Pleasant Grove
Utah's City of Trees

PLEASANT GROVE CITY
2013 STORM WATER MASTER PLAN & IMPACT FEE FACILITY PLAN

PREPARED BY

HORROCKS ENGINEERS

PLEASANT GROVE CITY

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Utah's City of Trees

2013 Storm Water Master Plan

&

Impact Fee Facility Plan

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May 23, 2013
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Prepared by

HORROCKS
ENGINEERS

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AAPR – Average Annual Percentage Growth Rate
Ac-ft – Acre Feet
CCI – Construction Cost Index
CFS – Cubic Feet per Second
CN – Curve Number
ERU – Equivalent Residential Unit
fps – Feet per Second
GIS – Geographic Information System
HDPE – High Density Polyethylene
IFFP – Impact Fee Facility Plan
NOAA – National Oceanic & Atmospheric Administration
NRCS – National Resource Conservation Service
SCS – Soil Conservation Service
Sf – Square Feet

S E C T I O N 1

General Background and Summary

General Background

The City of Pleasant Grove is located in Utah County, Utah. This report address's the current and future demands on the City's storm water facilities. These facilities include; pipes, ditches, culverts, manholes, catch basins, sumps, ponds, and other appurtenances related to conveying storm water throughout the City. All of these items together comprise the storm water system for Pleasant Grove City.

The purpose of the master plan is to determine deficiencies in the current storm water system, to determine upgrades needed to address the current deficiencies, and determine upgrades necessary to meet the needs of future development. This master plan is for the geographic area within the boundaries of Pleasant Grove City. The plan also addresses some limited areas outside the boundaries of the City that drain through the City storm water system.

Pleasant Grove generally slopes from the northeast to the southwest, and the storm water system collects storm water along City streets and channels it through the City in this direction. Pipes and channels collect storm water on the upper end of town which become increasingly larger as they get closer to the southwest side of the City. Detention ponds throughout the City detain storm water to reduce the peak flows from different areas. The system ultimately outlets into Utah Lake. The area of the City is approximately 5,846 acres.

The computer program Bentley SewerGEMS was used to model the system. An "existing" model of the system was created using data that included pipe sizes, pipe locations, detention and retention pond sizes and locations. After a review of the existing model, critical areas were identified and those were surveyed to obtain elevation data and enhance model accuracy. Additional portions of the existing system were surveyed as budget allowed. The model was also refined using aerial photos and elevation contours of the City.

Next a model of proposed upgrades to the storm water system was also created. Various alternatives were considered and modeled to determine the best solution for the future storm water system.

Population Projections

Figure 1 shows the population history and projections for Pleasant Grove. The projections were developed by the Mountainland Association of Governments (MAG). The City is anticipated to grow at a rate between 1.5 and 1.8 percent for the next several years.

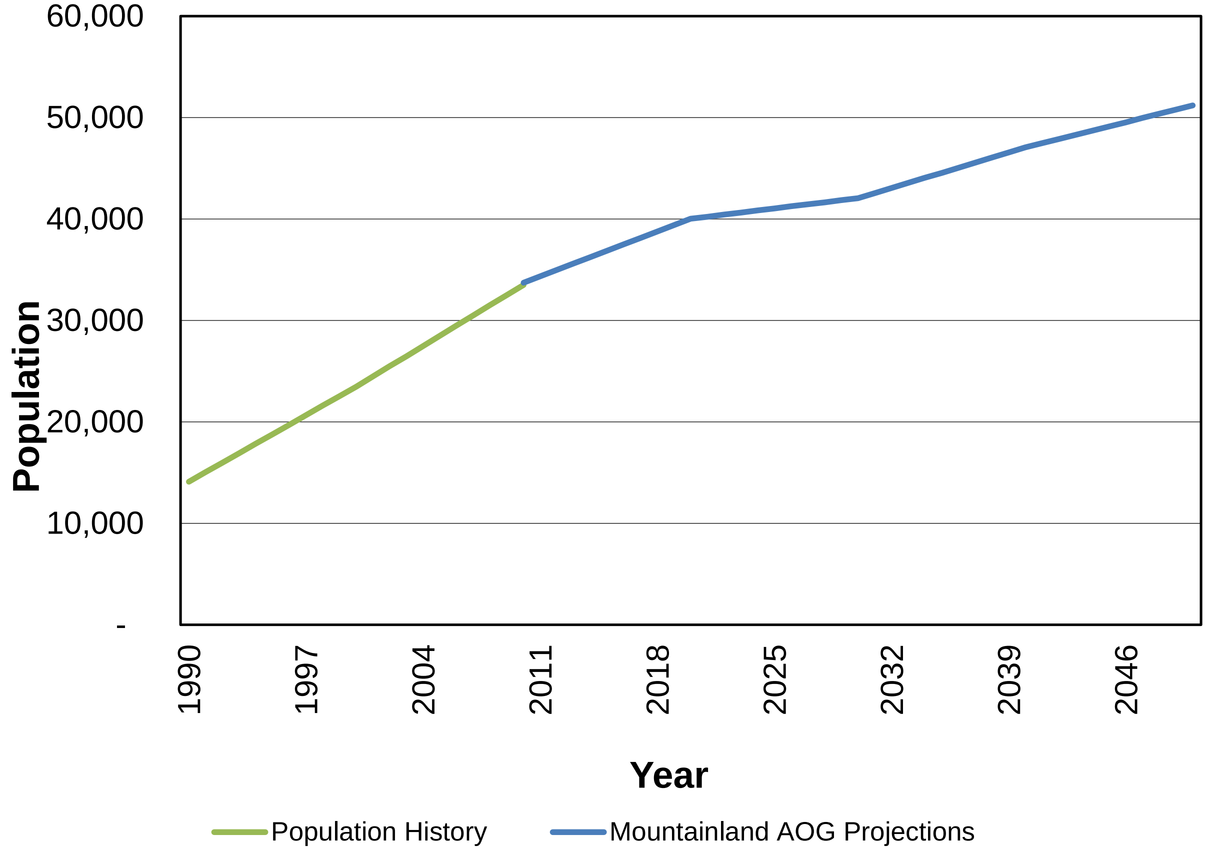

Figure 1 Population Projections

Table 1 shows the projected growth rate of storm water Equivalent Residential Units (ERU's). It is anticipated that storm water ERU's will grow at a rate similar to population but adjusted based on available undeveloped land remaining in the City. It is anticipated that non-residential growth will be slightly faster than residential growth over the planning period given there is slightly more undeveloped area zoned for non-residential than residential. A storm water ERU is defined as 4,400 square feet (sf) of impermeable hardscape. This is the approximate average of impervious area for a single family residence in Pleasant Grove City. This was determined during this study by taking a random sample of residential homes in the City and measuring the amount of impervious area.

In addition to residential uses in the City there are commercial, institutional and other uses which have their own ERU's associated. These ERU's were determined based on the average commercial and institutional impervious area. Commercial areas typically have 85 percent impervious area while churches have 70 percent and schools have 50 percent. An analysis of the number of commercial and institutional parcels was performed to determine the average number of existing ERU's per commercial and institutional unit. The total area of each category was multiplied by the percent hardscape associated and divided by 4,400 sf/ERU to determine the average ERU per connection. These values were used to estimate existing and future ERU's for planning purposes. When developments are proposed it is recommended that the actual amount of impervious surface area be utilized when assigning impact fees.

In addition to the ERU calculation, an adjustment factor was calculated and applied to account for those areas that are required to provide detention as a condition of development. The adjustment factor was determined by comparing the peak flows generated from a 25-year storm when discharging directly versus discharging through a 10-year detention system. A similar adjustment factor was calculated and applied for those areas that are required to provide 100 year detention. Adjustment factors were calculated for several existing areas with factors ranging from 12 to 37 percent with an average of approximately 20 percent (80 percent reduction) for areas with 10-year detention requirements. Similar calculations return an average 3 percent adjustment factor (97 percent reduction) for those areas with 100-year detention requirements.

The ERU for each type of development should be calculated as follows. An ERU of 1.0 should be applied to each residential unit in a project where detention is not required. For each project where detention is required the total actual impervious area should be calculated and divided by 4,400 sf/ERU. An adjustment factor of 0.20 should be applied to those with 10-year detention and an adjustment factor of 0.03 to those with 100-year detention. The area where 100-year detention is required is identified in Figure 13 in the appendix.

Table 1 Population and Equivalent Usage Projections

Year	Population	Equivalent Residential Units (ERU's)
2010	33,728	11,102
2011	34,359	11,289
2012	34,989	11,496
2013	35,620	11,705
2014	36,250	11,914
2015	36,881	12,124
2016	37,512	12,335
2017	38,142	12,547
2018	38,773	12,760
2019	39,403	12,974
2020	40,034	13,188
2021	40,237	13,344
2022	40,440	13,492
2023	40,642	13,643
2024	40,845	13,796
2025	41,048	13,951
2026	41,251	14,109
2027	41,454	14,269
2028	41,656	14,432
2029	41,859	14,597
2030	42,062	14,765
2040	47,053	17,085
2050	51,200	19,074

S E C T I O N 2

Storm Water System Analysis

Design Storm/Level of Service

Every community decides what level of storm water service to provide to its citizens. Factors such as cost and potential for flooding are taken into account. A community may choose not to provide any storm water system, which may result in regular and even significant flooding during storm events. The same community may decide to provide a storm water system that will handle any potential storm water but at a very high cost. Most communities choose to provide a storm water system that will handle the most frequent storm events recognizing that less frequent, but more intense storms, may cause flooding. They accept the liability that goes with the lower expenditures.

Pleasant Grove City has chosen to develop and maintain a storm water system that meets the following level of service. Combined conveyance and detention facilities are designed to handle the 25-year storm[a]. Regional detention facilities are provided to limit the outlet flow to the capacity of various downstream conveyance facilities. Storms larger than the 25-year storm are required to be discharged to a downstream City street. If a development cannot discharge larger than 25-year storms to a downstream City street, they are required to provide 100-year conveyance to a suitable outlet on a downstream City street.

All single family residential developments and multiple residential developments fronting on City streets are not required to provide storm water detention. All other developments including private multi-residential, commercial, industrial, institutional, etc. are required to construct detention facilities for a 10-year storm. Flow limiting outlets from these facilities are limited to 0.15 cfs per acre. Conveyance for these flows and overflows are directed to appropriate City facilities at the 25-year or 100-year capacity as appropriate.

These standards are minimum in nature and are adjusted upward (more restrictive) as necessary on a case by case basis based on unique circumstances of each site. For example, areas on the upper reaches of the 2000 west corridor are required to provide 100-year detention with outlet capacity of 0.05 cfs per acre because of limited conveyance and outlet capacities downstream.

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[a] http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ut

In master plan modeling for the Pleasant Grove City storm water system, the 25-year 6-hour storm is used with a SCS type II distribution curve. Point rainfall data was taken from NOAA's Atlas 14 which can be found online[b]. Pleasant Grove City covers a large area and has a significant elevation change from the west to east. Therefore, the intensity of the 25-year storm varies significantly depending on location in the City. For master planning purposes the City was broken up into three major bands and the average 25-year storm across each band was utilized to model the storm water system. Figure 3 in the appendix shows the rainfall data utilized for master plan modeling. As developments are designed and constructed across the City, we recommend the 25-year design storm for the specific site be obtained from the noted link above. That way each development can have a storm water system tailored to its location instead of using an average. This will also ensure the master planned system will have the ability to convey the design storm from every site.

Hydraulic Model

A storm water model was developed utilizing SewerGEMS V8i software by Bentley. The model includes pipes, channels, detention basins, and drainage areas. The City was broken up into unique drainage areas where all storm water from the area drains to a single point. Each area was characterized by slope, soil type, 25-year storm, development type, etc. Each area drains to a storm water pipe or channel. These pipes and channels convey storm water from the drainage areas to outlet points at the City's southern boundary. Regional detention basins limit peak flow in the system and are included in the modeled.

STORM WATER SYSTEM DATA

Data for the model was obtained in a number of different ways. An existing storm water model and GIS information was provided to Horrocks from Pleasant Grove City. A review of this data was performed to determine what information could and could not be used.

Critical areas that did not have existing data or incomplete data were then identified. Pipes, catch basins, manholes, ponds, and other storm water features were surveyed to record exact locations, and measured to obtain the required technical information (invert elevations, pipe and structure sizes, etc). Existing information with correct locations, but no elevation data were also surveyed to determine accurate elevations.

Data for some elements of the storm water system was obtained from aerial images, such as detention pond sizes and locations, land uses, and open channel locations. GIS contours of the City were used to determine approximate elevations for areas that were not surveyed.

[b] http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ut

Additionally, field inspections and observations were used to determine other information such as sizes of pipes that were not readily accessible to surveyors.

It is recommended that the City budget to collect more survey data to make the model more accurate. This version of the storm water model represents the most critical portions of the system with surveyed data. Figure 6 in the appendix shows the existing storm water system.

Hydraulic Analysis

The NRCS TR-55 method [c] was used to model the rainfall runoff for this master plan. This is a widely used and accepted method to model rainfall runoff in urban settings. A curve number (CN) was selected for each drainage area. The CN is based on land use type, and the hydrologic soil group. The hydrologic soil group is a measure of the soils capacity to infiltrate water and they are grouped into 4 different groups, A, B, C, and D. Group A would infiltrate the most storm water, and group D the least. Therefore, locations with a hydrologic soil group of D, would have the most runoff after a storm. Figure 2 in the appendix shows the existing soil types for the planning area. [d,e] Figure 4 in the appendix shows the current curve numbers. Figure 5 in the appendix shows the City broken up into drainage areas.

Current land use was determined from zoning, aerial images and site visits. Future land use was determined from the City's zoning map which is included as Figure 8 in the appendix.

Appropriate lag time values were determined for each drainage area. Lag time is the amount of time that it will take rainfall to travel from the most remote part of the drainage area to the outlet. The SCS lag time method was used to determine these values. The lag time varies with CN, slope and length of the drainage area.

There are a number of ditches, pipes and other channels throughout the City that have a continuous flow throughout the year. This is due to ground water, irrigation water or other sources. Larger channels throughout the City have been observed and a "base flow" amount was been determined from field observations. This amount was then added into the model.

Irrigation channels throughout the City also collect rainfall during a storm. The irrigation water in these channels was not modeled, because it can be controlled, and it varies throughout the year. These flows will also diminish over time as surface flood irrigation is replaced with pressurized sprinkler irrigation and farm land is developed.

An areal reduction factor was also applied to the storm water model. A typical storm event is oval shaped with the strongest portion concentrated over a smaller area. The size of the City's

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[c] National Resource Conservation Service (NRCS), Urban Hydrology for Small Watersheds, TR-55
[d] NRCS, Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
[e] NRCS Soil Data Mart, Utah County, http://soildatamart.nrcs.usda.gov/Survey.aspx?County=UT049

storm water system is large enough that it qualifies for the reduction factor since the strongest part of the design storm will not cover the entire City at any given time.[f]

Per City code, regional detention and conveyance facilities are designed for the 25-year storm. New, non-single family residential, developments are required to provide detention for the 10 year storm, and are required to limit the runoff from their site to 0.15 cfs/acre. In the buildout model, representative 10-year detention basins were added for areas with future development.

2000 WEST DRAINAGE AREA

The Grove/2000 West area has different standards for storm water. They are required to detain the 100-year storm, and required to have a release rate of only 0.05 cfs/acre. Figure 13 in the appendix shows the areas that are required to detain the 100 year storm.

The area along 2000 West, on the southwest side of Pleasant Grove, drains to a single outlet on the southeast side of the I-15 Interchange. Because the outlet has a limited capacity, any flows above the 25-year storm may cause flooding at the freeway. To minimize the impact of potential flooding, it is proposed that a 30 foot wide area along I-15 be designated as a buffer area for flooding. This buffer area would extend along the north side of I-15 from 1300 West to Pleasant Grove Boulevard. No structures should be allowed in this area. Landscaping, parking, and open space could be allowed, with the knowledge that the area may be inundated during major storm events. This area will serve as an area to collect excess storm water to minimize flooding to surrounding structures. The area should be 30 feet wide starting at the toe of the slope from I-15, and should be an average of 1.5 feet of storage capacity. The area could be used for site storm water detention as long as 1.5 feet of storage is available for 100-year flooding. Currently there is a minimum set back of 30 feet from I-15 required so this requirement should not significantly impact development in the area.

MODEL CALIBRATION

Calibrating a storm water model is not an exact science. The data used to calibrate the model is highly variable and difficult to obtain. Normally, calibration would be attempted by comparing a known event to modeled results and adjusting the model to match field data. In this case we don’t have a known event since storms by their nature are highly variable across a drainage area. Rainfall data is collected at only a few locations and may or may not represent what is happening throughout the area. Flow measurements also do not exist in various portions of the conveyance system. Therefore calibration of the model consisted of running the model and displaying the data for the City operators to review and comment on. The field experience of City staff is invaluable in that they know where there are flooding problems during certain storms.

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[f] National Resource Conservation Service (NRCS), Urban Hydrology for Small Watersheds, TR-55

S E C T I O N 3

Storm Water System Improvements

Operation and Maintenance

The City's current storm water system consists of pipes, open channels, detention basins, inlets, outfalls, junction manholes, etc. The system started by using the flood irrigation ditches to move storm water. These ditches by necessity followed the contour of the land and did not necessarily follow City streets. This leaves many current storm water facilities on private property behind homes that are difficult and expensive to maintain. This plan provides data for the City to budget a certain amount every year in the storm water fund to move these facilities into City right of way whenever possible. These costs are operating costs and are not eligible for impact fees unless the facility needs to be upsized for future growth. Cost estimates in this report include a breakdown of what percentage if any is growth related.

Pleasant Grove City storm water facilities range from new to 100 years old. Table 2 shows an estimate of the replacement cost of the City's storm water system. The typical design life of a storm water facility ranges between 30 to 80 years. At some point all storm water facilities will need to be replaced and therefore the City should budget a certain amount each year to replace aged and failing storm water infrastructure. Table 2 shows the cost per year to replace the existing infrastructure over an 80 year time frame. Moving facilities into street right of way, as noted above, can be considered a replacement cost so the combined cost of these two items should be equal to the yearly cost noted in the table. The costs are operating costs and not eligible for impact fees unless the facility needs to be upsized for future growth.

The plan also identifies what the City should continue to budget for related to operating and maintaining the storm water system, including but not limited to, storm water management plan implementation and inspection, storm water system cleaning and inspection, detention basin inspection and maintenance, street sweeping, repair, etc. Table 3 show the anticipated capital equipment and employee costs anticipated over the planning period.

