.e., flooding) and not water quality.
- The EPA, through National Pollutant Discharge Elimination System (NPDES) permits, is now looking at both the quantity and quality of storm water runoff.
- Consequently, NCTCOG and over sixty area cities began meeting to add storm water quality considerations in the design of drainage facilities for development projects.

BACKGROUND

- Through these meetings, NCTCOG developed the iSWM manual to help area cities implement more environmentally friendly approaches for storm water management.
- The iSWM goal is to manage storm water runoff as close to the development site as possible to reduce:
  - the volume of the development runoff and
  - the pollutants leaving the development site.
- NCTCOG completed the iSWM manual in January 2006 with the aim that each area city would adopt iSWM and add their own local criteria to supplement the iSWM manual's regional approach.

BACKGROUND

- In 2007, as part of the City's green building initiatives, a Subdivision/iSWM Task Force was formed. The task force included citizens, professional groups, developers, and staff members.

- The task force concentrated their efforts on storm water management and suggested that the City adopt the iSWM Manual.

- In February 2008, city council authorized a contract with Freese and Nichols to develop our local criteria and to update the City's drainage design criteria to include the iSWM manual.

BACKGROUND

- The task force worked with Freese and Nichols to draft the City's local criteria for development.

- The task force held six public meetings (two in October 2008, one in December 2008, one in January 2009, one in September 2009 and one in October 2009) to receive input from the development and professional community on adopting the iSWM manual, the draft local criteria, and proposed incentives.

- All of this information was put on a website link to the City of Dallas green website.

Key iSWM Principles

For any development or redevelopment project,

- Assess and mitigate downstream impacts (City already requires).
- Assess discharge from the site to minimize downstream bank and channel erosion (City already requires; however these policies can be enhanced).
- Control conveyance of runoff within and from the site to minimize flood risk to people and property (City already requires)
- **NEW: If the impervious area is increased more than five percent over existing conditions, developer must either:**
  - **Treat the storm water runoff on-site at developer's cost; or**
  - **Use a certain number of integrated site design practices in lieu of treatment (i.e., preservation of open space/natural features, natural pathways for drainage, or pervious surfaces).**

INTEGRATED SITE DESIGN PRACTICES

The iSWM manual encourages such practices as:

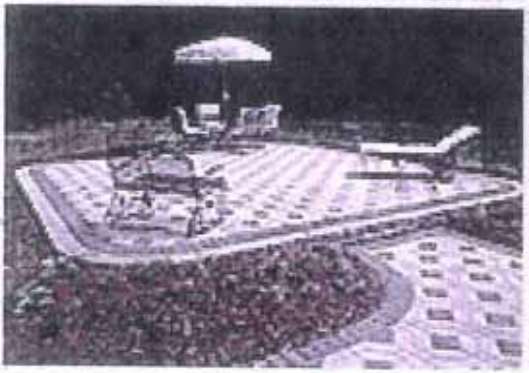
- Preserve creeks, wetlands, and forest areas:
- Use natural drainage ways instead of drainage pipes and channels
- Fit design to the terrain
- Reduce the extent of clearing and grading
- Use vegetated swales and bioswales
- Direct runoff towards buffers and undisturbed areas
- Incorporate creative designs, such as:
  - Eco-rooftops/roof gardens

Appendix A provides a more complete list of techniques

Runoff from parking lot is directed to an infiltration area

Example of a bioswale

Example of a Rain Garden

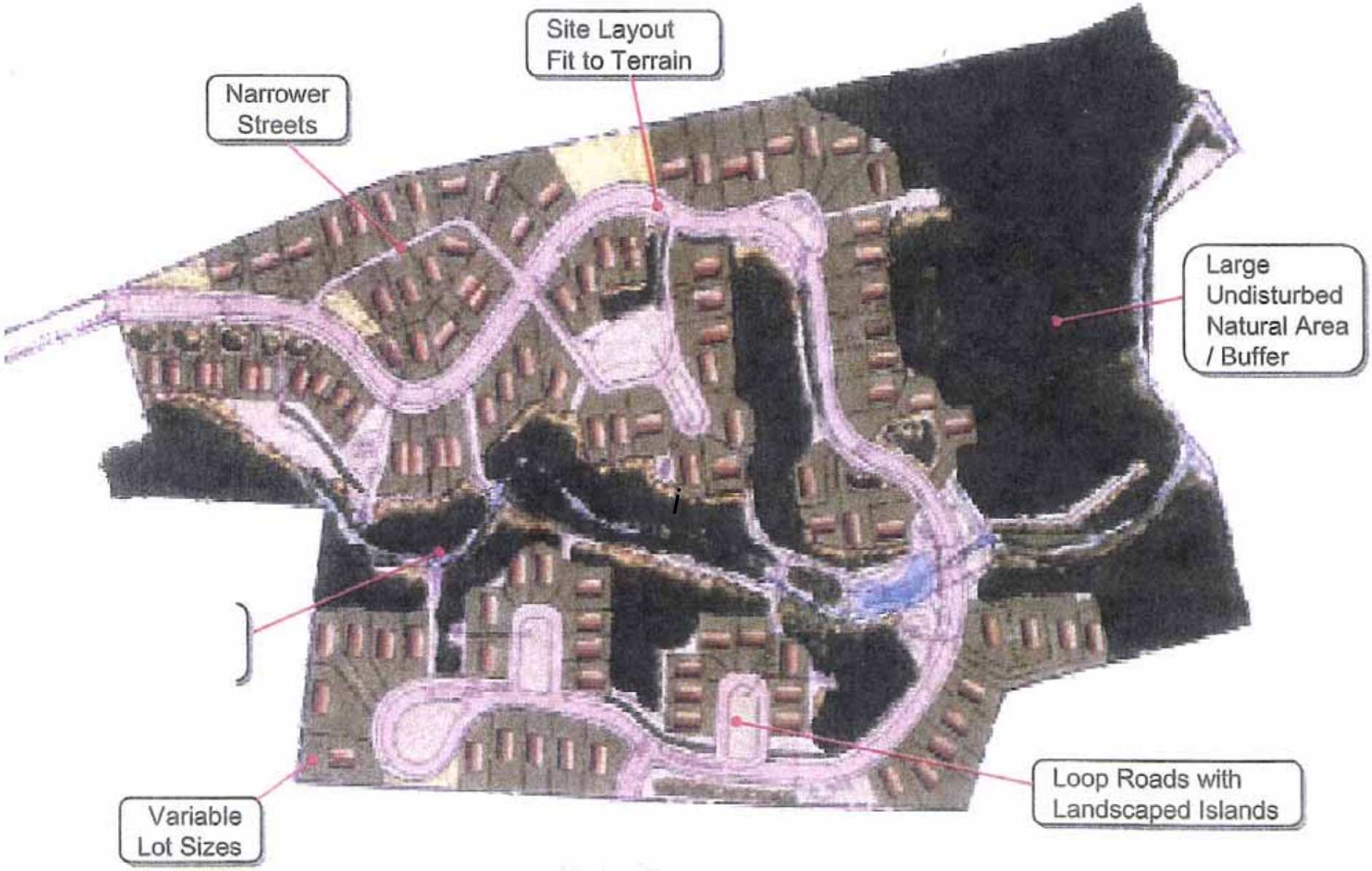


Examples of Porous Paver Surfaces
(Sources: Invisible Structures, Inc.; EP Henry Corp.)

Bioswale Example

Comparison of a Traditional Residential Subdivision Design with an Innovative Site Plan Developed Using *integrated* Site Design Practices.

RESIDENTIAL SUBDIVISION #2 - CONVENTIONAL DESIGN



RESIDENTIAL SUBDIVISION #2 – integrated SITE DESIGN

iSWM PROCEDURES

- While iSWM techniques can be applied to smaller areas, iSWM is most applicable to developments larger than three acres.
- The iSWM site plan must show:
  - existing site conditions,
  - proposed development, and
  - integrated site design practices that the developer will use.
- If the impervious area is increased more than five percent over existing conditions, developer must either:
  - Treat the storm water runoff on-site at developer's cost; or
  - Use a certain number of integrated site design practices in lieu of treatment.

iSWM PROCEDURES

- Each integrated site design practice has an assigned number of points.
- If the development earns the minimum points required using integrated site design practices, no on-site treatment is required.
- If the development exceeds the minimum points required using additional integrated site design practices, incentives/or tradeoffs may be available to developers to help offset the cost of building the site practices.

PROPOSED INCENTIVES

- The following incentives may be offered to developers who exceed the minimum points required using integrated site design practices in their development:
  - Reduced ROW requirements in residential subdivisions.
  - Narrower pavement widths for minor streets.
  - Bar ditches in lieu of curb and underground storm sewer pipes / culverts for subdivisions with lots that are 7,500 square feet or more.
  - Reduced parking requirements for warehouse / industrial / retail (not including restaurants).
  - Increase density in a community unit development.
  - Reduced tree mitigation requirements.