Table 2 Existing System Replacement Costs

Item	Description	Quantity	Units	Unit Cost	Cost
1	Mobilization	1	LS	----	$3,475,997
2	15 Inch Storm Drain (15 and smaller)	127,557	LF	$40.00	$5,102,280
3	18 Inch Storm Drain	81,990	LF	$45.00	$3,689,550
4	21 Inch Storm Drain	6,368	LF	$50.00	$318,400
5	24 Inch Storm Drain	53,497	LF	$54.00	$2,888,838
6	30 Inch Storm Drain	21,835	LF	$58.00	$1,266,430
7	36 Inch Storm Drain	14,467	LF	$75.00	$1,085,025
8	42 Inch Storm Drain	13,168	LF	$110.00	$1,448,480
9	48 Inch Storm Drain	340	LF	$150.00	$51,000
10	Misc and Unknown Storm Drain Sizes	70,320	LF	$54.00	$3,797,280
11	Open Channel	51,120	LF	$90.00	$4,600,800
12	Detention Basin (0.5 acre per basin Ave)	22	Acre	$90,000.00	$1,980,000
13	Storm Drain Boxes	659	EA	$3,500.00	$2,306,500
14	Storm Drain Manholes	500	EA	$4,500.00	$2,250,000
15	Inlet Boxes	1,150	EA	$2,500.00	$2,875,000
16	Storm Drain Sumps	21	EA	$6,500.00	$136,500
17	Class "A" Road Repair	3,505,878	SF	$5.25	$18,405,860
18	Class "D" Field Repair	1,577,586	SF	$0.90	$1,419,827
19	Imported Backfill	389,542	TON	$16.00	$6,232,672
20	Railroad Crossing	15	LS	$108,000.00	$1,620,000
21	State Road Crossing	20	LS	$220,000.00	$4,400,000
22	Traffic Control	1	LS	$475,500.09	$475,500
23	Utility Relocation (20% of pipe cost)	1	LS	$3,170,000.60	$3,170,001
	Sub Total (Construction)				$72,995,940
	Contingencies	15%			$10,949,391
	Total (Construction)				$83,945,331
	Design and Construction Engineering	15%			$10,949,391
	Administration, Legal, and Bond Counsel	1%			$729,959
	Total (Professional Services)				$11,679,350
	Grand Total				**$95,624,681**
	January 2013 CCI = 9437				
	Data From Pleasant Grove City GIS Data Base				
	Costs are in 2013 dollars				
	Replacement Costs Per Year (80 Years)				**$1,195,309**

Table 3 Anticipated Yearly Capital Equipment and Employee Costs

	Employee	Vac-Truck	Sweeper	Backhoe	Pickup	Dump Truck	Annual Cost
2013	4.5	1	0	1	2	3	$657,000
2014	4.5	1	1	1	2	3	$607,000
2015	4.5	1	1	1	2	3	$419,500
2016	5.5	1	1	1	3	3	$499,500
2017	5.5	1	1	1	3	3	$479,500
2018	5.5	1	1	1	3	3	$479,500
2019	5.5	1	1	1	3	3	$479,500
2020	6.5	1	1	1	3	4	$595,500
2021	6.5	1	1	1	3	4	$547,500
2022	6.5	1	1	1	3	4	$547,500
2023	6.5	1	1	1	3	4	$547,500
2024	6.5	1	1	1	3	4	$547,500
2025	7.5	1	2	1	3	4	$785,000
2026	7.5	1	2	1	3	4	$660,000
2027	7.5	1	2	1	3	4	$660,000
2028	7.5	1	2	1	3	4	$660,000
2029	7.5	1	2	1	3	4	$660,000
2030	7.5	2	2	2	4	4	$988,000
2040	8.5	2	2	2	4	5	$826,000
2050	8.5	2	2	2	4	5	$796,000

Notes.

1. Annual cost includes amortized capital cost of equipment over expected life.
2. 2013 includes full vac-truck capital costs and 2014 includes full sweeper capital cost.
3. Costs are in 2013 dollars.
4. Costs do not include O&M costs which need to be budgeted separately.

Item	Capital Cost	Expected Life (years)
Vac-Truck	$350,000.00	7
Street Sweeper	$250,000.00	4
Pickup	$50,000.00	10
Dump Truck	$120,000.00	20

Trackhoe is $8,000 per year rental cost

Employee is $50,000 per year average wages and benefits

Existing Deficiencies

Using the model of the existing system, problem areas have been identified in the model. These include manholes or catch basins that overflow, pipes or channels that are over capacity, and detention or retention ponds that overflow. Other problem areas have been identified through field observations, and through consultation with City staff.

Areas of the City have been identified that are not connected to the overall storm water system, or are not completely connected to the storm water system. These areas are not included in the model of the existing system. In this way, the model of the existing system more accurately reflects the existing conditions and deficiencies attributable to current users.

Figure 6 in the appendix shows the existing system. Figure 7 in the appendix shows the existing deficiencies with a number corresponding to the list below. Cost estimates include an estimate of the portion to be paid for by existing users and the portion eligible for impact fees.

1. **600 West 600 North Detention and Pipeline Improvements**

Construct a 30 ac-ft detention facility and upsize the existing line on 600 West to a 42-inch (121 cfs) from the entrance to the detention facility to 1000 North and to 36 inch (60 cfs) from 1000 to 1100 North. The detention facility will need to be upsized to 40 ac-ft in the future and the pipeline will need to be upsized to 48-inch (138 cfs). The outflow will need to be limited to 1.5 cfs during the storm event and increased as downstream capacity becomes available.

2. **400 North 400 West to 200 North 200 East Pipeline**

This project will redirect flow from the ditch on 200 North 200 East west to the new 600 West detention facility through a new 30-inch pipe (63 cfs). Pipeline will need to be upsized for buildout to 36-inch (98 cfs).

3. **700 South 100 East Connection**

Redirect flows from the southeast side of the railroad tracks on 700 South to the north side with a 24-inch pipeline (30 cfs).

4. **200 South from Locust Ave to 400 East and south to 350 South**

Collect water from the Upper Main Ditch on 200 south with a new 18-inch line (24 cfs) and connect to the Lower Main Ditch. Then upsize the existing line from 200 South to 350 South to a 24-inch (24 cfs).

5. **Mahogany Detention Basin Inlet and Outlet Piping**

The existing Mahogany Detention Basin at approximately 500 West and 800 North currently has no primary inlet or outlet piping. Connect the basin inlet to the storm drain on 1300 West and 800 North with a 48-inch pipeline (93 cfs). Connect the basin outlet to the existing State Street crossing on Garden Drive with a 24-inch pipeline (13 cfs). The detention basin will need to be upsized for buildout to 16 ac-ft.

6. Anderson Park Detention and Outlet Piping

Construct a 2.6 ac-ft detention basin in Anderson Park and construct new 15-inch (9 cfs) outlet piping to 600 East on 100 South. The detention basin will need to be upsized for buildout to 4 ac-ft. Storm water from the North Union Ditch would be diverted through this facility.

7. 1100 North from 600 West to 300 West Piping

Replace the existing piping on the north side of the road with 30 inch (32 cfs).

8. 1100 North from 300 West to 100 West Piping

Replace the existing piping on the north side of the road with 24-inch (32 cfs) and connect the north and south pipelines with a 30-inch (24 cfs) pipeline at 100 West.

9. 1100 North from 300 East to 430 East Piping

Connect the Mill Ditch to existing piping on the north side of the road from 300 East to 430 East with a 15-inch pipe (25 cfs). The piping will need to be upsized to 24-inch (43 cfs) for buildout.

10. 600 West 1800 North Detention and Piping

Construct a 1.3 ac-ft detention basin at approximately 1700 North and 600 West. Up-size the existing piping on 1800 North from 600 West to approximately 450 West with 24-inch (25 cfs). The detention basin will need to be upsized to 2.7 ac-ft and the piping will need to be upsized to 36-inch (37 cfs) for buildout.

11. 900 North 470 East to 1000 North 500 East

Upgrade existing piping on 900 North to 21 inch (21 cfs) and on 500 East to 18-inch (12 cfs).

12. 1300 West From Center St to 100 South Piping

Install new 42-inch (84 cfs) piping in the open ditch on 1300 West between approximately Center Street and 100 South.

13. 1000 South from 700 West to 850 West

Upgrade existing piping to 24-inch (25 cfs) on 1000 West between 700 West and 850 West.

14. 700 South from 600 West to 900 West Piping

Upgrade existing piping and open ditch to 42-inch (73 cfs) on 700 South between 600 West and 900 West. Piping will need to be upsized to 48-inch (80 cfs) for buildout.

15. Lindon Bypass

The Lindon bypass is explained in more detail later in the chapter.

Table 4 shows the necessary existing system improvements.

Table 4 Existing System Improvements

Item	Description	Cost	Existing	Growth
1	600 West 600 North Detention and Pipeline Improvements	$6,411,840	$4,857,160	$1,554,680
2	400 North 400 West to 200 North 200 East Pipeline	$783,811	$670,265	$113,546
3	700 South 100 East Connection	$174,370	$174,370	$0
4	200 South from Locust Ave to 400 East and 350 South	$157,518	$157,518	$0
5	Mahogany Detention Basin Inlet and Outlet Piping	$1,070,690	$521,735	$548,955
6	Anderson Park Detention and Outlet Piping	$587,947	$501,290	$86,657
7	1100 North from 600 West to 300 West Piping	$282,640	$282,640	$0
8	1100 North from 300 West to 100 West Piping	$199,471	$199,471	$0
9	1100 North from 300 East to 430 East Piping	$219,204	$189,501	$29,703
10	600 West 1800 North Detention and Piping	$423,483	$299,576	$123,907
11	900 North 470 East to 1000 North 500 East	$136,620	$136,620	$0
12	1300 West From Center St to 100 South Piping	$142,875	$142,875	$0
13	1000 South from 700 West to 850 West Piping	$141,680	$141,680	$0
14	700 South from 600 West to 900 West Piping	$321,617	$269,243	$52,374
15	Lindon Bypass	$4,166,876	$3,500,176	$666,700
	Grand Total	**$15,220,639**	**$12,044,118**	**$3,176,521**

January 2013 CCI = 9437
Costs are in 2013 dollars

Growth Related Improvements

After determining the existing needs, a model of the City's buildout storm drain system was developed. In the buildout model, all areas of the City are connected to the storm water system, and each area is modeled as if it were completely developed, according to its future land use type. For example, an area that is currently an open field, but is in a commercial zone, is modeled as if it were fully developed in a commercial area. This provides the most accurate estimate of the future storm flows to be expected from each area. The City requires that commercial, industrial, and high density residential areas detain the 10-year storm. These requirements for detention have been accounted for in the buildout model. The buildout model includes a detention pond for each of these areas that represents a future 10-year detention pond.

The completed buildout model is used to determine what areas of the storm water system need to be upgraded to accommodate future growth. The buildout model is also used to determine the best alternatives for detention locations and sizes, pipe sizes and routes, etc.

There are many ways to address storm water conveyance ranging from no storm water system at all to elaborate pipe and detention combinations. The purpose of detention facilities is to detain high peak flows in a storage facility and release these flows over a period of time. This allows downstream facilities to be smaller and less expensive. There is a balance between the cost associated with piping peak flows and the cost to detain flows. Horrocks Engineers looked at many different combinations of pipe/detention systems to convey storm water out of the City. After reviewing many different options and costs and presenting different scenarios to City Council and staff we developed this plan to serve future growth. One major concept drove development of the current master plan. This was the desire to limit the amount of area required for detention south of State Street both because of the cost to purchase land in the area and the desire to have more economic development in the area. There was also the desire to bring the 2000 West corridor closer to the storm water development standard of the rest of the City.

The current outlet for 2000 West goes under I-15 just southeast of the Pleasant Grove Interchange with a capacity of 125 cfs. Downstream conveyance facilities are limited to about 35 cfs through Lindon. We recommend in this master plan that a new conveyance facility with a capacity of at least 125 cfs be constructed to Utah Lake that bypasses the current Lindon City Infrastructure. This and other improvements north of I-15 allows the majority of the 2000 West basin to follow the same discharge standards as the rest of the City. Figure 10 in the appendix shows the proposed buildout storm water facilties. Figure 13 shows the areas along the 2000 West corridor that need to maintain the current 100-year detention and 0.05 cfs per acre outlet flows.

This plan also calls for a major detention facility in the area of 400 North and 600 West which allows for smaller detention facilities south of State Street.

The following list describes the improvements necessary for the buildout system.

1. **900 South from 900 East to Locust Ave**

Construct new 15-inch (10 cfs) piping from 900 East to Locust Ave. This will collect water from the existing irrigation/storm ditch on 900 East and direct it through the City instead of Lindon.

2. 200 North from 450 East to 750 East

Replace existing pipe and construct new 30-inch (63 cfs) piping on 200 North from 450 East to 750 East. This facility will collect water from the historic Grove Creek channel.

3. 2600 North Detention Basins

Construct new detention basins on 2600 North at approximately 1146 West (1.8 ac-ft) and 600 West (2.8 ac-ft)

4. 900 West from 2850 North to Murdock Trail

Construct new 15-inch (10 cfs), 21-inch (18 cfs), and 24-inch (27 cfs) on 900 West from 2850 North to the Canal trail.

5. 1000 South from 400 West to 700 West

Upgrade existing piping to 24-inch (24 cfs) on 1000 South from 400 West to 700 West.

6. 1000 South from 700 West to 800 West Bypass line

Construct new 3- inch (28 cfs) piping on 1000 South from 700 West to 800 West that bypasses the detention basin in the area.

7. 1300 West from 1000 South to I-15

Construct new 30-inch (27 cfs) piping on 1300 West from 1000 South to I-15.

8. 220 South Smith Property Detention

Construct a new 11.1 ac-ft detention facility in the area of 220 South and 900 West.

9. Pleasant Springs Detention

Modify and enlarge an existing areas north of Pleasant Springs to detain 7.5 ac-ft of water.

10. 1000 South 900 West Detention

Construct a new 10.0 ac-ft detention facility in the area of 1000 South and 900 West.

11. 1000 South from 1300 West to 1700 West and South to I-15

Construct new 48-inch (127 cfs) pipelines from 1000 South and 1300 West to I-15. This facility will allow more free drainage from the 1300 West corridor.

12. Outfall from I-15 to Utah Lake

Construct 5- inch, 60-inch, 66-inch, open concrete channels and open earthen channels (127 cfs) from I-15 to Utah Lake.

Table 5 shows the buildout system improvements.

Table 5 Buildout System Improvements

Item	Description	Cost
1	900 South from 900 East to Locust Ave	$149,950
2	200 North from 450 East to 750 East	$797,715
3	2600 North Detention Basins	$309,488
4	900 West from 3000 North to Murdock Trail	$693,025
5	1000 South from 400 West to 700 West	$182,557
6	1000 South from 700 West to 800 West Bypass line	$54,878
7	1300 West from 1000 South to I-15	$429,013
8	220 South Smith Property Detention	$532,319
9	Pleasant Springs Detention	$458,042
10	1000 South 900 West Detention	$2,821,734
11	1000 South from 1300 West to 1700 West and South to I-15	$946,708
12	Outfall from I-15 to Utah Lake	$3,499,280
	Grand Total	**$10,874,709**

January 2013 CCI = 9437
Costs are in 2013 dollars

Lindon City Bypass Alternative

Pleasant Grove City currently discharges storm water into Lindon City, in the area of 1000 South between State Street and Locust Ave on the border between the two cities (Upper and Lower Main Ditches). As Lindon and Pleasant Grove grow, upgrades will be needed to accommodate the future storm water flows in Lindon that are coming from Pleasant Grove. This will require Pleasant Grove to either reduce the future flows going into Lindon, or to participate financially in upgrades to Lindon's storm water system. This plan includes an option to reduce the future amount of storm water that discharges into Lindon. A pipe would be built in 1000 West starting at the Upper Main Ditch and connect to a new detention pond in the area of 1000 South and 200 East. The storm water would then be routed to the west, to the main storm water system outlet. The result would be that the two existing outlets into Lindon would be limited to 10 and 13 cfs cfs respectively. This will reduce the impact onto Lindon's storm water system, and reduce or eliminate any financial obligations that Pleasant Grove might have to Lindon.

Other efforts have been made within Pleasant Grove City to limit the amount of storm water that discharges into Lindon. In buildout, some channels and pipes will be re-routed, so that flows will be diverted within Pleasant Grove, and not discharge into Lindon. At 200 North and 220 East a channel currently flows to the south to Lindon. This channel will be connected to the west, eliminating the flow to the south going into Lindon.

A new detention pond will be built at approximately 100 South and 900 East. This will reduce some of the stormwater flows that discharge into Lindon.

At 125 North and 725 East, storm water and irrigation water combine and flow to the northwest and southwest. The southwest leg eventually flows into Lindon. The southwest leg will be cut off, eliminating the storm water and irrigation flows to Lindon.

Table 6 shows the cost estimates for the Lindon bypass option. Figure 11 in the appendix shows the Lindon bypass option.

Table 6 Lindon Bypass Option

Item	Description	Quantity	Units	Unit Cost	Cost
1	Mobilization	1	LS	----	$79,823
2	24 Inch Storm Drain	3,300	LF	$65.00	$214,500
3	36 Inch Storm Drain	4,800	LF	$90.00	$432,000
4	Junction Boxes	21	EA	$6,000.00	$126,000
5	Class "A" Road Repair	2,000	SF	$5.25	$10,500
6	Class "D" Field Repair	74,400	SF	$0.90	$66,960
7	Imported Backfill	11,200	TON	$14.00	$156,800
8	1000 South Railroad Crossing	1	LS	$108,000.00	$108,000
9	Traffic Control	1	LS	$19,395.00	$19,395
10	Utility Relocation (20% of pipe cost)	1	LS	$129,300.00	$129,300
11	Detention Basin Construction	4	ACRES	$90,000.00	$333,000
	Sub Total (Construction)				$1,676,278
	Contingencies	15%			$251,442
	Land	161,172	SF	$7.50	$1,208,790
	Right of Way	121,500	SF	$3.75	$455,625
	Total (Construction)				$3,592,134
	Design and Construction Engineering	15%			$538,820
	Administration, Legal, and Bond Counsel	1%			$35,921
	Total (Professional Services)				$574,742
	Grand Total				**$4,166,876**
	January 2013 CCI = 9437				
	Costs are in 2013 dollars				
	Cost to Existing Users	84%			$3,500,175.77
	Cost to Future Users	16%			$666,700.15

Potential Snow Melt Flood Flow Routing

Periodically, winter snows and spring snow melt combine to produce significant flood flows from Battle Creek and Grove Creek canyons east of the City. The historic channels that carried this water to Utah Lake have been obliterated by development and diverted for irrigation purposes. During those times when the flood flows were greater than the irrigation system can handle the general practice was to direct these flows into the Provo Reservoir Canal.

During the years of 2011 and 2012 the canal was piped and was unavailable for the surface discharge of flood flows. The City has negotiated an agreement with the Metropolitan Water

District of Salt Lake and Sandy (MWDSL&S) to allow the discharge of flood flows into the piped canal. As of the time of this master plan it is still necessary to negotiate agreements with the other major stake holders in the canal for this discharge to occur. Among other requirements, the City had to construct pressure pipelines from the mouth of Battle Creek and Grove Creek Canyons to collect and measure flood flows, screen debris, pressurize the flow and connect to the piped canal for discharge. These facilities were constructed in 2012. The Battle Creek pipeline has a capacity of approximately 124 cfs while the Grove Creek Pipeline has a capacity of 186 cfs. For comparison it is estimated that the flood flows in 1983 were 70 and 140 cfs respectively.

The agreement to discharge gives the MWDSL&S the right to revoke the approval and give the City 15 years to construct other means of transmitting the flood flows. One option to deal with flood flows is to construct pipe/channel improvements to Utah Lake. Table 7 gives a cost estimate to construct pipelines and open channels to Utah Lake for these flood flows. Figure 12 in the appendix shows a possible alignment for this option.

Table 7 Snow Melt Flood Flow Options Cost Estimate

Item	Description	Quantity	Units	Unit Cost	Cost
1	Mobilization	1	LS	----	$701,280
2	30 Inch HDPE	2,580	LF	$90.00	$232,200
3	36 Inch HDPE	3,485	LF	$110.00	$383,350
4	48 Inch HDPE	2,890	LF	$150.00	$433,500
5	54 Inch HDPE	7,800	LF	$200.00	$1,560,000
6	63 Inch HDPE	19,600	LF	$250.00	$4,900,000
7	Manholes/Inlets	27	EA	$8,000.00	$216,000
8	Class "A" Road Repair	545,325	SF	$5.25	$2,862,956
9	Class "D" Field Repair	181,775	SF	$0.90	$163,598
10	Imported Backfill	44,780	TON	$14.00	$626,920
11	Railroad Crossing	2	LS	$350,000.00	$700,000
12	State Road Crossing	1	LS	$220,000.00	$220,000
13	Traffic Control	1	LS	$225,271.50	$225,272
14	Utility Relocation (20% of pipe cost)	1	LS	$1,501,810.00	$1,501,810
	Sub Total (Construction)				$14,726,886
	Contingencies	15%			$2,209,033
	Land	140,700	SF	$7.50	$1,055,250
	Right of Way	160,350	SF	$3.75	$601,313
	Total (Construction)				$18,592,481
	Design and Construction Engineering	15%			$2,209,033
	Administration, Legal, and Bond Counsel	1%			$147,269
	Total (Professional Services)				$2,356,302
	Grand Total				**$20,948,783**
	January 2013 CCI = 9437	Costs are in 2013 dollars			

Future Challenges

Government storm water quality regulations tend to increase over time with the effect of those regulations being unknown. There are several potential items that may significantly change the way the City handles storm water and may have significant financial repercussions. Currently Utah Lake is listed as impaired with respect to phosphorus and total dissolved solids (TDS). The normal process for an impaired water body is for the State and EPA to study the causes of impairment and recommend a total maximum daily load (TMDL) limit for the constituent involved. Everyone discharging to Utah Lake would be limited in the amount of contaminant that can be released. There is currently no TMDL established for Utah Lake for either phosphorous or TDS. When a TMDL is established the result could be the requirement to treat all storm water runoff in a treatment plant.

Another potential regulation is the concept of limiting runoff from any parcel to the historical runoff prior to development. This regulation is currently being pushed by the EPA but has yet to be implemented. This may limit the size of storm water conveyance (piping and ditch) facilities the City will need to install and maintain but will shift a significant financial burden to developers who may find it impossible to develop. Existing development would likely be grandfathered initially with the requirement to upgrade when re-developed.

Another item that needs to be addressed is the impact of ground water on the City storm water system. Draining ground water from a home or business into the City storm water system requires larger facilities to be constructed at a significant cost to the City and developers. We recommend that the City include a monthly utility charge for those who discharge ground water to the storm water system to cover the increased cost.

S E C T I O N 4

Storm Water System Impact Fee Facility Plan

Impact Fee Facility Plan Requirements

General Background

Pleasant Grove City is expecting significant growth in years to come. This growth, through the construction of homes, parks, commercial areas and other amenities incidental to development, will increased the demand on the City's storm water system. Pleasant Grove City's objective is to provide adequate storm water facilities to provide a level of protection against flooding.

Pleasant Grove City has developed a Storm Water Master Plan to plan storm water facilities to meet a level of protection against flooding. The plan proposes guidelines and suggests controls for the design and installation of storm water facilities. The plan also establishes estimated costs associated with storm water facilities.

Required Elements of an Impact Fee Facilities Plan

The purpose of this Impact Fee Facility Plan (IFFP) is to identify storm water impacts placed on existing storm water facilities by new development and propose means by which Pleasant Grove City will meet these demands. Various funding possibilities for these facilities are discussed.

A IFFP, or its equivalent, must be in place if impact fees are to be considered as a financing source. Impact fees are one-time fees charged to new development to cover costs of increased capital facilities necessitated by new development. They are a critical financing source for Pleasant Grove City to consider, given the anticipated growth.

Utah Code Ann. §11-36a-202 provides that the plan shall identify:

(i) Demands placed upon existing public facilities by new development activity; and

(ii) The proposed means by which the local political subdivision will meet those demands.

Demands on Existing Facilities

Service Area

Pleasant Grove City is located in the Northeastern portion of Utah County near the base of the Wasatch Mountains and includes an area of approximately 9 square miles. It is bordered on the West by American Fork City, on the South by Lindon City, on the East by Utah County Lands and the Forest Service, and on the North by the Cedar Hills City. Existing land uses vary from pasture and farmland to high-density residential housing and commercial complexes. Therefore, the community can be classified as both rural and suburban.

Pleasant Grove City owns and operates a storm water system that collects and transmits storm water through the City. The system collects storm water from upstream communities (Cedar Hills, and Utah County Lands) and discharges to downstream communities (Lindon).

Existing Storm Water Requirements

Pleasant Grove City has chosen to develop and maintain a storm water system that meets the following level of service. Combined conveyance and detention facilities are designed to handle the 25-year storm. Regional detention facilities are provided to limit the outlet flow to the capacity of various downstream conveyance facilities. Storms larger than the 25-year storm are required to be discharged to a downstream city street. If a development cannot discharge larger than 25-year storms to a downstream city street, they are required to provide 100-year conveyance to a suitable outlet on a downstream city street.

An ERU is an equivalent residential unit and is the measure used to adequately represent all uses and requirements. A storm water ERU is defined as 4,400 square feet (sf) of impermeable hardscape. This is the approximate average of impervious area for a single family residence in Pleasant Grove City. This was determined during this study by taking a random sample of residential homes in the City and measuring the amount of impervious area.

In addition to residential uses in the City there are commercial, institutional and other uses which have their own ERU's associated. These ERU's were determined based on the average commercial and institutional impervious area. Commercial areas typically have 85 percent impervious area while churches have 70 percent and schools have 50 percent. An analysis of the number of commercial and institutional parcels was performed to determine the average number of existing ERU's per commercial and institutional unit. The total area of each category was multiplied by the percent hardscape associated and divided by 4,400 sf/ERU to determine the average ERU per connection. These values were used to estimate existing and future ERU's for planning purposes. When developments are proposed it is recommended that the actual amount of impervious surface area be utilized when assigning impact fees.

In addition to the ERU calculation, an adjustment factor was calculated and applied to account for those areas that are required to provide detention as a condition of development. The adjustment factor was determined by comparing the peak flows generated from a 25 year storm when discharging directly versus discharging through a 10 year detention system. A similar adjustment factor was calculated and applied for those areas that are required to provide 100 year detention. Adjustment factors were calculated for several existing areas with factors ranging from 12 to 37 percent with an average of approximately 20 percent (80 percent reduction) for areas with 10-year detention requirements. Similar calculations return an average 3 percent adjustment factor (97 percent reduction) for those areas with 100-year detention requirements.

The ERU for each type of development should be calculated as follows. An ERU of 1.0 should be applied to each residential unit in a project where detention is not required. For each project where detention is required the total actual impervious area should be calculated and divided by 4,400 sf/ERU. An adjustment factor of 0.20 should be applied to those with 10-year detention and an adjustment factor of 0.03 to those with 100-year detention. The area where 100-year detention is required is identified in Figure 13 in the appendix.

Existing Storm Water Facilities

Existing conditions at the time of this study were established using data collected from the City as well as field data generated specifically for this IFFP. Some of the data gathered and used includes an existing storm water model, the existing storm water master plan, existing City maps and field flow data. Figure 6 in the appendix shows Pleasant Grove's existing storm water system and facilities. Existing conditions including conveyance and detention facilities and their deficiencies are described in the following tables.

Discharges to the storm water system include residential, school, church, commercial, and City owned facilities for a total of 19,049 equivalent residential units (ERUs).

Deficiencies Based on Existing Development

Pleasant Grove City's existing storm water system has areas that meet current minimum levels of Service and other areas that are deficient. Figure 7 in the appendix shows the improvements necessary to correct existing system deficiencies.

Current Capital Facility Needs

Figure 7 in the appendix shows the storm water capital facilities required for existing users.

Future Capital Facilities

Figure 10 in the appendix shows the buildout storm water system layout. Table 8 shows the anticipated ten year improvement schedule with associated impact fee related costs.

Table 8 Ten Year Improvement Schedule (2013 Dollars)

Fiscal Year	Description	Cost	% Benefit to Existing	Impact Expense	Operating Expense
2012-13	5 Year Master Plan Update	$75,000	0%	$75,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,195,139	0%	$795,419	$2,399,720
2013-14	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2014-15	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2015-16	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2016-17	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000

	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2017-18	5 Year Master Plan Update	$40,000	0%	$40,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,160,139	0%	$760,419	$2,399,720
2018-19	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2019-20	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2020-21	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
2021-22	Annual Master Plan Review	$4,000	0%	$4,000	$0
	Back Yard Storm Drain Relocation	$195,309	100%	$0	$195,309
	System Replacement	$1,000,000	100%	$0	$1,000,000
	System Deficiencies	$1,522,064	79%	$317,652	$1,204,412
	Buildout Improvements	$402,767	0%	$402,767	$0
	Yearly Total	$3,124,139	0%	$724,419	$2,399,720
	Total Expenditures	**$31,348,394**		**$7,351,191**	**$23,997,203**

Capital Facility Cost and Proportionate Share

Cost of Capital Facilities

Engineer's estimates of cost are described in Tables 9 and 10. These costs are associated with master planned improvements in order to properly handle existing and future development demands.

Table 9 Existing System Improvements

Item	Description	Cost	Existing	Growth
1	600 West 600 North Detention and Pipeline Improvements	$6,411,840	$4,857,160	$1,554,680
2	400 North 400 West to 200 North 200 East Pipeline	$783,811	$670,265	$113,546
3	700 South 100 East Connection	$174,370	$174,370	$0
4	200 South from Locust Ave to 400 East and 350 South	$157,518	$157,518	$0
5	Mahogany Detention Basin Inlet and Outlet Piping	$1,070,690	$521,735	$548,955
6	Anderson Park Detention and Outlet Piping	$587,947	$501,290	$86,657
7	1100 North from 600 West to 300 West Piping	$282,640	$282,640	$0
8	1100 North from 300 West to 100 West Piping	$199,471	$199,471	$0
9	1100 North from 300 East to 430 East Piping	$219,204	$189,501	$29,703
10	600 West 1800 North Detention and Piping	$423,483	$299,576	$123,907
11	900 North 470 East to 1000 North 500 East	$136,620	$136,620	$0
12	1300 West From Center St to 100 South Piping	$142,875	$142,875	$0
13	1000 South from 700 West to 850 West Piping	$141,680	$141,680	$0
14	700 South from 600 West to 900 West Piping	$321,617	$269,243	$52,374
15	Lindon Bypass	$4,166,876	$3,500,176	$666,700
	Grand Total	**$15,220,639**	**$12,044,118**	**$3,176,521**

January 2013 CCI = 9437
Costs are in 2013 dollars

Table 10 Buildout System Improvements

Item	Description	Cost
1	900 South from 900 East to Locust Ave	$149,950
2	200 North from 450 East to 750 East	$797,715
3	2600 North Detention Basins	$309,488
4	900 West from 3000 North to Murdock Trail	$693,025
5	1000 South from 400 West to 700 West	$182,557
6	1000 South from 700 West to 800 West Bypass line	$54,878
7	1300 West from 1000 South to I-15	$429,013
8	220 South Smith Property Detention	$532,319
9	Pleasant Springs Detention	$458,042
10	1000 South 900 West Detention	$2,821,734
11	1000 South from 1300 West to 1700 West and South to I-15	$946,708
12	Outfall from I-15 to Utah Lake	$3,499,280
	Grand Total	**$10,874,709**

January 2013 CCI = 9437
Costs are in 2013 dollars

Free Capacity in Storm Water System

With the exception of some deficiencies as noted in the following section, the storm water system has the capacity to serve the storm water needs of the current residents.

Table 11 Storm Water System Cost Summary

Item Description	Cost Estimate
Current System Deficiencies Costs	$12,044,118
Replacement Program Costs (27 Year Planning Period)	$32,273,330
Future System Upsize Cost	$14,410,230
Total	**$58,727,678**

Cost Associated with Deficiency

As described in Section 2, the existing storm water system has deficiencies. The City will need to install and upgrade facilities in order to properly handle existing storm water demands. The cost associated with these deficiencies will be paid through other funding sources and is not eligible to be paid for through impact fees.

Replacement and Relocation Program Costs

The City's current storm water system consists of pipes, open channels, detention basins, inlets, outfalls, junction manholes, etc. The system started by using the flood irrigation ditches to move storm water. These ditches by necessity followed the contour of the land and did not necessarily follow City streets. This leaves many current storm water facilities on private property behind homes that are difficult and expensive to maintain. It is recommended that the City budget a certain amount every year in the storm water fund to move these facilities into City right of way whenever possible. The costs to do so is an operating cost and not eligible for impact fees unless the facility needs to be upsized for future growth. Cost estimates in this report include a breakdown of what percentage if any is growth related.

The plan identifies what the City should continue to budget for related to operating and maintaining the storm water system including but not limited to storm water management plan implementation and inspection, storm water system cleaning and inspection, detention basins inspection and maintenance, street sweeping, repair, etc.

The plan includes a replacement program to upgrade many older storm water facilities in the City as they reach their useful life. These costs are not eligible for impact fee funding and should be funded through user rates.

Previous Bonding Costs

Previous to this Impact Fee Facility Plan, the City has bonded for improvements necessary. Most notably a $5 million dollar bond in 2010. These bonds were used exclusively for storm water related expenditures. They were general obligation bonds with system revenues and impact fees from users dedicated to make bond payments. No property tax revenues were anticipated to be utilized in bond payments.

Developer Contributions

As growth occurs throughout the City, developers are required to install minimum size storm water lines to serve the homes within their development. Many lines throughout the City need to be upsized to accommodate homes outside the development. The City collects impact fees from all development to cover the cost of the facilities proposed in this master plan. The detailed cost estimates identify the amount associated with future growth and the amount associated with existing deficiencies. Individual developments are required to put in the minimum size and larger if the storm water generated on their site requires it.

Revenue Source to Finance Impacts to System Improvements

General Fund Revenues

While general fund revenues can be used to fund capital facilities, they are generally insufficient to meet the demands of large infrastructure projects. General fund revenues are mainly drawn from property, sales and franchise tax revenues.

Grants and Donations

Grants monies or low interest loans for capital facilities may be available through a variety of state and federal programs. Competition for these types of funds is often strong, but should not be overlooked as a potential funding source.

Storm Water Utility

Pleasant Grove City has enacted a storm water utility to help pay the cost of capital facilities. All residents pay a monthly storm water utility fee. Monthly fees are then used to maintain the system and/or construct capital facility improvements. Additional charges are proposed to convey non-storm water discharges.

Impact Fees

Impact fees are an important means of financing future storm water capital facility improvements, especially given the growth anticipated. The fees collected can be used for infrastructure as outlined in this capital facility plan. Impact fees are a one-time fee charged to new development that allow development to "pay its own way" in terms of the additional costs cities experience when growth occurs. Impact fees must meet the requirements of Utah law and must demonstrate that there is a rational connection between the fees charged to correct deficiencies in an existing system, and provides that adjustment to impact fees must be made to appropriately credit any significant past payments or anticipated future payments to capital facilities. This is to insure that the new development is not "double charged" for capital facilities. Impact fees are necessary in order to achieve an equitable allocation between the costs borne in the past and the cost to be borne in the future. Existing residents and businesses are mostly well served by the existing storm water system with some deficiencies. However, with additional growth, improvements and expansion of the storm water system will be needed to provide adequate service for the future.

Debt Financing

Pleasant Grove City can also fund storm water facilities through bonding. Bonding is often a good approach when large sums are needed up-front because it allows the payments to be spread over a longer time period. Pleasant Grove City does have a revenue source in storm water user rates to pay back a debt service payment for storm water system improvements. Bonding can be obtained on the open market.

I certify that the attached impact fee facilities plan:

1. includes only the costs of public facilities that are:
   a. allowed under the Impact Fees Act; and
   b. actually incurred; or
   c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;

2. does not include:
   a. costs of operation and maintenance of public facilities;
   b. costs for qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents;
   c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and

3. complies in each and every relevant respect with the Impact Fees Act.

John E. Schiess

Digitally signed by John E Schiess
DN: c=US, o=TrustID personal certificate, ou=Utah, cn=John E Schiess, email=jschiess@horrocks.com, 0.9.2342.19200300.100.1.1=A01413E0000013920665685000000E8B
Date: 2013.05.23 15:16:41 -06'00'

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John E. Schiess, P.E.
Horrocks Engineers

APPENDIX

O:\2011\PG-058-1101 Pleasant Grove City Gen\!Phase 112 Storm Water Master Plan\Engineering Data\GIS\PG Hydrologic Soil Groups.mxd, 4/30/2013 2:49:18 PM, jschiess

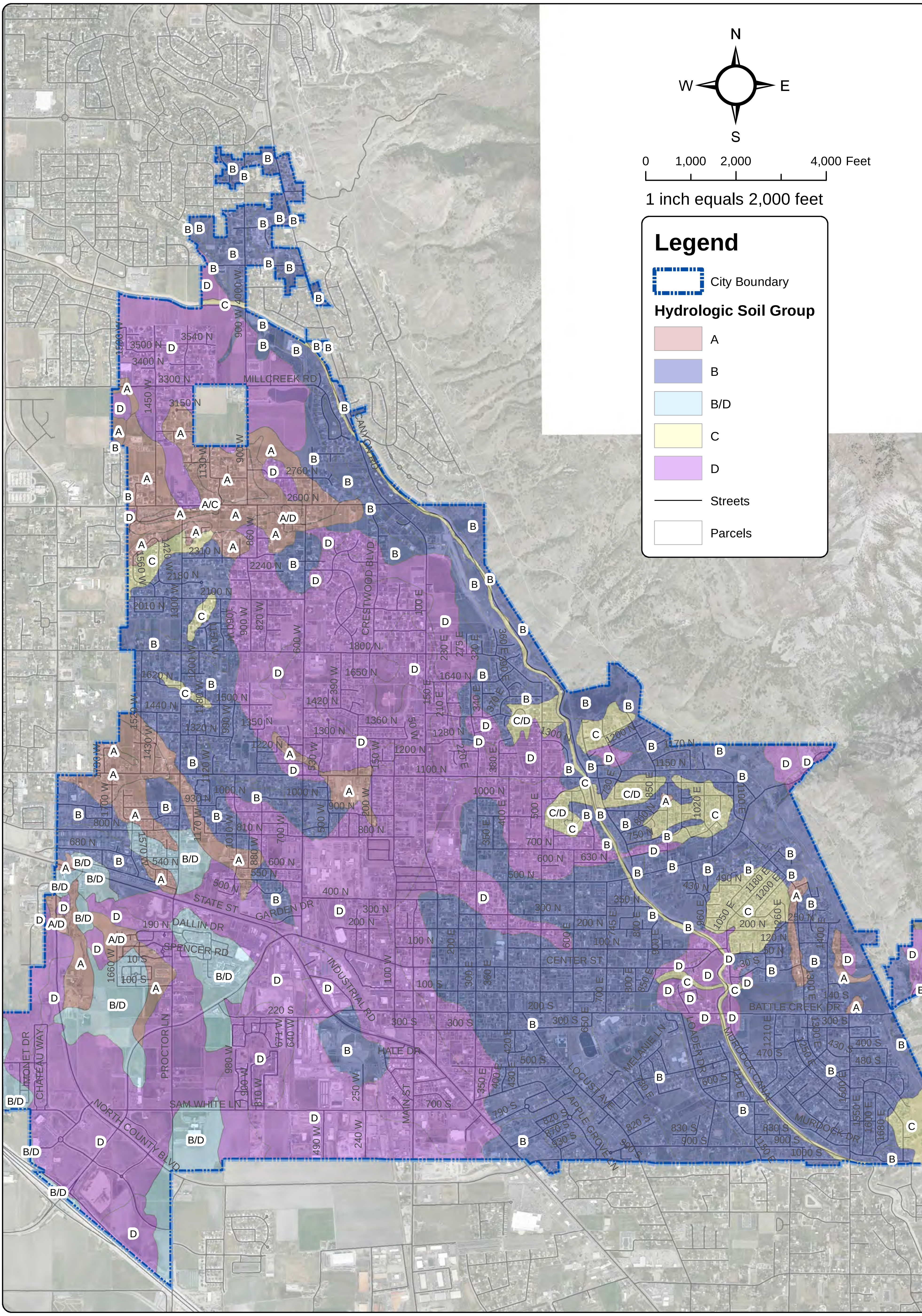

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FIGURE 2 HYDROLOGIC SOIL GROUPS