BENEFITS OF ADOPTING iSWM MANUAL

- Reduces the volume of storm water runoff leaving the site
- Higher quality of storm water runoff leaving the site
- Promotes green space/natural drainage pathways and preserves natural creeks
- Facilitates the use of green drainage techniques in green building projects
- The City's current drainage design manual does not allow or promote the use of many of the iSWM techniques. Developers wishing to use these techniques might have to go to the Board of Adjustment.

IMPLEMENTION OF THE iSWM MANUAL:

- Based upon citizen input, implementation of the iSWM manual is recommended to happen in the following three phases:
  - Phase I- Voluntary use only
  - Phase II- Voluntary use plus adoption of local criteria and incentives
  - Phase III- Adjustment of use based upon experience of use

STAFF RECOMMENDATION - PHASE I

RECOMMENDATION

- Voluntary use of iSWM criteria manual for those developers choosing to use these techniques
- Voluntary use of iSWM Plan questionnaire.
- Form a “Technical Committee” and a “Policy Committee” representing developers, professional engineers/architects, interested citizens, the environmental community, and city staff to develop and implement incentives and look at regional approaches to addressing stormwater quality issues and erosion control

ACTION REQUIRED

- City council resolution adopting voluntary use of iSWM criteria manual as part of the drainage design criteria.

STAFF RECOMMENDATION - PHASE II

RECOMMENDATION

- Continue voluntary use of iSWM criteria manual.
- Committees assess effectiveness of development projects using iSWM criteria.
- Committees recommend voluntary local iSWM criteria, which supplements the regional iSWM Manual and includes incentives.
- Consider adoption of minor technical changes to the City's Drainage Design manual to incorporate certain iSWM design provisions

ACTIONS REQUIRED

- Codify development incentives (i.e., Amend Article IV, Zoning; Article VIII, Platting; etc.)
- City council resolution adopting voluntary local iSWM criteria that includes incentives.

STAFF RECOMMENDATION - PHASE III

Actions Required:

- Brief city council two years after adoption of the local criteria in Phase II
- Make recommendations on whether the iSWM policies or local criteria should be amended.

Appendix A

Drainage techniques allowed and promoted by iSWM

INTEGRATED SITE DESIGN PRACTICES

The iSWM manual encourages such practices as:

- Create/preserve undisturbed natural areas:
  - Creeks
  - Wetlands
  - Forests
- Use natural drainage ways instead of drainage pipes and channels
  - Direct runoff to creeks and swales, ensuring that peak flows and velocities will not cause erosion.

INTEGRATED SITE DESIGN PRACTICES

- Preserve buffer zones along steams:
  - Conserving natural areas along stream, wetlands or shorelines.
- Use open space development:
  - Conservation areas.
  - Open space.
  - Clustering development.
- Incorporate creative designs, such as:
  - Eco-rooftops/roof gardens.
- Avoid steep slopes:
  - Build on flat areas of development.
  - Preserve natural state of Geologically Similar Areas (GSA) next to escarpment.

INTEGRATED SITE DESIGN PRACTICES

- Minimize siting on porous or eroding soils:
  - Locate buildings on portions of a site with least permeable soils.
  - Avoid siting on highly erodible soils.
  - Conserve areas with highly permeable soils such as sand.
- Drain rooftop runoff to pervious areas:
  - Drain rooftops to permeable areas on site.
  - Use vegetated areas to filter rooftop storm runoff.
  - Use vegetated infiltration basins/rain gardens to capture rooftop runoff.