PLEASANT GROVE STORM WATER MASTER PLAN

Pleasant Grove
Utah's City of Trees

O:\\2011\PG-058-1101 Pleasant Grove City Gen\\Phase 112 Storm Water Master Plan\Engineering Data\GIS\PG Rainfall Zones.mxd, 4/30/2013 2:54:19 PM, jschiess

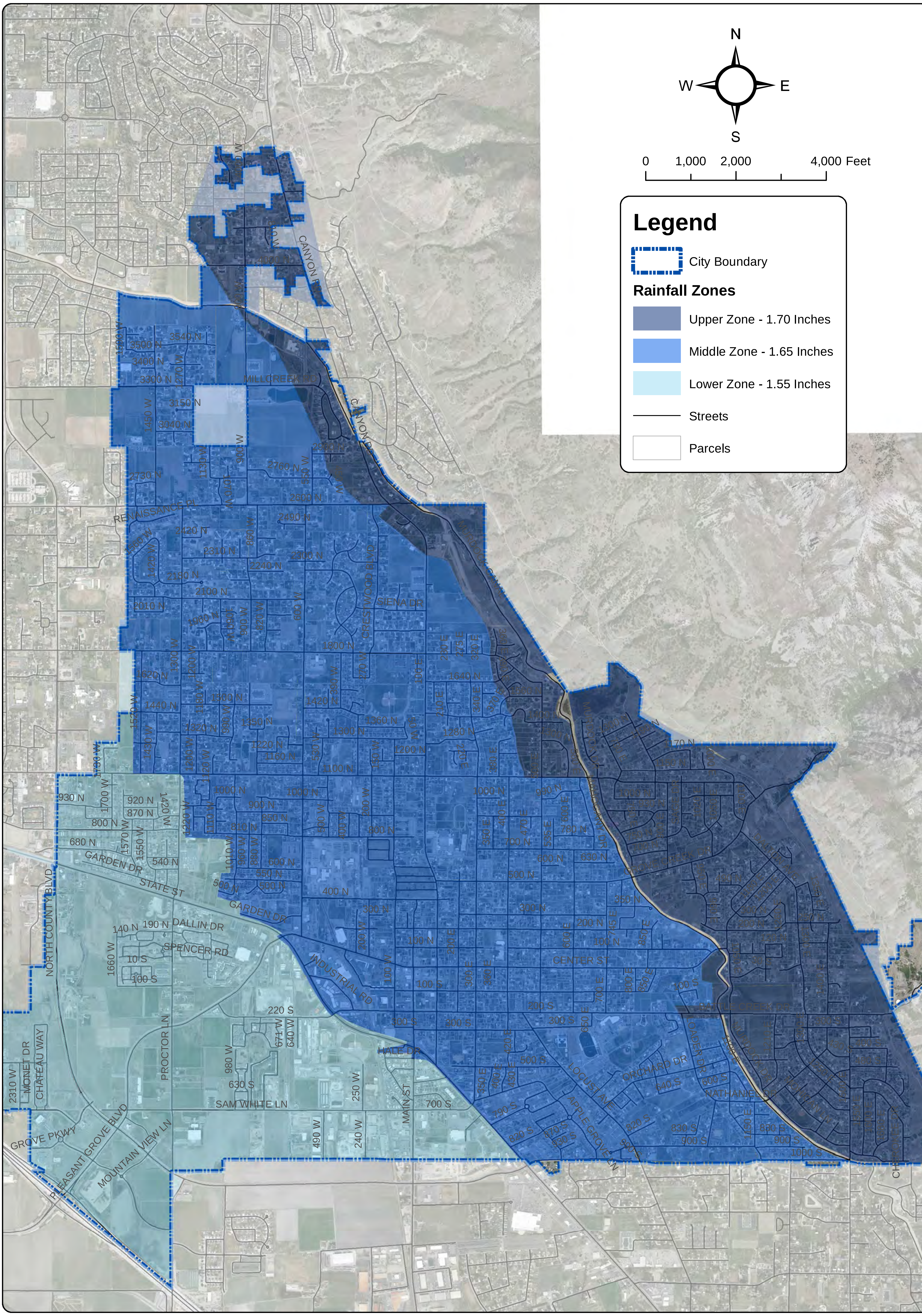

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FIGURE 3 RAINFALL ZONES - 25 YEAR 6 HOUR STORM

PLEASANT GROVE STORM WATER MASTER PLAN

Pleasant Grove
Utah's City of Trees

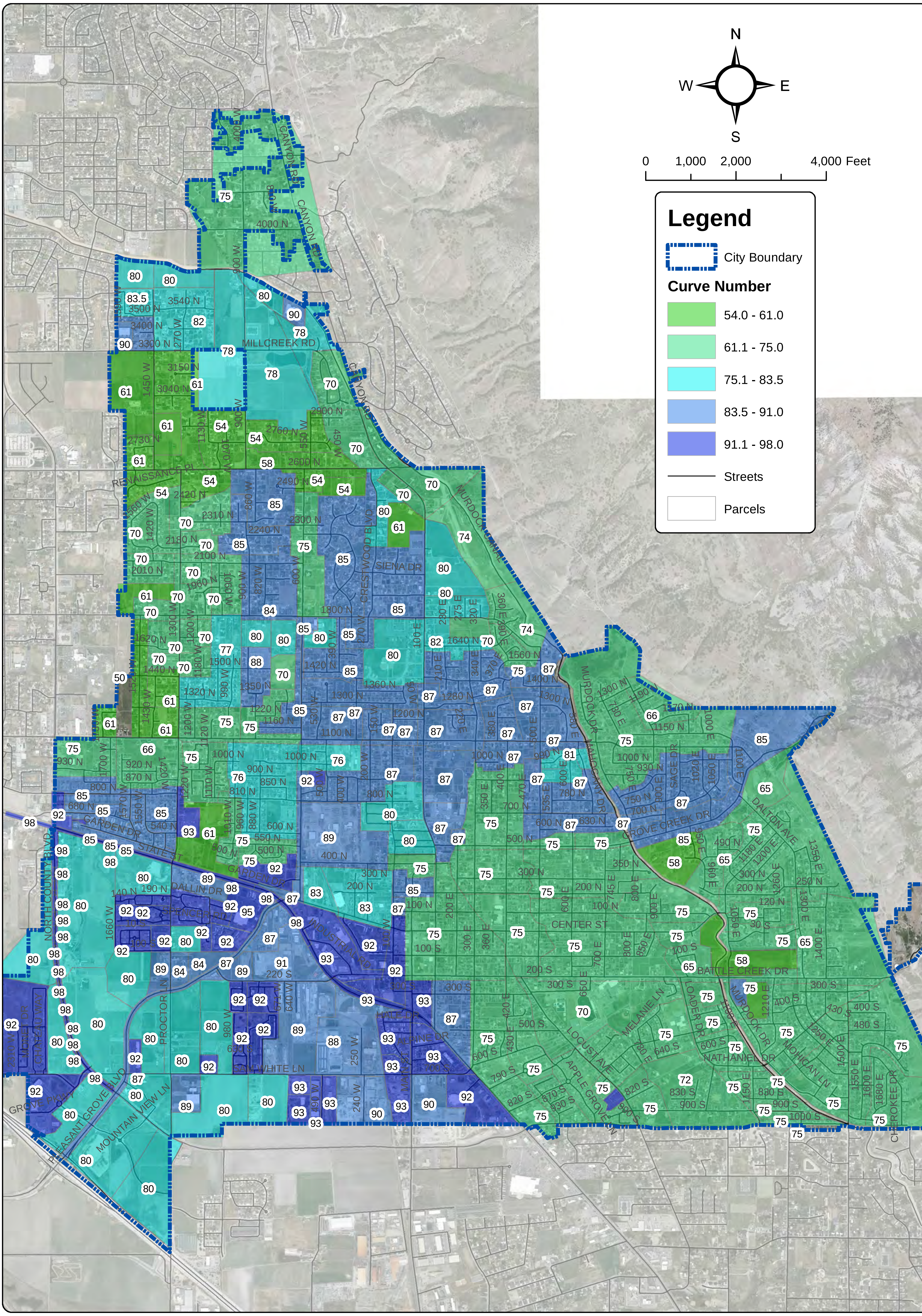

FIGURE 4 CURRENT CURVE NUMBERS

PLEASANT GROVE STORM WATER MASTER PLAN

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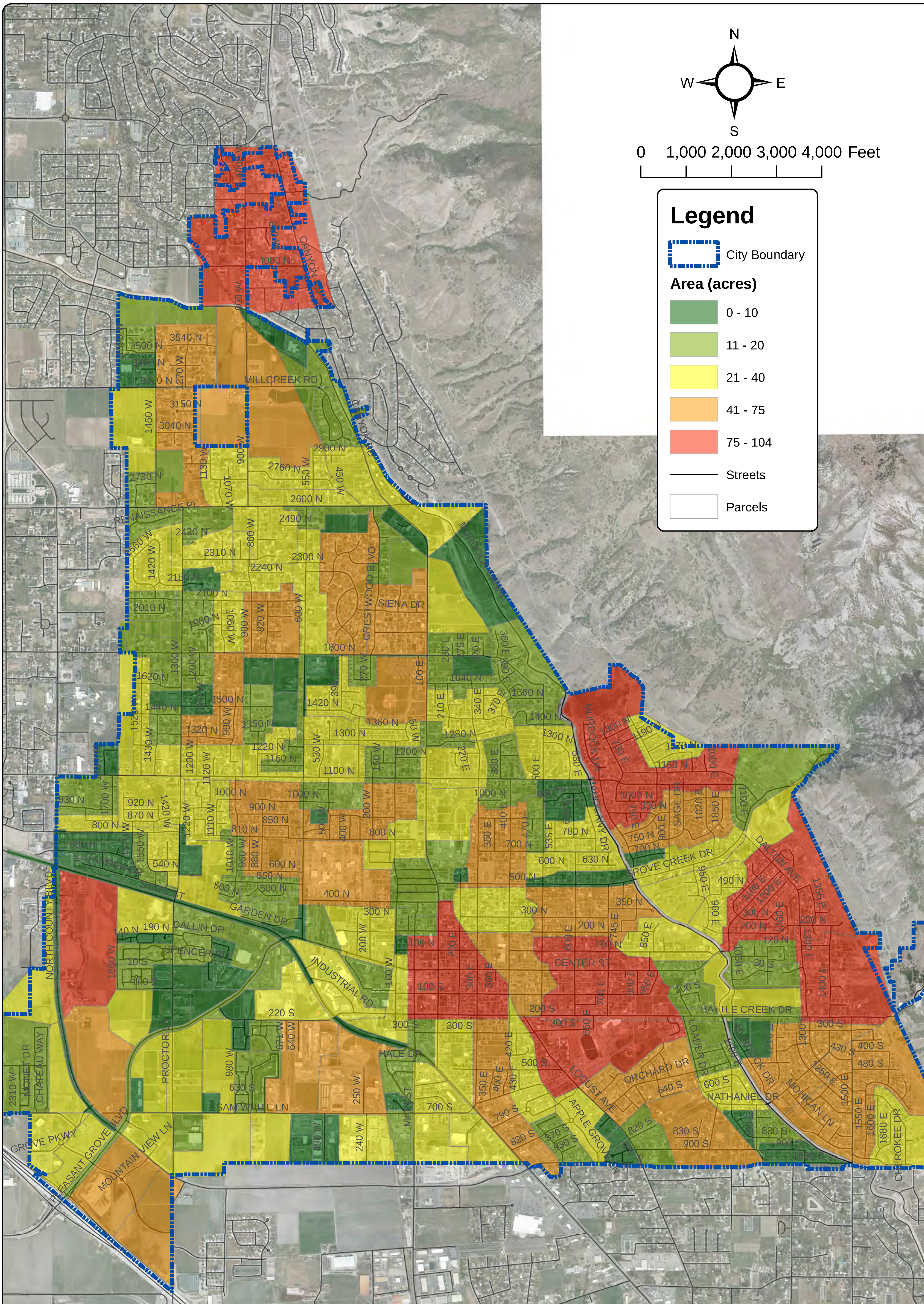

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FIGURE 5 CURRENT CATCHMENTS

PLEASANT GROVE STORM WATER MASTER PLAN

Pleasant Grove
Utah's City of Trees

O:\!2011\PG-058-1101 Pleasant Grove City Gen\!Phase 112 Storm Water Master Plan\Engineering Data\GIS\PG Existing SD System.mxd, 4/30/2013 3:17:32 PM, jschiess

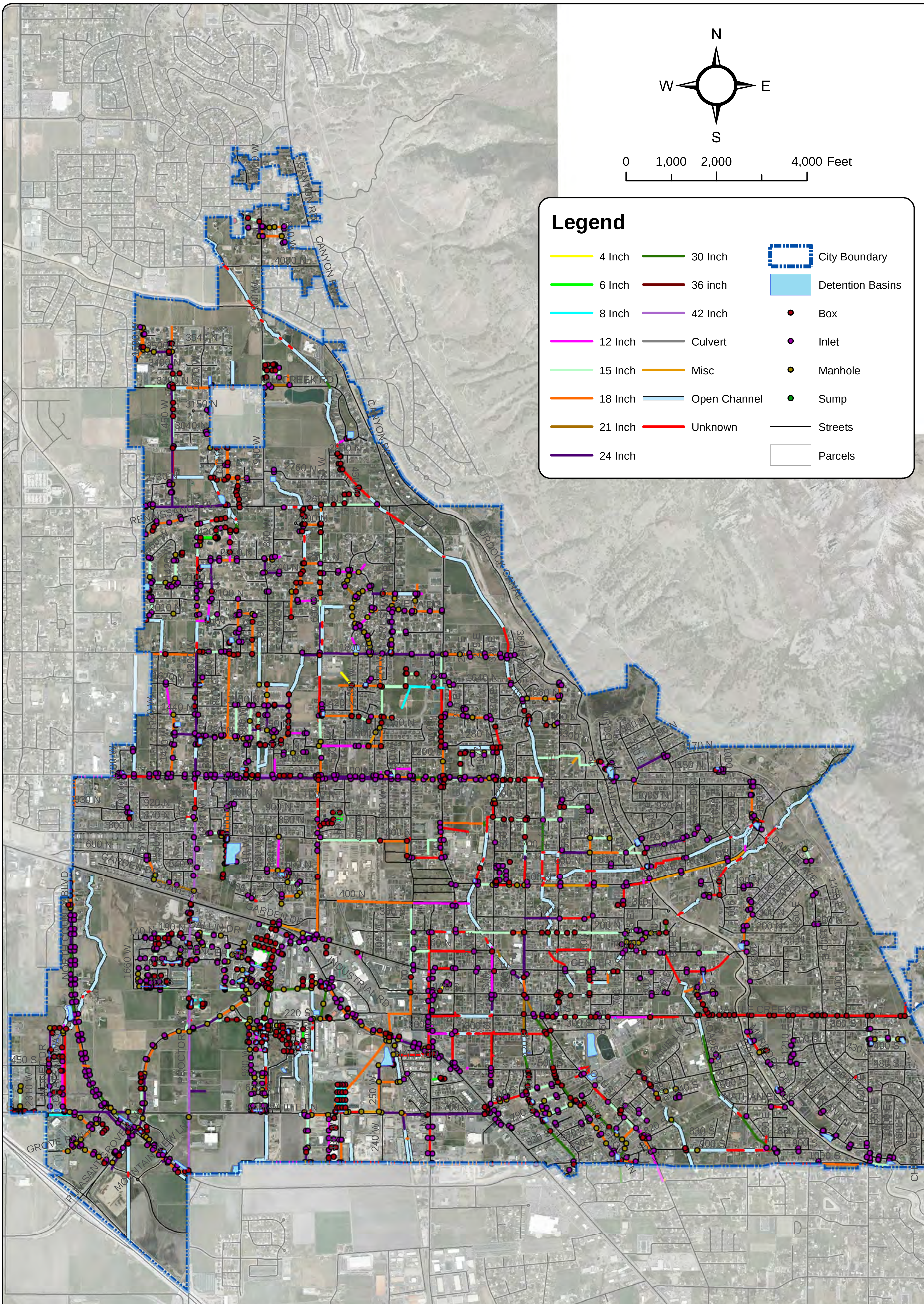

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FIGURE 6 EXISTING STORM WATER SYSTEM

PLEASANT GROVE STORM WATER MASTER PLAN

Pleasant Grove
Utah's City of Trees

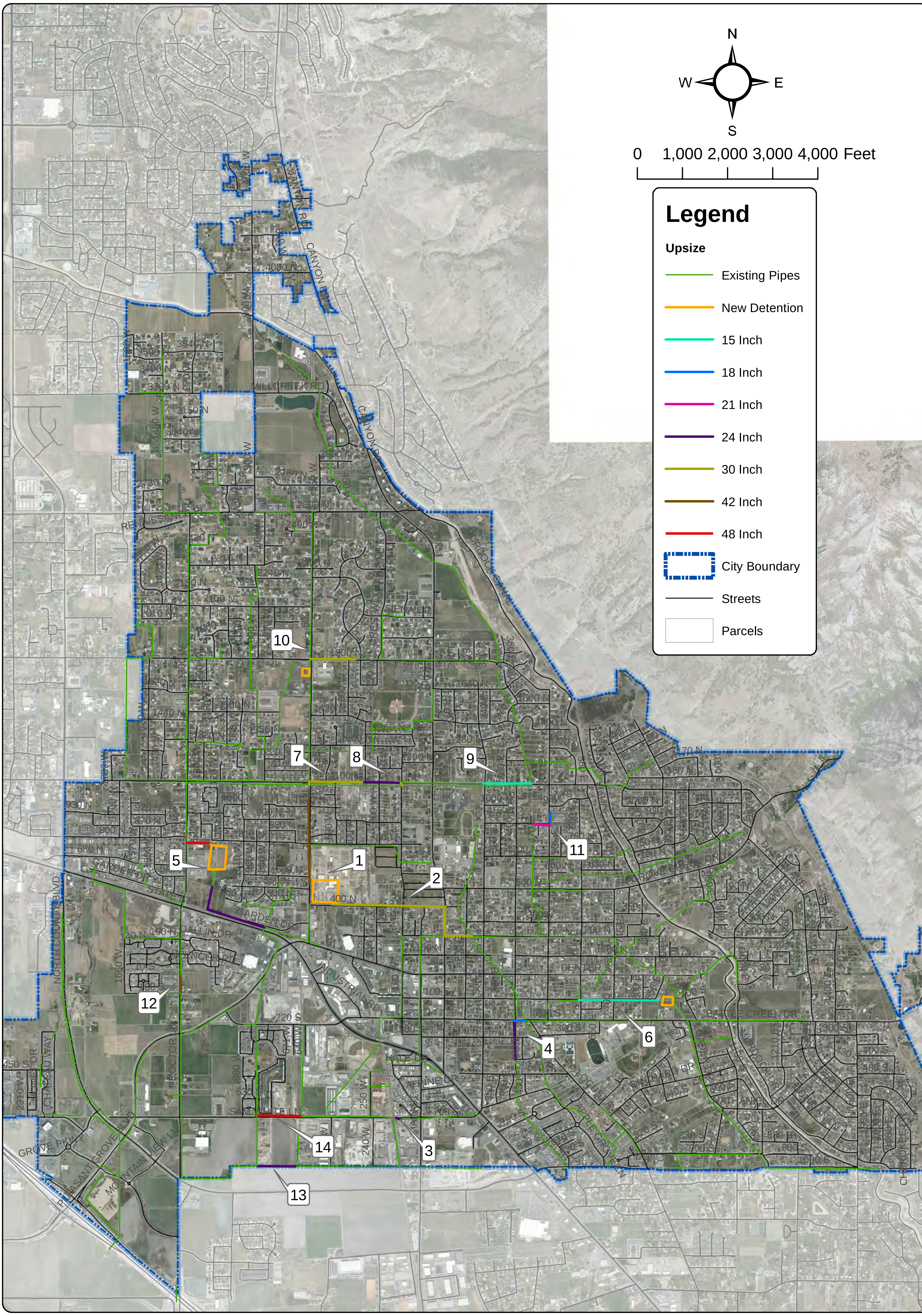

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FIGURE 7 EXISTING SYSTEM IMPROVEMENTS

PLEASANT GROVE STORM WATER MASTER PLAN

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Utah's City of Trees

O:\2011\PG-058-1101 Pleasant Grove City Gen\Phase 112 Storm Water Master Plan\Engineering Data\GIS\PG Existing Zoning.mxd, 4/30/2013 3:21:59 PM, jschiess

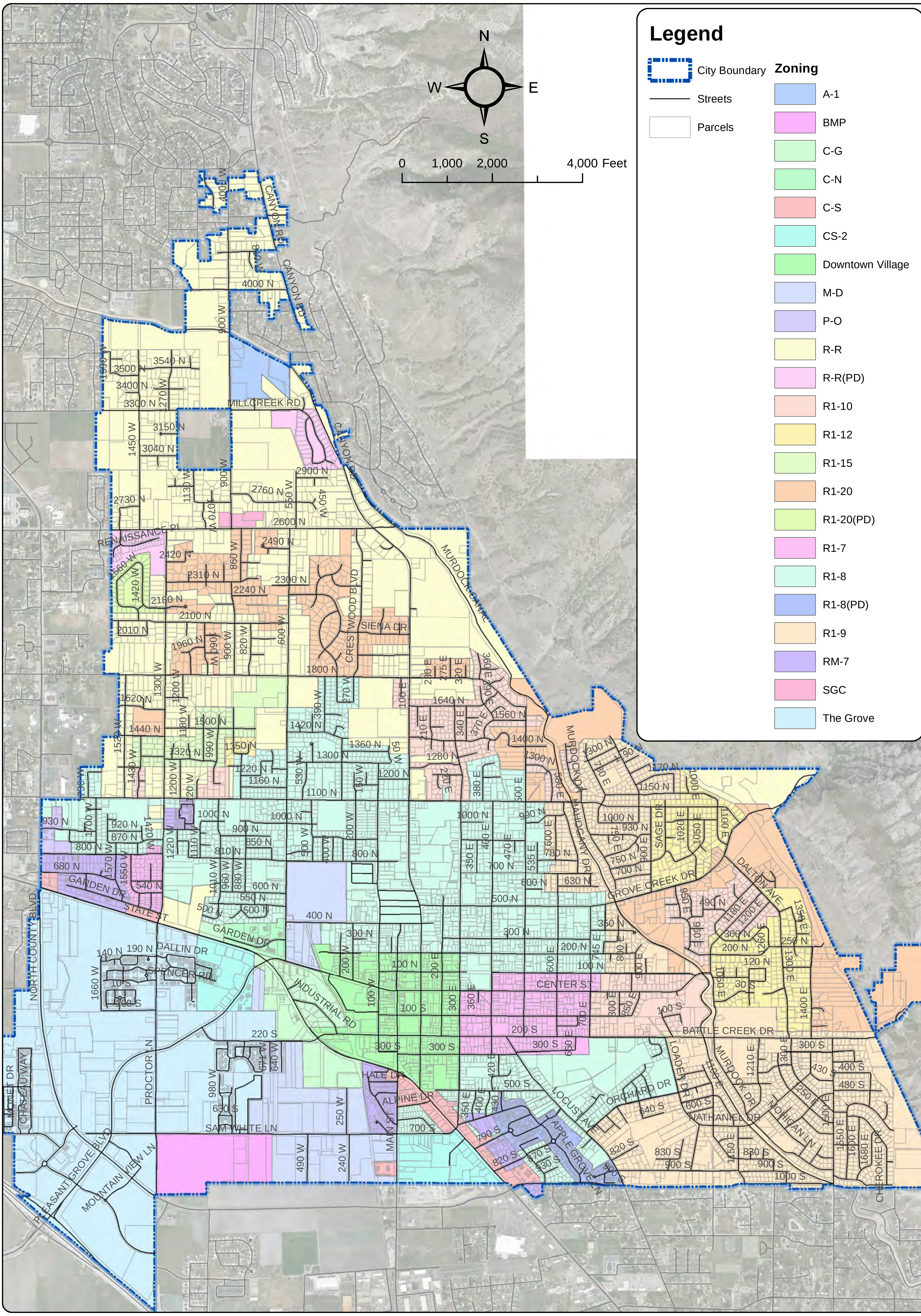

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FIGURE 8 CURRENT CITY ZONING

PLEASANT GROVE STORM WATER MASTER PLAN

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Utah's City of Trees

O:\!2011\PG-058-1101 Pleasant Grove City Gen\!Phase 112 Storm Water Master Plan\Engineering Data\GIS\PG Buildout CNs.mxd, 4/30/2013 3:26:20 PM, jschiess

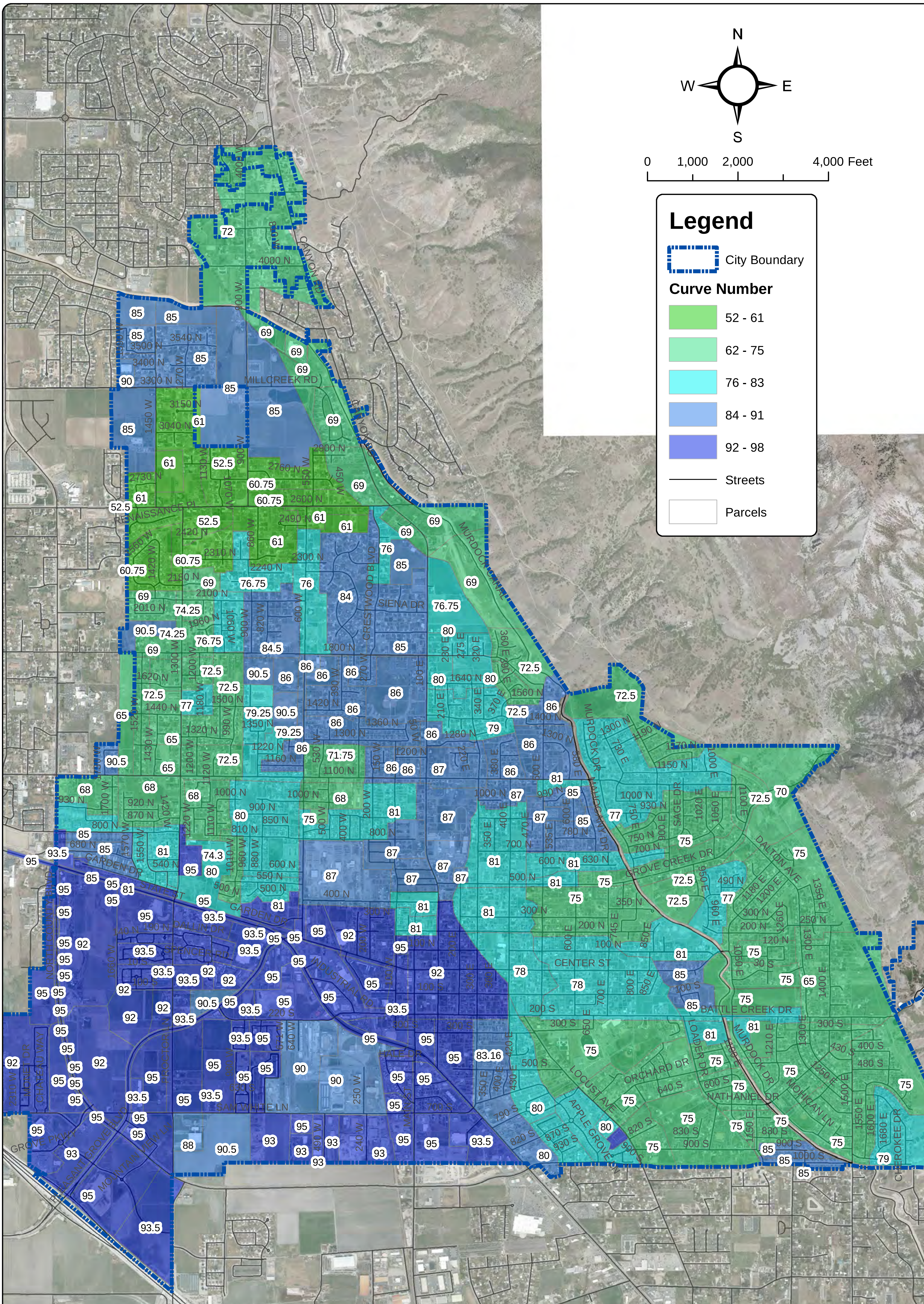

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FIGURE 9 BUILDOUT CURVE NUMBERS

PLEASANT GROVE STORM WATER MASTER PLAN

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Utah's City of Trees

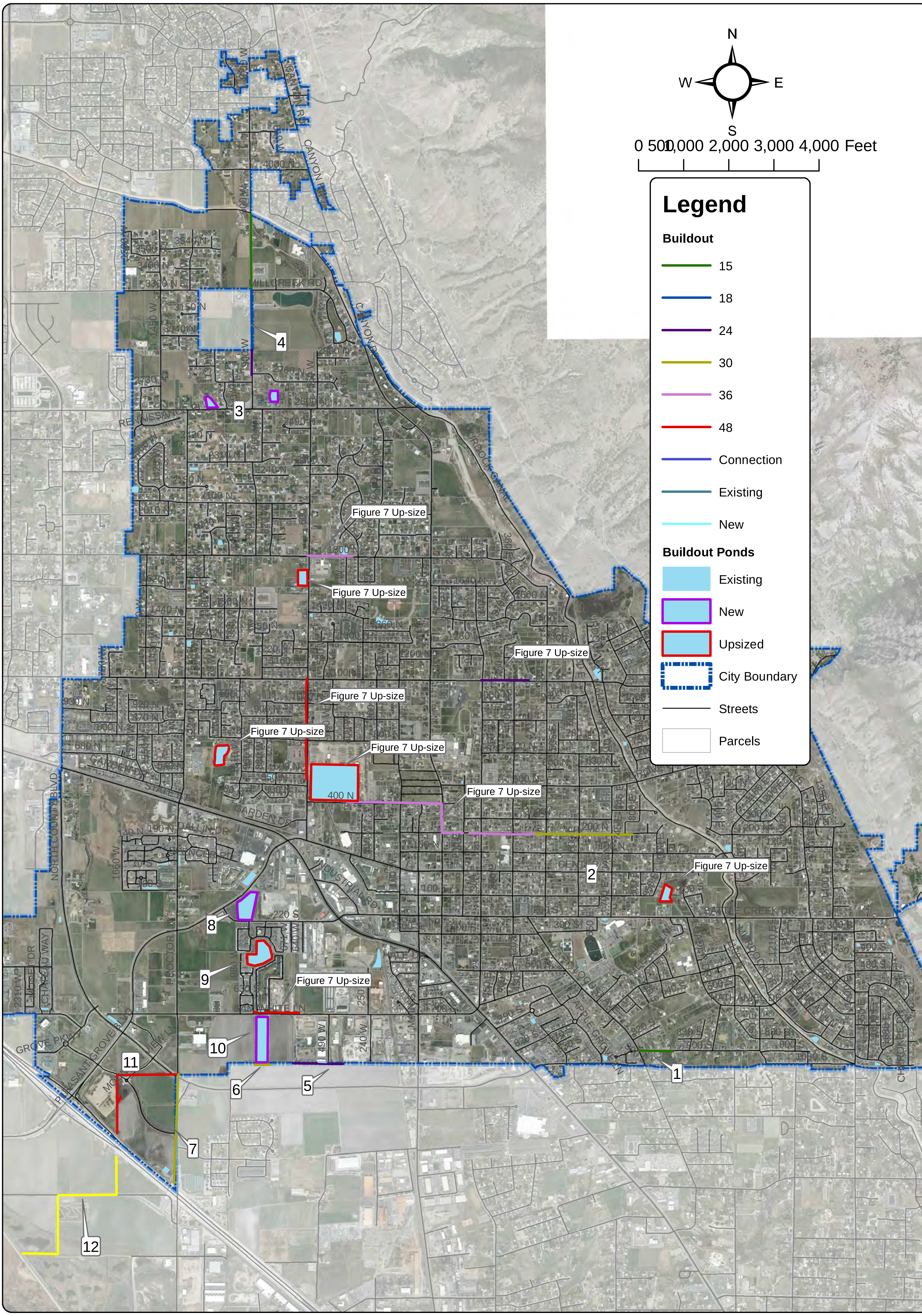

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FIGURE 10 BUILDOUT SYSTEM IMPROVEMENTS

PLEASANT GROVE STORM WATER MASTER PLAN

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Utah's City of Trees

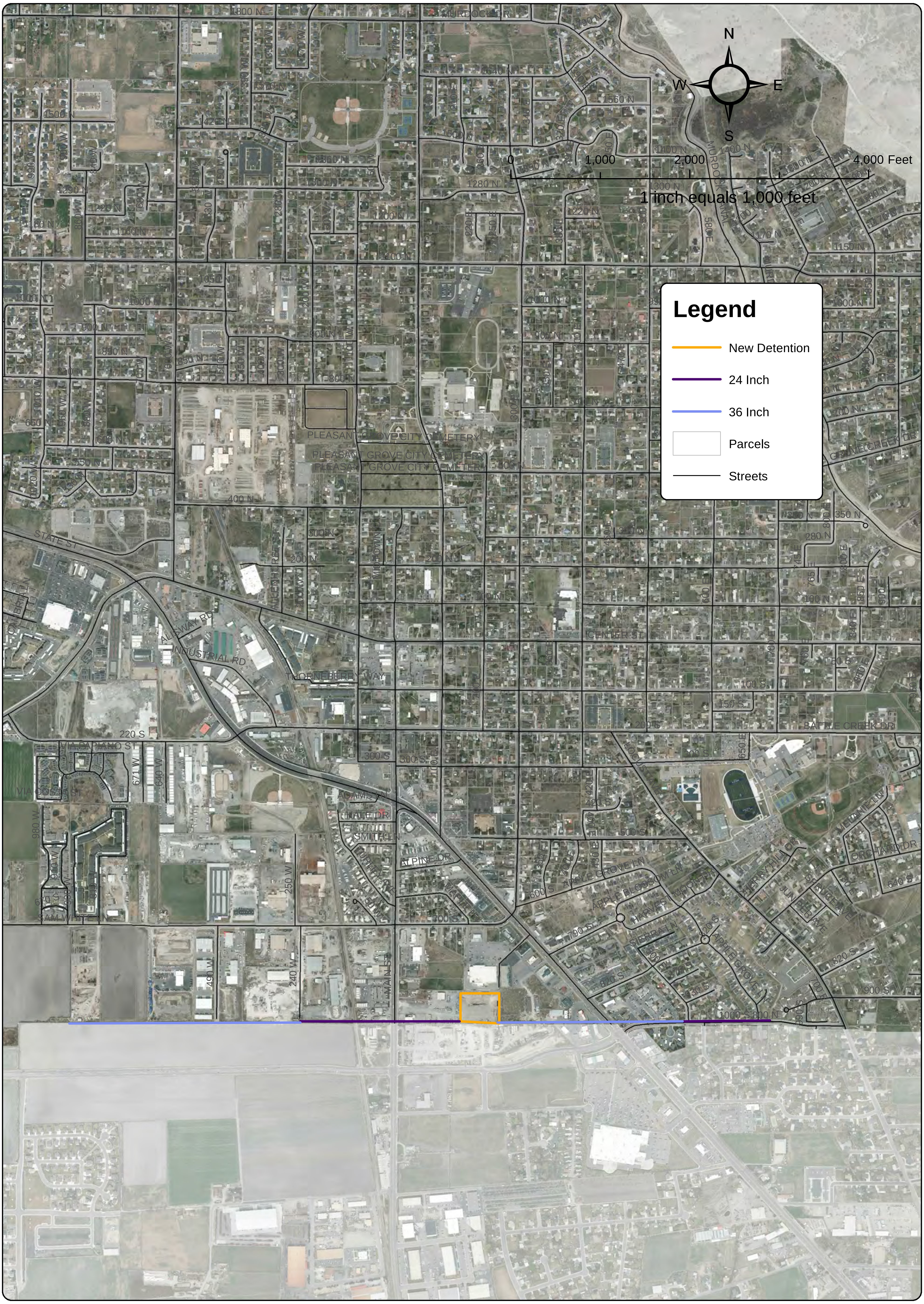

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FIGURE 11 LINDON BYPASS OPTION

PLEASANT GROVE STORM WATER MASTER PLAN

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Utah's City of Trees

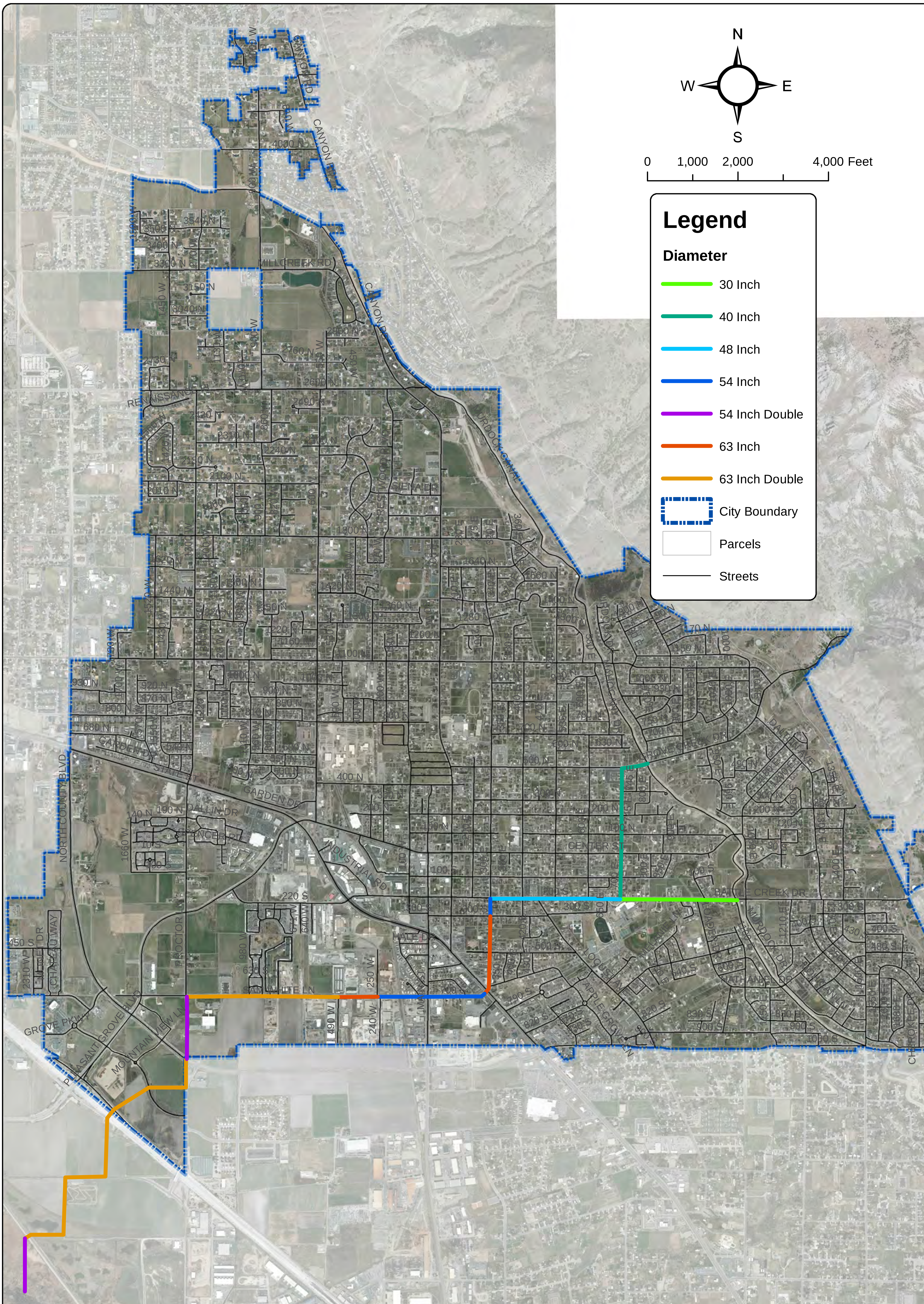

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FIGURE 12 SNOW MELT FLOOD FLOW OPTION