INTEGRATED SITE DESIGN PRACTICES

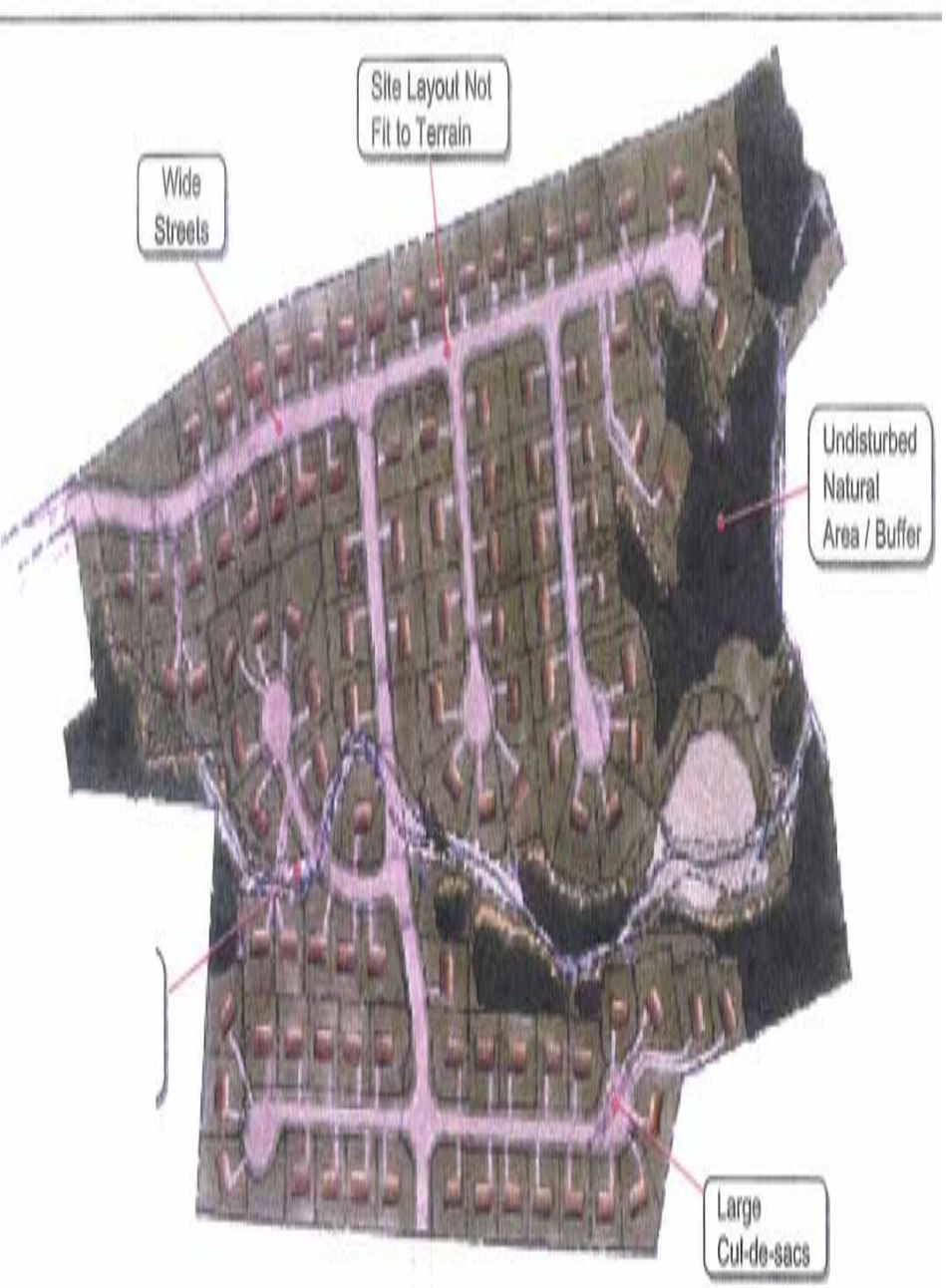
- Fit design to terrain:
  - Preserve natural drainage ways
  - Provide vegetated swales
  - Leave undisturbed vegetation on slopes
- Reduce the limit of clearing and grading:
  - Preserve more undisturbed natural areas on a development site
  - Protect natural conservation areas and other site features
- Locate development in less sensitive areas:
  - Use natural site features to prevent/mitigate storm water impact
  - Lay out site to minimize the hydrologic impact of structures and impervious surfaces

INTEGRATED SITE DESIGN PRACTICES

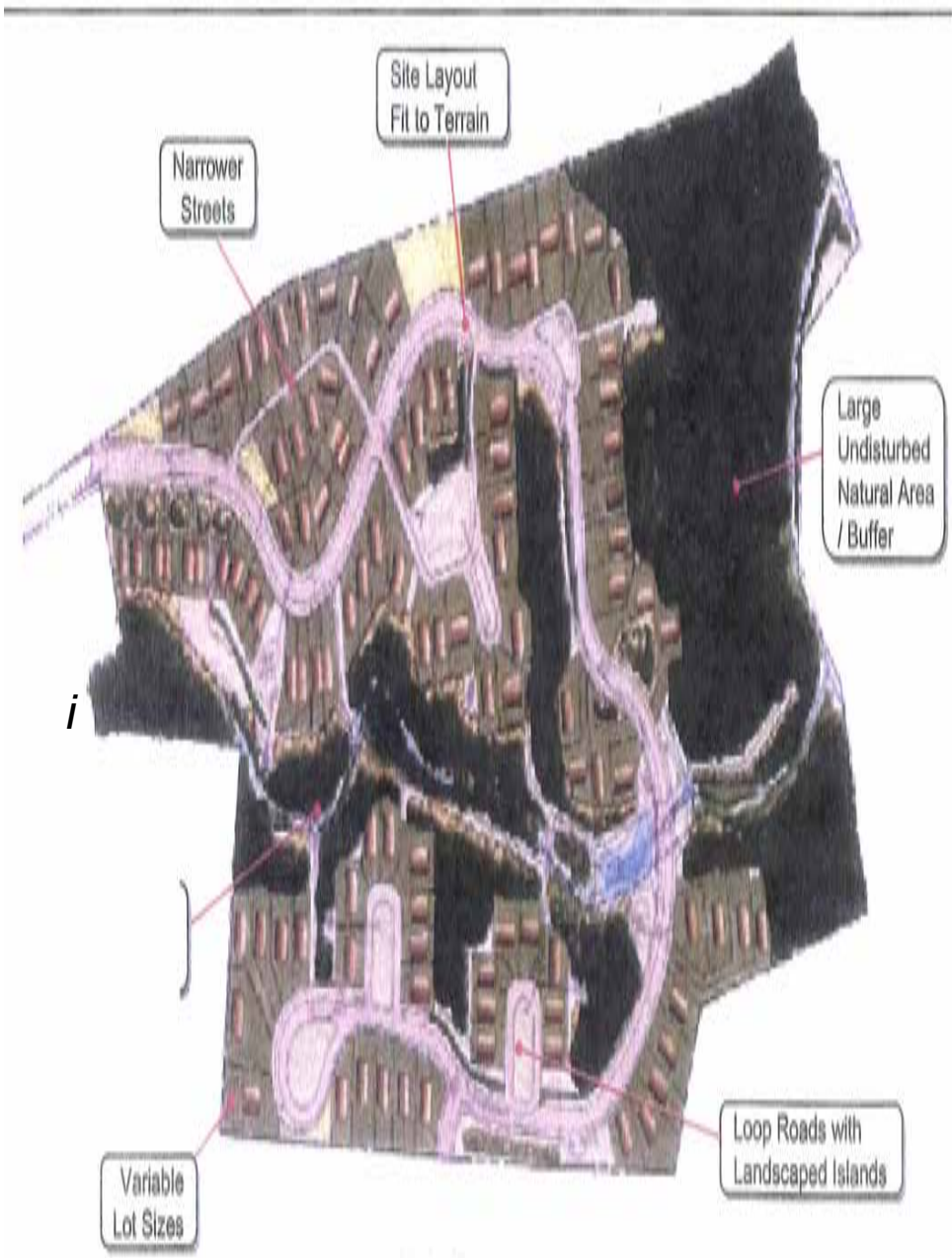
- Use buffers and undisturbed areas:
  - Direct runoff towards buffers and undisturbed areas.
  - Use natural depressions for runoff storages.
- Use vegetated swale design:
  - Open vegetated channels along roadway.
  - Grass channels and enhanced dry swales in developments.
  - Storm water rain gardens.
  - Storm water curb extensions.
- Create parking lot storm water islands:
  - Integrate porous areas such as landscape islands, swales, filter strips and bio-retention areas in parking lot design.

INTEGRATED SITE DESIGN PRACTICES

- Reduce parking footprint:
  - Consider using parking structures and shared parking.
  - Use alternative porous surface areas.
- Use fewer or alternative cul-de-sacs (hammerhead turnaround).



RESIDENTIAL SUBDIVISION
#2 - CONVENTIONAL DESIGN



RESIDENTIAL SUBDIVISION #2
integrated SITE DESIGN

Appendix B

- Examples of how other cities are using these integrated approaches to drainage

Other Storm Water Treatment Programs

City of Austin

- Allows developers to pay an impact fee in lieu of design/construction and maintenance of treatment facilities.
  - Impact fee is based on the
    - type of development and
    - Area of imperviousness
  - For a five acre development that is 70% impervious, fee is approximately $100,000.

Other Storm Water Treatment Programs

City of Austin- Continued

- Requires the developer to treat the storm water runoff for any new development or redevelopment.
- Maintains treatment facilities for residential developments, developer maintains treatment facilities for nonresidential development.

Other Storm Water Treatment Programs

Nationwide

- Seattle, Washington; Portland, Oregon; and Maryland, North Carolina have policies similar to Austin for treatment of storm water runoff.