PLEASANT GROVE STORM WATER MASTER PLAN

Pleasant Grove
Utah's City of Trees

O:\2011\PG-058-1101 Pleasant Grove City Gen\Phase 112 Storm Water Master Plan\Engineering Data\GIS\PG 100 Year Detention Areas.mxd, 5/21/2013 2:54:48 PM, jschiess

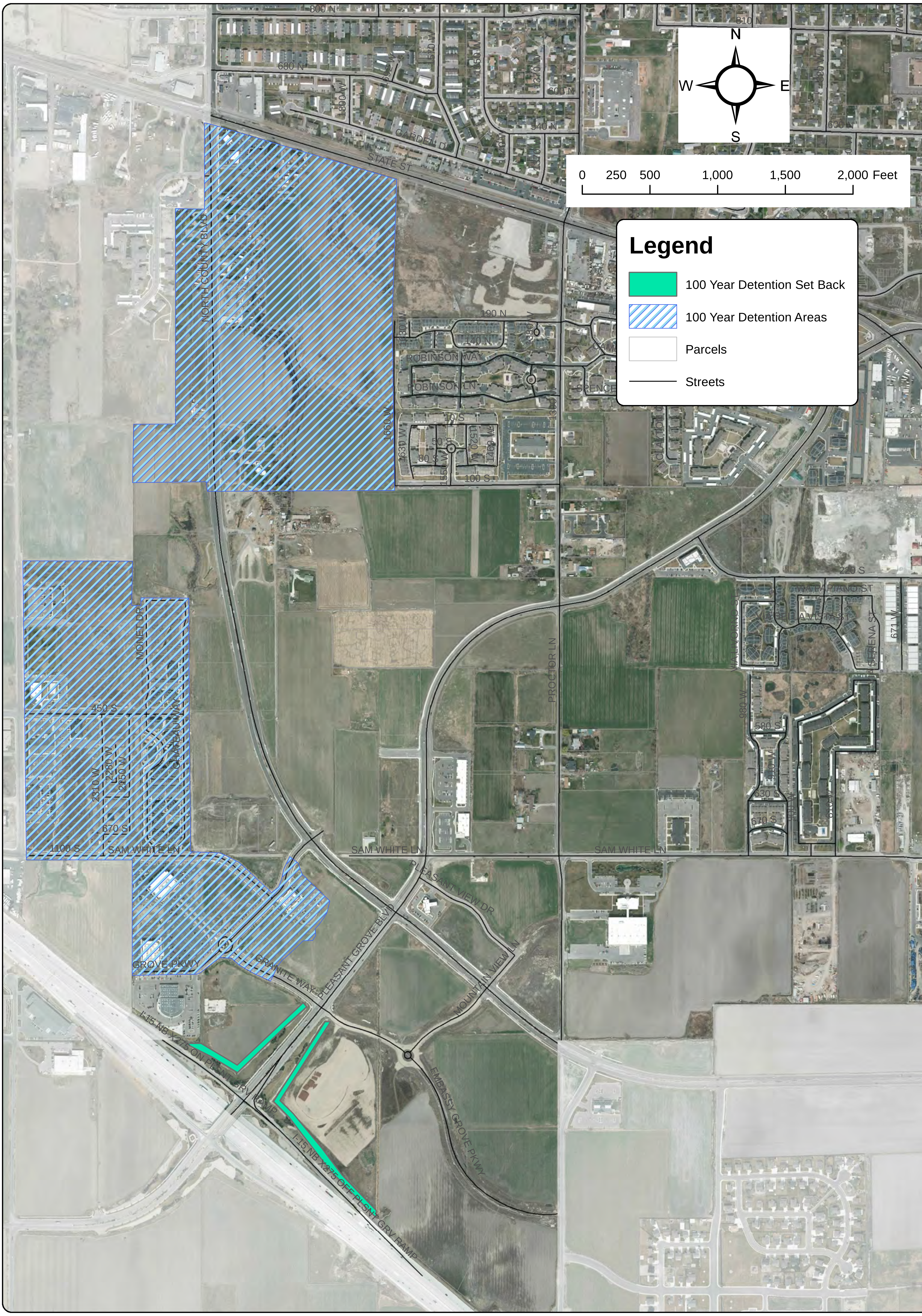

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FIGURE 13 100 YEAR DETENTION AREAS

PLEASANT GROVE STORM WATER MASTER PLAN

Pleasant Grove
Utah's City of Trees

Existing System

Scenario: 25 yr
Current Time Step: 0.000Hr
FlexTable: Catchment Table

Id	Label	Outflow Node	Area (ft^2)	Flow (Peak) (ft^3/s)	SCS CN	Time of Concentration (hours)	Volume (Total Runoff) (ft^3)
531	UMSB-4	MH-23	99,839.5	0.76	75.000	0.510	3,172.0
532	10OWSB-2	1W-SB2	119,790.0	3.69	87.000	0.117	6,405.0
533	500N-SB1	Pond 12	236,748.6	1.74	87.000	0.510	5,620.0
534	GC-SB1	GC-SB1	241,758.0	6.24	87.000	0.233	12,927.0
535	1300W-SB24	13W-SB24	244,807.2	0.44	70.000	0.567	2,525.0
536	600W-SB7	6W-SB7	255,479.4	7.08	87.000	0.250	15,008.0
537	UMSB-2	OUTFALL UM-SB8	271,291.7	1.21	75.000	0.510	5,064.0
538	NUSB-10	MH-28	323,999.3	1.20	75.000	0.667	6,048.0
539	MILL-SB2	MILL-SB2	331,753.0	9.34	87.000	0.183	17,739.0
540	MILL-SB5	MILL-SB3	342,294.5	6.69	87.000	0.233	13,864.0
542	MILL-SB3	MILL-SB3	356,495.0	10.04	87.000	0.200	19,617.0
543	N600W-SB26	N6W-SB26	395,481.2	3.08	85.000	0.483	9,790.0
544	MILL-SB14	MILL-SB14	408,592.8	0.80	70.000	0.483	4,214.0
545	1300W-SB35	13W-SB35	409,420.4	0.92	70.000	0.383	4,223.0
546	1300W-SB25	13W-SB24	413,820.0	0.74	70.000	0.567	4,268.0
547	500N-SB5	MH-126	414,952.6	1.85	75.000	0.510	7,712.0
548	NU-SB6	NU-SB6	435,730.7	4.91	80.000	0.333	13,331.0
549	N600W-SB25	Pond 7	436,209.8	8.46	85.000	0.350	21,784.0
550	1300W-SB32	13N-SB32	452,327.0	0.99	70.000	0.400	4,666.0
551	11N-SB8	11N-SB8	455,942.5	8.61	87.000	0.417	24,379.0
552	1300W-SB26	NthfldDet	466,484.0	0.83	70.000	0.583	4,812.0
553	100W-SB3	1W-SB3	467,181.0	8.35	83.000	0.250	18,213.0
554	400N-SB1	4N-SB1	473,976.4	3.01	75.000	0.300	8,848.0
555	600W-SB9	6W-SB9	494,667.4	7.30	83.000	0.400	21,056.0
556	1300W-SB27	13W-SB27	502,116.1	0.77	70.000	0.750	5,179.0
557	N600W-SB30	N6W-SB30	512,744.8	0.00	54.000	0.400	0.0
558	MILL-SB1	MILL-SB1	514,530.7	8.60	87.000	0.500	27,510.0
559	11N-SB9	11N-SB9	529,515.4	9.34	87.000	0.467	28,310.0
560	500N-SB3	MH-98	532,085.4	1.46	75.000	0.510	6,097.0
561	MILL-SB9	MILL-SB9	562,621.0	2.72	75.000	0.450	10,494.0
562	UM-SB12	MH-123	569,111.4	10.90	87.000	0.510	35,207.0
563	13W-SB15	13W-SB11	587,885.8	2.31	75.000	0.617	10,974.0
564	1300W-SB23	WoodsDet	592,677.4	0.11	61.000	1.167	1,007.0
565	NU-SB7	NU-SB7	596,510.6	2.72	75.000	0.500	11,234.0
566	UMSB-1	Pond 20	619,466.8	4.80	75.000	0.510	20,051.0
567	SOUTH-SB2	CB-12	638,241.1	12.65	93.000	0.700	49,201.0
568	600W-SB12	6W-SB12	648,869.8	1.57	75.000	1.283	12,112.0
569	WEST-SB6	532	652,441.7	0.00	54.000	0.500	0.0
570	N600W-SB20	11N-SB7	680,842.8	5.35	85.000	1.100	31,175.0
571	1300W-SB39	538	685,198.8	0.00	54.000	0.367	0.0
572	600W-SB14	6W-SB14	688,509.4	2.20	75.000	0.650	10,869.0
573	200S-SB4	MH-11	689,946.8	1.36	75.000	0.217	3,278.0
574	800N-SB2	8N-SB2	698,484.6	6.21	80.000	0.467	21,090.0
575	600W-SB8	6W-SB8	702,013.0	15.80	92.000	0.550	51,959.0
576	N600W-SB34	Pond 3	707,675.8	0.00	54.000	0.767	0.0
577	WEST-SB4	WEST-SB4	726,406.6	1.04	70.000	0.867	7,493.0
578	UM-SB13	MILL-SB7	728,758.8	12.06	87.000	0.510	38,965.0
579	WEST-SB3	WEST-SB3	737,688.6	0.63	70.000	0.883	4,545.0
580	MILL-SB8	MILL-SB8	741,129.8	16.99	87.000	0.300	39,626.0
581	1300W-SB29	13W-SB29	750,974.4	1.30	70.000	0.617	7,746.0
582	LMSB-1	MH-21	760,731.8	3.40	75.000	0.510	14,201.0
583	GC-SB2	Pond 9	770,227.9	10.68	85.000	0.510	35,269.0
584	11N-SB2	11N-SB2	782,206.9	4.25	75.000	0.483	17,159.0
585	200S-SB3	2S-SB3	811,827.7	2.84	75.000	0.500	11,748.0
586	800N-SB3	8N-SB3	818,753.8	11.33	87.000	0.667	44,364.0
587	600W-SB18	6W-SB18	822,064.3	4.47	76.000	0.467	16,955.0

588	700S-SB4	7S-SB4	845,586.7	32.57	93.000	0.367	83,825.0
589	MILL-SB18	AspenDet	861,616.8	1.38	70.000	0.717	8,872.0
590	MILL-SB12	MILL-SB12	873,378.0	1.17	74.000	0.667	6,072.0
591	800N-SB1	8N-SB1	887,055.8	10.98	80.000	0.383	32,480.0
592	DB-SB3	DB-SB3	940,591.1	2.06	70.000	0.400	9,702.0
593	SOUTH-SB3	OF-70	948,039.8	21.87	90.000	0.500	68,618.0
594	MILL-SB11	MILL-SB11	958,450.7	2.28	74.000	0.700	12,235.0
595	MILL-SB13	MILL-SB13	960,977.2	1.23	70.000	1.083	9,912.0
596	NUSB-8	NU-SB8	979,185.2	3.24	75.000	0.800	18,278.0
597	700N-SB1	7N-SB1	993,168.0	11.03	81.000	0.417	33,758.0
598	500N-SB4	5N-SB4	996,086.5	16.69	87.000	0.517	53,940.0
599	1300W-SB30	Pond 4	1,022,788.8	1.34	70.000	0.783	9,168.0
600	MILL-SB16	MILL-SB16	1,028,059.6	2.44	70.000	0.350	10,604.0
601	11N-SB4	MH-152	1,035,595.4	2.65	80.000	0.767	12,804.0
602	DB-SB1	DB-SB1	1,039,167.4	0.60	65.000	0.400	4,730.0
603	N600W-SB33	2600NDet	1,050,362.3	0.00	54.000	0.717	0.0
604	11N-SB1	MH-154	1,053,063.0	2.89	75.000	1.067	19,657.0
605	600W-SB4	6W-SB5	1,104,855.8	9.51	87.000	0.459	28,701.0
606	SOUTH-SB4	OF-70	1,127,768.4	25.66	92.000	0.583	87,297.0
607	11N-SB7	11N-SB7	1,147,980.2	19.81	87.000	0.483	61,379.0
608	11N-SB3	11N-SB3	1,167,320.9	17.61	88.000	0.404	48,495.0
609	1300W-SB37	Pond 28	1,167,451.6	1.59	70.000	0.967	12,042.0
610	10OWSB-1	1W-SB1	1,177,165.4	35.21	92.000	0.300	81,315.0
611	1300W-SB36	13W-SB36	1,193,544.0	4.47	76.000	0.750	23,529.0
612	DB-SB2	DB-SB1	1,234,403.3	0.69	65.000	0.483	5,668.0
613	700S-SB5	7S-SB5	1,252,654.9	9.34	87.000	1.567	69,446.0
614	N600W-SB24	Pond 7	1,258,143.5	9.89	85.000	0.867	47,773.0
615	13W-SB13	Pond 10	1,261,759.0	3.78	75.000	0.933	23,611.0
616	NUSB-11	9S-1	1,288,069.2	3.19	75.000	0.379	10,943.0
617	WEST-SB5	Pond 2	1,311,896.5	2.35	70.000	0.567	13,532.0
618	500N-SB7	MH-98	1,321,174.8	18.30	85.000	0.510	60,432.0
619	600W-SB11	6W-SB9	1,365,823.8	14.75	83.000	0.700	63,004.0
620	WEST-SB1	WEST-SB1	1,380,285.7	0.24	61.000	1.383	2,344.0
621	MILL-SB19	MH-3	435,600.0	6.11	78.000	0.119	10,957.0
622	PARK-SB3	PARK-SB3	1,417,050.4	4.61	82.000	1.033	26,451.0
623	600W-SB5	Pond48	1,431,468.7	23.47	95.000	0.452	68,322.0
624	1300W-SB38	13W-SB38	1,436,783.0	0.29	61.000	0.533	2,604.0
625	N600W-SB22	N6W-SB20	1,441,487.5	16.81	87.000	0.850	78,599.0
626	800N-SB4	8N-SB3	1,447,629.5	26.00	87.000	0.450	77,399.0
627	WEST-SB2	OF-49	1,473,983.3	0.00	50.000	1.633	0.0
628	LMSB-2	MH-18	1,476,509.8	6.60	75.000	0.510	27,562.0
629	MILL-SB7	MILL-SB7	1,491,494.4	29.27	87.000	0.417	82,921.0
630	CNTR-SB2	CNTR-SB2	1,506,740.4	3.85	75.000	0.483	15,536.0
631	700S-SB3	7S-SB3b	1,524,600.0	27.24	93.000	0.188	52,933.0
632	13W-SB9	OF-37	1,545,770.2	0.24	61.000	0.748	2,163.0
633	1300W-SB22	Pond 6	1,615,640.4	5.96	77.000	1.200	42,144.0
634	N600W-SB28	N6W-SB28	1,617,992.6	5.17	75.000	0.833	30,055.0
635	13W-SB14	13W-SB13	1,629,274.7	0.88	66.000	1.317	9,035.0
636	NU-SB2	MH-109	1,673,052.5	12.02	80.000	0.633	50,516.0
637	2000W-SB2	Pond42	1,690,520.0	28.92	92.000	0.540	93,165.0
638	PARK-SB2	PARK-SB2	1,743,358.3	24.85	87.000	0.633	93,241.0
639	11N-SB10	MH-169	1,801,990.1	16.10	87.000	0.783	71,012.0
640	N600W-SB32	N6W-SB32	1,837,752.8	0.07	58.000	0.767	404.0
641	18N-SB5	OF-46	1,842,108.8	8.67	80.000	0.800	43,346.0
642	PARK-SB1	Pond 30	1,861,667.3	12.09	80.000	0.700	55,006.0
643	11N-SB5	11N-SB5	1,894,032.4	13.11	84.000	1.133	78,430.0
644	200S-SB1	946	1,933,497.7	8.64	75.000	0.510	36,092.0
645	UM-SB11	MH-125	1,953,143.3	10.23	75.000	0.510	42,719.0
646	13W-SB5	OF-57	2,123,593.6	8.09	80.000	0.529	29,986.0
647	600W-SB17	6W-SB17	2,181,310.6	23.27	87.000	0.869	109,945.0
648	RET-SB2	Ret2 Det	2,181,615.5	8.10	75.000	0.667	40,724.0
649	UMSB-6	MH-26	2,333,117.2	11.95	75.000	0.460	46,802.0
650	MRDK-SB2	MRDK-SB2	2,445,022.8	0.79	66.000	0.550	6,172.0
651	700N-SB3	MhillsDet	2,465,365.3	7.07	73.000	0.633	36,936.0
652	NU-SB4	NU-SB4	2,531,968.6	3.39	75.000	0.275	9,494.0
653	600W-SB1	OF-55	2,609,853.8	5.14	80.000	1.399	38,298.0
654	700S-SB2	OF-66	2,652,978.2	32.62	88.000	0.717	132,430.0
655	13W-SB3	OF-59	2,675,237.4	5.39	80.000	0.945	30,097.0

	700S-SB6	7S-SB6	2,724,155.3	6.75	75.000		1.250	50,852.0
657	RET-SB1	Ret1 Det	2,855,750.0	11.01	75.000		0.633	53,308.0
658	600W-SB15	Pond 11	2,860,454.5	13.99	76.000		0.576	61,408.0
659	600W-SB16	OF-25	2,915,514.4	53.99	89.000		0.454	158,209.0
660	NU-SB3	NU-SB3	2,936,728.1	9.10	75.000		0.800	51,422.0
661	2000W-SB1	N246	2,970,966.2	11.60	80.000		1.158	75,061.0
662	1300W-SB40	2600NDet	3,020,058.4	0.42	61.000		0.510	3,723.0
663	18N-SB2	Pond 5	3,087,707.0	29.27	85.000		0.767	129,862.0
664	N600W-SB38	513	3,197,478.2	13.75	82.000		0.835	67,723.0
665	1300W-SB41	527	3,326,459.4	0.08	61.000		2.000	825.0
666	18N-SB3	MH-148	3,331,599.5	5.05	80.000		0.515	18,331.0
667	600W-SB3	OF-68	3,509,934.1	21.29	91.000		0.850	95,629.0
668	UMSB-3	MH-29	3,540,077.6	1.19	65.000		0.352	9,129.0
669	UMSB-8	UM-SB8	3,651,199.2	12.13	75.000		0.811	69,064.0
670	SOUTH-SB1	OF-69	3,661,740.7	18.68	90.000		0.841	84,169.0
671	700S-SB1	OF-66	3,704,690.9	30.37	89.000		0.895	143,566.0
673	13W-SB2	OF-34	3,847,698.4	11.50	80.000		0.684	51,030.0
674	13W-SB10	13W-SB10	3,894,961.0	7.63	85.000		1.617	59,128.0
675	NU-SB1	NU-SB1	3,951,501.8	12.57	75.000		0.850	73,763.0
676	2000W-SB4	CS-2	4,197,572.3	6.16	80.000		0.895	33,436.0
677	13W-SB6	Pond 25	4,456,318.7	14.45	92.000		0.483	43,421.0
678	N600W-SB36	OF-38	4,482,585.4	11.86	78.000		1.140	78,922.0
679	200S-SB2	2S-SB2	4,571,883.4	2.30	65.000		0.733	20,771.0
680	200S-SB5	2S-SB5	4,856,548.0	1.85	65.000		0.633	16,150.0
681	MRDK-SB1	Pond 8	5,017,153.7	16.13	75.000		0.657	79,885.0
682	2000W-SB3	MH-31	5,249,720.5	17.54	80.000		1.067	108,043.0
683	NU-SB16	MH-131	5,535,343.4	9.69	75.000		0.659	48,111.0
684	CNTR-SB1	CenterDet	6,578,692.6	15.26	75.000		0.700	78,866.0
698	600 W 1800 N 01	Pond 7	0.0	3.09	80.000		0.500	11,031.0
699	Pleasant Grove Blvd	20W-SB1	0.0	8.67	87.000		0.500	27,720.0
1008	A 3-7	CB 4-7	14,592.6	0.98	98.000		0.083	1,736.0
1009	A 7-3	CB 8-3	7,884.4	0.82	98.000		0.083	1,461.0
1010	A 2-3	CB 3-3	15,202.4	1.05	98.000		0.083	1,867.0
1011	A 6-5	CB 7-5	6,229.1	0.42	98.000		0.083	744.0
1012	A 7-1	CB 8-1	4,660.9	0.31	98.000		0.083	552.0
1013	A 5-6	CB 6-6	12,806.6	0.86	98.000		0.083	1,526.0
1014	A 6-3	CB 7-3	15,333.1	1.03	98.000		0.083	1,825.0
1015	A 6-1	CB 7-1	3,441.2	0.23	98.000		0.083	407.0
1016	A 4-1	CB 5-1	8,886.2	0.60	98.000		0.083	1,058.0
1017	A 5-1	CB 6-1	8,232.8	0.55	98.000		0.083	981.0
1018	A 3-5	CB 4-5	8,102.2	0.54	98.000		0.083	962.0
1019	A 1-4	CB 2-4	8,145.7	0.55	98.000		0.083	969.0
1020	A 4-5	CB 5-5	3,659.0	0.25	98.000		0.083	438.0
1021	A 3-1	CB 4-1	6,229.1	0.44	98.000		0.083	786.0
1022	A 1-5	CB 2-5	10,062.4	0.68	98.000		0.083	1,198.0
1023	A 1-8	CB 2-8	5,314.3	0.36	98.000		0.083	631.0
1024	A 3-3	CB 4-3	13,721.4	0.92	98.000		0.083	1,632.0
1025	A 3-8	CB 4-8	15,594.5	1.05	98.000		0.083	1,858.0
1026	A 1-7	CB 2-7	4,704.5	0.32	98.000		0.083	560.0
1027	A 6-7	CB 7-7	11,107.8	0.75	98.000		0.083	1,322.0
1028	A 2-2	CB 3-2	5,837.0	0.41	98.000		0.083	721.0
1029	A 1-10	CB 2-10	15,899.4	1.07	98.000		0.083	1,894.0
1030	A 2-1	CB 3-1	6,926.0	0.48	98.000		0.083	847.0
1031	A 4-3	CB 5-3	11,456.3	0.77	98.000		0.083	1,365.0
1032	A 2-4	CB 3-4	14,505.5	1.07	98.000		0.083	1,904.0
1033	A 1-3	CB 2-3	8,407.1	0.57	98.000		0.083	1,002.0
1034	A 3-2	CB 4-2	6,142.0	0.45	98.000		0.083	801.0
1035	A 3-4	CB 4-4	13,721.4	0.92	98.000		0.083	1,632.0
1036	A 1-6	CB 2-6	9,757.4	0.66	98.000		0.083	1,162.0
1037	A 7-4	CB 8-4	10,715.8	0.99	98.000		0.083	1,758.0
1038	A 6-2	CB 7-2	4,051.1	0.27	98.000		0.083	483.0
1039	A 1-1	CB 2-1	5,880.6	0.39	98.000		0.083	697.0
1040	A 3-6	CB 4-6	8,799.1	0.59	98.000		0.083	1,046.0
1041	A 1-2	CB 2-2	5,575.7	0.37	98.000		0.083	664.0
1042	A 5-3	CB 6-3	12,109.7	0.81	98.000		0.083	1,443.0
1043	A 4-6	CB 5-6	4,530.2	0.30	98.000		0.083	537.0
1044	A 6-4	CB 7-4	16,552.8	1.11	98.000		0.083	1,972.0
1045	A 5-4	CB 6-4	6,229.1	0.42	98.000		0.083	739.0

	A 1-9	CB 2-9	14,810.4	0.99	98.000	0.083	1,762.0
1047	A 6-6	CB 7-6	5,227.2	0.35	98.000	0.083	624.0
1048	A 6-8	CB 7-8	10,454.4	0.72	98.000	0.083	1,281.0
1049	A 5-2	CB 6-2	23,566.0	1.58	98.000	0.083	2,804.0
1050	A 4-2	CB 5-2	7,405.2	0.50	98.000	0.083	882.0
1051	A 5-5	CB 6-5	4,312.4	0.29	98.000	0.083	512.0
1052	A 5-7	CB 6-7	10,585.1	0.71	98.000	0.083	1,262.0
1053	A 4-4	CB 5-4	11,064.2	0.74	98.000	0.083	1,316.0
1054	A 7-2	CB 8-2	5,445.0	0.41	98.000	0.083	726.0
1080	CM-78	CS-17	0.0	5.38	80.000	0.791	26,542.0
1171	CM-79	MH 8-1	0.0	5.35	98.000	0.330	13,796.0
1216	CM-80	Pond 26	0.0	14.62	92.000	0.705	56,913.0
1219	CM-81	OF-58	0.0	12.66	80.000	1.067	77,986.0
1225	CM-82	Freeway	0.0	8.36	80.000	1.340	60,144.0
1542	CM-83	657	0.0	9.66	85.000	0.200	19,004.0
1543	CM-84	658	0.0	9.22	85.000	0.150	16,690.0
1544	CM-85	664	0.0	10.93	85.000	0.100	18,609.0
1545	CM-86	655	0.0	12.26	85.000	0.125	21,541.0
1546	CM-87	663	0.0	9.63	85.000	0.125	16,916.0
1550	CM-88	MH 1-2	0.0	9.70	98.000	0.083	17,190.0
1610	CM-89	510	0.0	6.70	87.000	0.500	21,429.0
1611	CM-90	507	0.0	7.38	83.500	0.400	21,111.0
1640	CM-91	MH-60	0.0	8.27	98.000	0.600	29,948.0
1644	CM-92	6W-SB8	0.0	10.20	98.000	0.327	26,115.0
1649	CM-93	MH-92	0.0	8.43	98.000	0.180	17,547.0
1651	CM-94	6W-SB4	0.0	4.59	98.000	0.114	8,605.0
1652	CM-95	MH-60	0.0	5.42	98.000	0.297	13,343.0
1734	CM-97	CB-7	0.0	8.99	92.000	0.370	23,032.0
1760	CM-98	MH-92	0.0	44.19	93.000	0.500	136,505.0
1780	CM-99	OF-61	0.0	8.15	80.000	0.571	31,966.0
1781	CM-100	MH-85	0.0	10.50	92.000	0.159	19,448.0
1782	CM-101	Pond 21	0.0	14.90	92.000	0.342	36,509.0
1783	CM-102	OF-60	0.0	10.36	89.000	0.633	38,032.0
1784	CM-103	Pond 24	0.0	18.90	92.000	0.384	49,496.0
1785	CM-104	OF-64	0.0	3.40	80.000	0.464	11,522.0
1786	CM-105	Pond48	0.0	7.72	92.000	0.358	19,382.0
1787	CM-106	Pond48	0.0	3.97	92.000	1.800	31,514.0
1789	CM-107	OF-57	0.0	12.59	89.000	0.200	24,557.0
1790	CM-108	MH-75	0.0	3.12	84.000	0.675	12,826.0
1792	CM-109	MH-90	0.0	5.52	92.000	0.219	11,126.0
1793	CM-110	13W-SB7	0.0	6.92	92.000	0.540	22,281.0
1795	CM-111	MH-79	0.0	6.35	92.000	0.358	15,933.0
1796	CM-112	OF-56	0.0	6.71	80.000	1.198	44,527.0
1798	CM-113	MH-75	0.0	7.39	87.000	0.500	23,637.0
1804	CM-114	N246	0.0	8.14	80.000	0.572	31,948.0
1806	CM-115	CNTR-SB1	0.0	2.81	75.000	0.700	14,535.0
1811	CM-116	MH-159	0.0	14.03	89.000	0.348	34,943.0
1843	CM-117	OF-63	0.0	7.30	89.000	0.497	22,710.0
1844	CM-118	Pond47	0.0	2.72	92.000	1.750	21,186.0
1845	CM-119	Pond46	0.0	18.32	92.000	0.211	36,580.0
1846	CM-120	MH-84	0.0	6.71	92.000	0.206	13,291.0
1851	CM-121	Pond47	0.0	6.44	92.000	1.200	37,556.0
1852	CM-122	Pond45	0.0	8.67	92.000	1.200	50,596.0
1870	CM-123	Pond 1	0.0	5.50	93.000	0.717	21,647.0
1882	CM-124	MH-11	0.0	7.48	89.000	0.083	12,081.0
1883	CM-125	OUTFALL UM-SB8	0.0	4.46	88.000	0.083	7,214.0
1885	CM-126	MH-24	0.0	5.71	75.000	0.183	12,719.0
1899	CM-127	Pond44	0.0	10.90	93.000	0.461	31,866.0
1900	CM-128	Pond43	0.0	7.60	93.000	0.461	22,208.0
1901	CM-129	MH-102	0.0	12.44	93.000	0.307	28,982.0
1902	CM-130	SOUTH-SB1	0.0	5.65	80.000	0.866	29,784.0
1906	CM-131	MH-105	0.0	8.82	93.000	0.222	17,956.0
1913	CM-132	7S-SB3	0.0	16.05	92.000	0.469	47,712.0
1914	CM-133	MH-106	0.0	9.05	92.000	0.104	15,320.0
1931	CM-134	13W-SB10	0.0	16.18	93.000	0.245	34,159.0
1963	CM-135	6W-SB9	0.0	18.69	92.000	0.500	57,898.0
1969	CM-136	MH-153	0.0	5.33	92.000	0.164	9,958.0
1971	CM-137	Pond 27	0.0	7.51	90.000	0.247	15,779.0

	CM-138	MH-120	0.0	8.05	90.000	0.296	18,552.0
1974	CM-139	MILL-SB19	0.0	6.96	80.000	0.104	12,062.0
1979	CM-140	N6W-SB22	0.0	13.53	87.000	0.175	25,288.0
1995	CM-141	MH-130	0.0	3.02	75.000	0.355	9,906.0
1996	CM-142	MH-130	0.0	6.61	75.000	0.517	27,851.0
2013	CM-143	BlckhwkDet	0.0	9.75	75.000	0.269	26,979.0
2023	CM-145	OF-38	0.0	13.28	75.000	0.640	64,563.0
2121	CM-146	MH-46	0.0	6.60	80.000	0.837	33,832.0
2137	CM-147	OF-62	0.0	5.50	80.000	0.219	11,832.0
2155	CM-148	CB-9	0.0	24.54	85.000	0.698	101,445.0
2170	CM-149	OF-41	0.0	7.26	80.000	0.250	16,571.0
2172	CM-150	OF-42	0.0	8.10	80.000	0.250	18,489.0
2175	CM-151	OF-43	0.0	9.66	78.000	1.140	64,268.0
2178	CM-152	OF-44	0.0	0.20	61.000	2.000	2,099.0
2180	CM-153	OF-45	0.0	0.10	61.000	2.000	1,026.0
2184	CM-154	619	0.0	6.82	80.000	0.400	20,885.0
2186	CM-155	OF-47	0.0	0.11	61.000	0.510	968.0
2188	CM-156	OF-48	0.0	0.08	61.000	0.510	757.0
2191	CM-157	WEST-SB2	0.0	0.06	61.000	1.633	624.0
2196	CM-158	OF-50	0.0	0.42	70.000	1.633	4,245.0
2198	CM-159	OF-51	0.0	0.00	54.000	0.400	0.0
2200	CM-160	OF-52	0.0	0.76	70.000	0.500	4,056.0
2202	CM-161	OF-53	0.0	0.11	58.000	0.347	567.0
2204	CM-162	OF-54	0.0	0.02	58.000	1.633	158.0
2244	CM-163	OF-64	0.0	3.93	84.000	0.657	15,780.0
2249	CM-164	Sump 1	0.0	1.21	75.000	0.356	3,966.0
2250	CM-165	Sump 2	0.0	1.41	75.000	0.356	4,632.0
2251	CM-166	NU-SB11	0.0	1.34	75.000	0.379	4,609.0

O:\!2011\PG-058-1101 Pleasant Grove City Gen\!Phase 112 Storm Water Master Plan\Engineering Data\Design\Hydraulics\PG SD Model v3.7.swg

Scenario: 25 yr ave
Current Time Step: 0.000Hr
FlexTable: Catchment Table

Buildout System

Id	Label	Outflow Node	Area (acres)	Flow (Peak) (ft³/s)	SCS CN	Time of Concentration (hours)	Volume (Total Runoff) (ac-ft)
531	UMSB-4	MH-23	2.292	1.30	80.000	0.510	0.1
532	10OWSB-2	1W-SB2	2.750	6.24	95.000	0.117	0.3
533	500N-SB1	Pond12	5.435	1.61	87.000	0.510	0.1
534	GC-SB1	GC-SB1	5.550	2.71	79.250	0.233	0.1
535	1300W-SB24	13W-SB24	5.620	0.60	72.500	0.567	0.1
536	600W-SB7	Prop Pond 30	5.865	11.94	95.000	0.250	0.6
537	UMSB-2	OUTFALL UM-SB8	6.228	2.07	80.000	0.510	0.2
538	NUSB-10	NU-SB10	7.438	1.08	75.000	0.667	0.1
539	MILL-SB2	MILL-SB2	7.616	7.36	85.000	0.178	0.3
540	MILL-SB5	MILL-SB3	7.858	2.92	81.000	0.337	0.2
542	MILL-SB3	MILL-SB3	8.184	7.34	85.000	0.243	0.4
543	N600W-SB26	Prop Pond 26	9.079	3.16	86.000	0.483	0.2
544	MILL-SB14	MILL-SB14	9.380	0.53	69.000	0.483	0.1
545	1300W-SB35	13W-SB35	9.399	0.60	69.000	0.383	0.1
546	1300W-SB25	13W-SB24	9.500	2.04	77.000	0.567	0.2
547	500N-SB5	MH-126	9.526	1.65	75.000	0.510	0.2
548	NU-SB6	NU-SB6	10.003	5.00	81.000	0.333	0.3
549	N600W-SB25	Pond7	10.014	8.48	86.000	0.350	0.5
550	1300W-SB32	13N-SB32	10.384	1.87	74.250	0.400	0.2
551	11N-SB8	11N-SB8	10.467	7.36	86.000	0.417	0.5
552	1300W-SB26	NthfldDet	10.709	1.14	72.500	0.583	0.1
553	100W-SB3	1W-SB3	10.725	6.25	81.000	0.250	0.3
554	400N-SB1	4N-SB1	10.881	5.79	81.000	0.300	0.3
555	600W-SB9	Prop Pond 54	11.356	20.43	95.000	0.317	1.1
556	1300W-SB27	13W-SB27	11.527	1.05	72.500	0.750	0.1
557	N600W-SB30	N6W-SB30	11.771	0.08	60.750	0.317	0.0
558	MILL-SB1	MILL-SB1	11.812	7.32	86.000	0.500	0.6
559	11N-SB9	11N-SB9	12.156	8.04	86.000	0.467	0.6
560	500N-SB3	MH-98	12.215	2.79	81.000	0.510	0.2
561	MILL-SB9	MILL-SB9	12.916	1.59	72.500	0.450	0.2
562	UM-SB12	MH-123	13.065	9.25	86.000	0.510	0.7
563	13W-SB15	MH-445	13.496	0.37	68.000	1.735	0.1
564	1300W-SB23	WoodsDet	13.606	0.22	65.000	1.167	0.1
565	NU-SB7	NU-SB7	13.694	2.43	75.000	0.500	0.2
566	UMSB-1	Pond20	14.221	8.19	80.000	0.510	0.7
567	SOUTH-SB2	Pond 59 - 10yr	14.652	14.49	95.000	0.667	1.3
568	600W-SB12	6W-SB12	14.896	2.88	81.000	1.283	0.5
569	WEST-SB6	532	14.978	0.00	52.500	0.500	0.0
570	N600W-SB20	11N-SB2	15.630	2.80	77.500	0.800	0.3
571	1300W-SB39	538	15.730	0.00	52.500	0.367	0.0
572	600W-SB14	6W-SB14	15.806	1.77	74.300	0.650	0.2
573	200S-SB4	MH-11	15.839	1.18	75.000	0.217	0.1
574	800N-SB2	8N-SB2	16.035	5.69	80.000	0.467	0.4
575	600W-SB8	Prop Pond 30	16.116	16.92	93.500	0.550	1.3
576	N600W-SB34	Pond24	16.246	0.17	60.750	0.767	0.0
577	WEST-SB4	WEST-SB4	16.676	0.73	69.000	0.867	0.1
578	UM-SB13	MILL-SB7	16.730	9.34	85.000	0.510	0.7
579	WEST-SB3	WEST-SB3	16.935	0.44	69.000	0.883	0.1
580	MILL-SB8	MILL-SB8	17.014	13.46	85.000	0.300	0.7
581	1300W-SB29	13W-SB29	17.240	2.34	74.250	0.617	0.3
582	LMSB-1	MH-21	17.464	5.80	80.000	0.510	0.5
583	GC-SB2	Pond9	17.682	2.03	72.500	0.510	0.2
584	11N-SB2	11N-SB2	17.957	6.73	79.250	0.483	0.6
585	200S-SB3	2S-SB3	18.637	5.44	81.000	0.500	0.4
586	800N-SB3	8N-SB3	18.796	10.64	87.000	0.667	1.0

587	600W-SB18	6W-SB18	18.872	0.85	68.000	0.467	0.1
588	700S-SB4	Pond63	19.412	35.64	95.000	0.367	2.1
589	MILL-SB18	AspenDet	19.780	0.95	69.000	0.717	0.2
590	MILL-SB12	MILL-SB12	20.050	0.41	69.000	0.667	0.1
591	800N-SB1	8N-SB1	20.364	14.48	83.500	0.383	0.9
592	DB-SB3	DB-SB3	21.593	1.73	70.000	0.400	0.2
593	SOUTH-SB3	Pond62	21.764	32.49	95.000	0.450	2.2
594	MILL-SB11	MILL-SB11	22.003	1.58	72.500	0.700	0.2
595	MILL-SB13	MILL-SB13	22.061	0.89	69.000	1.083	0.2
596	NUSB-8	NU-SB8	22.479	2.88	75.000	0.800	0.4
597	700N-SB1	7N-SB1	22.800	15.04	85.000	0.417	1.0
598	500N-SB4	5N-SB4	22.867	8.56	81.000	0.517	0.7
599	1300W-SB30	Pond4	23.480	3.38	76.750	0.783	0.4
600	MILL-SB16	MILL-SB16	23.601	1.59	69.000	0.350	0.2
601	11N-SB4	11N-SB4	23.774	4.48	86.000	0.767	0.5
602	DB-SB1	DB-SB1	23.856	3.14	72.500	0.400	0.3
603	N600W-SB33	Prop Pond 25	24.113	0.00	52.500	0.717	0.0
604	11N-SB1	11N-SB1	24.175	1.79	72.500	1.067	0.3
605	600W-SB4	OF-40	25.364	16.82	95.000	0.459	1.1
606	SOUTH-SB4	Pond62	25.890	27.37	93.500	0.583	2.1
607	11N-SB7	11N-SB7	26.354	2.72	71.750	0.483	0.3
608	11N-SB3	11N-SB3	26.798	5.25	79.250	0.600	0.5
609	1300W-SB37	13W-SB37	26.801	0.16	60.750	0.967	0.0
610	10OWSB-1	Pond79	27.024	35.66	93.000	0.300	1.9
611	1300W-SB36	13W-SB36	27.400	4.45	76.750	0.750	0.5
612	DB-SB2	DB-SB1	28.338	6.79	77.000	0.483	0.6
613	700S-SB5	7S-SB5	28.757	18.42	92.000	1.035	2.2
614	N600W-SB24	Pond7	28.883	10.08	86.000	0.867	1.1
615	13W-SB13	Pond10	28.966	0.99	68.000	0.933	0.2
616	NUSB-11	9S-1	29.570	0.81	75.000	2.617	0.2
617	WEST-SB5	Pond2	30.117	0.19	60.750	0.567	0.0
618	500N-SB7	MH-98	30.330	3.48	72.500	0.510	0.4
619	600W-SB11	Prop Pond 54	31.355	57.88	92.000	0.232	2.7
620	WEST-SB1	WEST-SB1	31.687	0.49	65.000	1.383	0.1
621	MILL-SB19	MH-3	32.052	2.07	69.000	0.119	0.1
622	PARK-SB3	PARK-SB3	32.531	3.14	79.250	1.033	0.4
623	600W-SB5	Pond48	32.862	20.24	93.500	0.452	1.3
624	1300W-SB38	13W-SB38	32.984	0.22	60.750	0.533	0.0
625	N600W-SB22	N6W-SB20	33.092	14.36	86.000	0.850	1.6
626	800N-SB4	8N-SB3	33.233	18.60	84.000	0.450	1.3
627	WEST-SB2	WEST-SB2	33.838	0.32	65.000	1.633	0.1
628	LMSB-2	Pond19	33.896	11.26	80.000	0.510	0.9
629	MILL-SB7	MILL-SB7	34.240	23.47	85.000	0.406	1.5
630	CNTR-SB2	CNTR-SB2	34.590	3.42	75.000	0.483	0.3
631	700S-SB3	7S-SB3b	35.000	15.05	95.000	0.699	1.3
632	13W-SB9	MH-137	35.486	8.54	80.000	0.613	0.8
633	1300W-SB22	Pond6	37.090	2.95	72.500	1.200	0.5
634	N600W-SB28	N6W-SB28	37.144	5.86	76.750	0.833	0.8
635	13W-SB14	13W-SB13	37.403	1.12	68.000	1.317	0.3
636	NU-SB2	MH-109	38.408	12.30	81.000	0.633	1.2
637	2000W-SB2	Pond42	38.809	27.92	93.000	0.578	2.2
638	PARK-SB2	PARK-SB2	40.022	10.20	79.000	0.633	1.0
639	11N-SB10	MH-185	41.368	13.86	86.000	0.783	1.4
640	N600W-SB32	N6W-SB32	42.189	0.12	60.750	0.767	0.0
641	18N-SB5	619	42.289	5.10	76.750	0.867	0.7
642	PARK-SB1	Pond 30	42.738	11.07	80.000	0.700	1.2
643	11N-SB5	11N-SB5	43.481	12.76	84.500	1.133	1.8
644	200S-SB1	946	44.387	5.89	78.000	1.366	1.0
645	UM-SB11	MH-125	44.838	19.55	81.000	0.510	1.6
646	13W-SB5	Pond75	48.751	27.92	92.000	0.382	1.7
647	600W-SB17	6W-SB17	50.076	12.63	81.000	0.817	1.4
648	RET-SB2	Ret2 Det	50.083	7.26	75.000	0.667	0.9
649	UMSB-6	MH-26	53.561	10.60	75.000	0.460	1.0
650	MRDK-SB2	MRDK-SB2	56.130	2.81	72.500	0.550	0.3
651	700N-SB3	MhillsDet	56.597	8.45	75.000	0.633	1.0
652	NU-SB4	OF-48	58.126	9.51	85.000	0.275	0.5
653	600W-SB1	Pond38	59.914	22.83	95.000	1.022	2.7

	700S-SB2	Pond 60 - 10yr	60.904	36.37	90.000	0.717	3.4
655	13W-SB3	Pond40	61.415	19.07	92.000	0.691	1.7
656	700S-SB6	7S-SB6	62.538	15.28	83.160	1.250	2.3
657	RET-SB1	Ret1 Det	65.559	9.79	75.000	0.633	1.1
658	600W-SB15	Pond11	65.667	8.06	74.000	0.730	1.0
659	600W-SB16	Pond29	66.931	39.35	87.000	0.517	2.9
660	NU-SB3	NU-SB3	67.418	9.04	75.000	0.767	1.2
661	2000W-SB1	Pond74	68.204	51.73	93.000	0.604	4.2
662	1300W-SB40	Prop Pond 25	69.331	0.31	61.000	1.484	0.1
663	18N-SB2	Pond5	70.884	23.30	84.500	0.900	2.7
664	N600W-SB38	513	73.404	14.16	85.000	1.083	1.9
665	1300W-SB41	527	76.365	0.07	61.000	0.784	0.0
666	18N-SB3	MH-148	76.483	2.41	76.750	0.733	0.3
667	600W-SB3	Pond 58 - 10yr	80.577	40.09	95.000	0.487	2.8
668	UMSB-3	MH-29	81.269	9.33	75.000	0.395	0.8
669	UMSB-8	UM-SB8	83.820	12.26	75.000	0.662	1.4
670	SOUTH-SB1	Pond 59 - 10yr	84.062	29.75	93.000	0.569	2.3
671	700S-SB1	Pond36	85.048	35.17	90.000	0.755	3.4
673	13W-SB2	Pond37	88.331	37.78	90.500	0.455	2.6
674	13W-SB10	13W-SB10	89.416	4.81	81.000	1.617	0.9
675	NU-SB1	NU-SB1	90.714	48.35	88.500	0.850	5.1
676	2000W-SB4	Pond73	96.363	12.34	92.000	1.417	1.9
677	13W-SB6	Pond 25	102.303	15.22	93.500	0.483	1.1
678	N600W-SB36	MH-161	102.906	6.26	77.250	1.192	1.0
679	200S-SB2	2S-SB2	104.956	20.54	78.000	0.763	2.4
680	200S-SB5	2S-SB5	111.491	1.49	65.000	0.633	0.3
681	MRDK-SB1	Pond8	115.178	17.02	77.000	0.767	2.1
682	2000W-SB3	Pond 68	120.517	62.87	92.000	0.779	6.1
683	NU-SB16	MH-131	127.074	8.60	75.000	0.659	1.0
684	CNTR-SB1	Pond13	151.026	14.24	75.000	0.652	1.7
698	600 W 1800 N 01	Pond7	0.000	3.52	82.000	0.500	0.3
699	Pleasant Grove Blvd	20W-SB1	0.000	15.24	95.000	0.500	1.1
1008	A 3-7	CB 4-7	0.335	0.78	95.000	0.083	0.0
1009	A 7-3	CB 8-3	0.181	0.66	95.000	0.083	0.0
1010	A 2-3	CB 3-3	0.349	0.84	95.000	0.083	0.0
1011	A 6-5	CB 7-5	0.143	0.34	95.000	0.083	0.0
1012	A 7-1	CB 8-1	0.107	0.25	95.000	0.083	0.0
1013	A 5-6	CB 6-6	0.294	0.69	95.000	0.083	0.0
1014	A 6-3	CB 7-3	0.352	0.82	95.000	0.083	0.0
1015	A 6-1	CB 7-1	0.079	0.18	95.000	0.083	0.0
1016	A 4-1	CB 5-1	0.204	0.48	95.000	0.083	0.0
1017	A 5-1	CB 6-1	0.189	0.44	95.000	0.083	0.0
1018	A 3-5	CB 4-5	0.186	0.43	95.000	0.083	0.0
1019	A 1-4	CB 2-4	0.187	0.44	95.000	0.083	0.0
1020	A 4-5	CB 5-5	0.084	0.20	95.000	0.083	0.0
1021	A 3-1	CB 4-1	0.143	0.35	95.000	0.083	0.0
1022	A 1-5	CB 2-5	0.231	0.54	95.000	0.083	0.0
1023	A 1-8	CB 2-8	0.122	0.28	95.000	0.083	0.0
1024	A 3-3	CB 4-3	0.315	0.74	95.000	0.083	0.0
1025	A 3-8	CB 4-8	0.358	0.84	95.000	0.083	0.0
1026	A 1-7	CB 2-7	0.108	0.25	95.000	0.083	0.0
1027	A 6-7	CB 7-7	0.255	0.60	95.000	0.083	0.0
1028	A 2-2	CB 3-2	0.134	0.33	95.000	0.083	0.0
1029	A 1-10	CB 2-10	0.365	0.85	95.000	0.083	0.0
1030	A 2-1	CB 3-1	0.159	0.38	95.000	0.083	0.0
1031	A 4-3	CB 5-3	0.263	0.62	95.000	0.083	0.0
1032	A 2-4	CB 3-4	0.333	0.86	95.000	0.083	0.0
1033	A 1-3	CB 2-3	0.193	0.45	95.000	0.083	0.0
1034	A 3-2	CB 4-2	0.141	0.36	95.000	0.083	0.0
1035	A 3-4	CB 4-4	0.315	0.74	95.000	0.083	0.0
1036	A 1-6	CB 2-6	0.224	0.52	95.000	0.083	0.0
1037	A 7-4	CB 8-4	0.246	0.79	95.000	0.083	0.0
1038	A 6-2	CB 7-2	0.093	0.22	95.000	0.083	0.0
1039	A 1-1	CB 2-1	0.135	0.31	95.000	0.083	0.0
1040	A 3-6	CB 4-6	0.202	0.47	95.000	0.083	0.0
1041	A 1-2	CB 2-2	0.128	0.30	95.000	0.083	0.0
1042	A 5-3	CB 6-3	0.278	0.65	95.000	0.083	0.0

	A 4-6	CB 5-6	0.104	0.24	95.000	0.083	0.0
1044	A 6-4	CB 7-4	0.380	0.89	95.000	0.083	0.0
1045	A 5-4	CB 6-4	0.143	0.33	95.000	0.083	0.0
1046	A 1-9	CB 2-9	0.340	0.79	95.000	0.083	0.0
1047	A 6-6	CB 7-6	0.120	0.28	95.000	0.083	0.0
1048	A 6-8	CB 7-8	0.240	0.58	95.000	0.083	0.0
1049	A 5-2	CB 6-2	0.541	1.26	95.000	0.083	0.0
1050	A 4-2	CB 5-2	0.170	0.40	95.000	0.083	0.0
1051	A 5-5	CB 6-5	0.099	0.23	95.000	0.083	0.0
1052	A 5-7	CB 6-7	0.243	0.57	95.000	0.083	0.0
1053	A 4-4	CB 5-4	0.254	0.59	95.000	0.083	0.0
1054	A 7-2	CB 8-2	0.125	0.33	95.000	0.083	0.0
1080	CM-78 - Belle Monet	Pond71	0.000	18.91	92.000	0.500	1.5
1171	CM-79	MH 8-1	0.000	4.33	95.000	0.330	0.2
1216	CM-80	Pond 26	0.000	13.91	92.000	0.705	1.2
1219	CM-81	Pond72	0.000	46.41	92.000	0.753	4.4
1225	CM-82	Pond69	0.000	48.76	93.000	0.534	3.6
1542	CM-83	657	0.000	11.08	95.000	0.587	0.9
1543	CM-84	658	0.000	3.94	85.000	0.654	0.4
1544	CM-85	664	0.000	4.72	85.000	0.588	0.4
1545	CM-86	655	0.000	2.49	81.000	0.999	0.3
1546	CM-87	663	0.000	3.52	85.000	0.782	0.4
1550	CM-88	Pond21	0.000	7.75	95.000	0.083	0.3
1610	CM-89	510	0.000	4.18	83.000	0.520	0.3
1611	CM-90	507	0.000	6.73	85.000	0.500	0.5
1640	CM-91	MH-60	0.000	6.65	95.000	0.600	0.5
1644	CM-92	6W-SB8	0.000	8.23	95.000	0.327	0.5
1649	CM-93	MH-92	0.000	6.97	95.000	0.180	0.3
1651	CM-94	6W-SB4	0.000	3.77	95.000	0.114	0.2
1652	CM-95	MH-60	0.000	2.30	95.000	0.854	0.2
1734	CM-97	CB-7	0.000	9.52	93.500	0.370	0.6
1760	CM-98	Pond61	0.000	53.10	95.000	0.431	3.5
1780	CM-99	Pond50	0.000	30.05	95.000	0.536	2.2
1781	CM-100	Pond 67 - 10yr	0.000	11.07	93.500	0.159	0.5
1782	CM-101	Pond 21	0.000	14.19	92.000	0.342	0.8
1783	CM-102	Pond50	0.000	13.88	93.500	0.633	1.2
1784	CM-103	Pond 24	0.000	17.68	92.000	0.384	1.1
1785	CM-104	Pond 66 - 10yr	0.000	12.75	93.500	0.339	0.7
1786	CM-105	Pond48	0.000	7.37	92.000	0.358	0.4
1787	CM-106	Pond48	0.000	3.78	92.000	1.800	0.7
1789	CM-107	Pond77	0.000	11.34	92.000	0.375	0.7
1790	CM-108	Pond49	0.000	7.27	93.500	0.587	0.6
1792	CM-109	Pond49	0.000	5.21	92.000	0.219	0.2
1793	CM-110	Pond50	0.000	7.34	93.500	0.540	0.5
1795	CM-111	Pond76	0.000	6.76	93.500	0.358	0.4
1796	CM-112	Pond39	0.000	23.79	92.000	0.876	2.5
1798	CM-113	MH-75	0.000	13.00	95.000	0.500	0.9
1804	CM-114	Pond70	0.000	30.30	93.000	0.418	1.9
1806	CM-115	CNTR-SB1	0.000	3.43	75.000	0.430	0.3
1811	CM-116	Pond41	0.000	13.27	88.000	0.293	0.7
1843	CM-117	Prop Pond 28	0.000	9.76	93.500	0.497	0.7
1844	CM-118	Pond47	0.000	2.91	93.500	1.750	0.5
1845	CM-119	Pond46	0.000	21.15	95.000	0.211	1.0
1846	CM-120	MH-84	0.000	7.04	93.500	0.206	0.3
1851	CM-121	Pond47	0.000	7.76	95.000	1.200	1.0
1852	CM-122	Pond45	0.000	19.14	95.000	0.517	1.4
1870	CM-123	Pond22	0.000	6.03	95.000	0.717	0.6
1882	CM-124	MH-11	0.000	3.53	81.000	0.083	0.1
1883	CM-125	OUTFALL UM-SB8	0.000	5.28	92.000	0.121	0.2
1885	CM-126	MH-24	0.000	5.09	75.000	0.183	0.3
1899	CM-127	MH-100	0.000	10.33	93.000	0.461	0.7
1900	CM-128	Pond43	0.000	7.20	93.000	0.461	0.5
1901	CM-129	Pond34	0.000	11.73	93.000	0.307	0.6
1902	CM-130	Pond33	0.000	24.15	93.000	0.534	1.8
1906	CM-131	Pond35	0.000	9.47	95.000	0.222	0.5
1913	CM-132	Pond63	0.000	19.55	95.000	0.448	1.3
1914	CM-133	Pond63	0.000	10.43	95.000	0.100	0.4

	CM-134	13W-SB10	0.000	17.49	95.000	0.245	0.9
1963	CM-135	Prop Pond 54	0.000	21.99	95.000	0.500	1.6
1969	CM-136	MH-119	0.000	1.02	75.000	0.164	0.1
1971	CM-137	Pond 27	0.000	7.12	90.000	0.247	0.3
1973	CM-138	MH-120	0.000	0.47	69.000	0.296	0.1
1974	CM-139	MILL-SB19	0.000	1.22	69.000	0.104	0.1
1979	CM-140	MH-185	0.000	7.39	86.000	0.436	0.5
1995	CM-141	MH-130	0.000	8.58	85.000	0.355	0.5
1996	CM-142	MH-130	0.000	10.76	81.000	0.517	0.9
2013	CM-143	BlckhwkDet	0.000	14.92	79.000	0.269	0.8
2151	CM-145	MH-159	0.000	4.94	70.000	0.654	0.7
2253	CM-146	Pond42	0.000	21.74	93.000	0.755	2.0
2254	CM-147	MH-7	0.000	6.22	90.500	0.000	0.6
2255	CM-148	MH-97	0.000	23.39	85.000	0.682	2.2
2256	CM-149	501	0.000	6.97	85.000	0.519	0.5
2257	CM-150	501	0.000	7.12	85.000	0.588	0.6
2258	CM-151	MH-161	0.000	4.79	77.250	0.988	0.7
2259	CM-152	522	0.000	1.36	69.500	0.904	0.2
2260	CM-153	MH-145	0.000	3.53	77.500	0.481	0.3
2261	CM-154	616	0.000	4.46	77.500	0.418	0.4
2262	CM-155	524	0.000	0.08	61.000	0.944	0.0
2263	CM-156	WEST-SB3	0.000	0.56	72.000	1.548	0.1
2264	CM-157	WEST-SB2	0.000	5.84	90.500	0.000	0.6
2265	CM-158	11N-SB4	0.000	6.54	90.500	0.000	0.6
2266	CM-159	N6W-SB30	0.000	1.44	78.000	1.042	0.2
2267	CM-160	PARK-SB3	0.000	6.26	85.000	0.367	0.4
2268	CM-161	2S-SB4	0.000	3.82	75.000	0.000	0.5
2269	CM-162	MH-11	0.000	1.06	75.000	0.000	0.1
2270	CM-163	Pond49	0.000	5.93	90.500	0.000	0.6
2271	CM-164	Sump 1	0.000	2.70	85.000	0.519	0.2
2272	CM-165	Sump 2	0.000	3.15	85.000	0.519	0.2
2273	CM-166	NU-SB11	0.000	3.14	85.000	0.519	0.2
2499	CM-146	MH-160	0.000	7.46	80.000	0.652	0.7
2501	CM-147	MH-160	0.000	6.55	80.000	0.548	0.6

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