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Benjamin A. Harris

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2016]

MAKING THE MOST OF EL NIÑO: STORMWATER
COLLECTION AND RAINWATER HARVESTING AS
POTENTIAL SOLUTIONS TO WATER SHORTAGES
IN SOUTHERN CALIFORNIA

BENJAMIN A. HARRIS†

ABSTRACT

California's dry climate has produced extended periods of drought in recent years, which are likely to worsen in the future as the global temperature rises. To remedy drought conditions, there has been an increasing push to identify new fresh water resources throughout the state. One under-utilized source of fresh water, particularly in Southern California, is the increased precipitation during El Niño events. This water can be collected and stored for later use during drought conditions in the form of stormwater collection at a centralized scale or rainwater harvesting at a distributed scale, instead of allowing that water to flow into the ocean as runoff. Since 2010, California state laws and existing programs reveal a policy favoring these solutions, including the Sustainable Groundwater Management Act of 2014. However, the current legal regime is inadequate to guarantee widespread implementation of programs to the necessary degree. In this paper, I propose several legal mechanisms for further encouraging stormwater collection and rainwater harvesting as a way to expand the amount of precipitation that can be collected. Ultimately, stronger legal directives for these programs could supplement local water supplies in Southern California, reduce the reliance on imported sources of water, and provide the state with long-term resilience to drought conditions.

I. INTRODUCTION

California is caught in the midst of an extreme drought, leaving the parched state with scarce water to meet demands. This is particularly problematic in the Southern California region, where precipitation is so minimal that vast imports of water from other surrounding areas are required to meet water demands. These drought occurrences are likely to become more frequent and severe in future years due to changing climate patterns. As a result, it

† J.D. Candidate, 2016, UCLA School of Law; B.S., 2013, University of California Los Angeles. I am very grateful for Professor Jim Salzman's support and guidance.

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is critical that California conserve and expand its existing water sources.

One significantly untapped source of water is increased precipitation from El Niño events. El Niño events are difficult to predict but occur fairly regularly, on the average of once per decade. El Niño events result in significant increases of precipitation during the winter season. In Southern California, this translates to a significant portion of the decadal average rainfall occurring in a small subset of seasons. The current 2015 winter season is expected to experience the largest El Niño event since 1998, with many residents hopeful that a wet winter will move California out of the current drought.

Unfortunately, most of the increased rainfall from El Niño events occurs in the southern and coastal regions of California, where no major water reservoirs exist. Much of this water is ultimately lost as runoff into the ocean, particularly in urban centers where significant infrastructure improvements reduce land permeability. Current efforts to harness this water source are scarce.

However, additional water storage capacity is still available in Southern California in the form of groundwater aquifers. While groundwater is already extensively used to supply water to much of the state, particularly in urban centers and agricultural regions, the available groundwater storage capacity is vastly under-utilized. Within the last several decades, excessive groundwater withdrawals have contributed to rapidly falling water tables and even subsidence, which causes an irreversible reduction in storage capacity. To maintain this storage capacity, and to provide a protected source of water that can be tapped during drought years, it is necessary to explore further mechanisms of how to replenish groundwater reservoirs with precipitation from El Niño events.

Two viable options to accomplish this task are stormwater collection and rainwater harvesting. These techniques capture precipitation in either a centralized location or in a distributed system. The resulting collection of precipitation can then be directed into the ground, where the water infiltrates into the subsurface aquifer. Effective use of these methods can drastically reduce the quantity of water that is lost to the ocean via urban runoff.

In this paper, I discuss the feasibility of implementing greater large-scale stormwater collection and rainwater harvesting technologies in Southern California urban areas, and their potential for mitigating against water shortages during severe drought conditions. Section II provides an overview of the current critical condi-



tions of California's water supply, including the present drought, the looming El Niño event and its anticipated effect on water sources, and groundwater usage and replenishment. It also generally discusses stormwater collection and rainwater harvesting methods, particularly focusing on how those practices can be used to replenish groundwater resources. Section III analyzes the legal bases in California for rainwater harvesting and stormwater collection. Section IV delves into existing programs to collect rainwater and reduce urban runoff in Southern California. Section V proposes how some of these programs can and should be expanded in urban areas to reduce ocean runoff and improve groundwater recharge, while discussing any disadvantages or obstacles to their implementation.

II. BACKGROUND

A. Where Is California's Water?

In 2015, California entered the fourth consecutive year of a drought so severe that Governor Edmund G. Brown had already declared a state of emergency on January 17, 2014.¹ The 2014 "Water Year," a 12-month period ending September 30, 2014, was the third driest year ever recorded in state history.² Both the 2014 and 2015 Water Years were the warmest recorded in history, with average temperatures over two degrees Celsius higher than the 20th century average.³ These conditions have led to a proliferation of wildfire events; from January to November, 2015, there were over 8,069 reported fires that burned 824,499 acres.⁴

This drought has had profound effects on state surface water supplies. Measured in April, 2015, the Sierra Nevada Mountains had only 5% of the average snowpack amount compared to previ-

1. See Press Release, Office of Governor Edmund G. Brown Jr., Governor Brown Declares Drought State of Emergency (Jan. 17, 2014) [hereinafter Drought State of Emergency], available at <https://www.gov.ca.gov/news.php?id=18368>.

2. See Nat'l Oceanic & Atmospheric Admin., *Climate at a Glance: Time Series*, NAT'L CTRS. FOR ENVTL. INFO., https://www.ncdc.noaa.gov/cag/time-series/us/4/0/pcp/12/9/1895-2015?base_prd=true&firstbaseyear=1901&lastbaseyear=2015 (last visited Dec. 14, 2015) (logging and ranking the recorded precipitation for each water year in California state history).

3. See Nat'l Oceanic & Atmospheric Admin., *Climatological Rankings: California Average Temperature Rankings, Sept. 2015*, NAT'L CTRS. FOR ENVTL. INFO., [https://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php?periods\[\]=12¶meter=tavg&state=4&div=0&month=9&year=2015#ranks-form](https://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/index.php?periods[]=12¶meter=tavg&state=4&div=0&month=9&year=2015#ranks-form) (last visited Dec. 14, 2015).

4. See Press Release, State of Cal., Drought Update: November 25, 2015, at 3 (Nov. 25, 2015), available at <http://ca.gov/drought/pdf/Weekly-Drought-Update.pdf>.

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ous years.⁵ During normal years, this snowpack melts to provide up to 30% of California's water needs in the form of runoff into rivers, streams, and eventually reservoirs.⁶ On September 30, 2015, California reservoir levels were far below historical averages, with all but two reservoirs under 50% of the historical average for that date and all reservoirs under 40% capacity.⁷

In his declaration of a state of emergency in January, 2014, Governor Brown called upon the state to reduce water usage by 20%.⁸ He reaffirmed this mandate several months later in an Executive Order that provided more specific limitations on residents to prevent wasting water.⁹ On April 1, 2015, Governor Brown increased the conservation target to a 25% reduction in potable urban water usage, among other measures designed to complement existing emergency drought directives.¹⁰ California hit this mandate for four straight months from June to September, cumulatively saving 777,739 acre-feet¹¹ of water over that timespan.¹²

B. California Groundwater Usage

Many regions in California rely heavily on local groundwater to meet water demand. Bulletin 118, a comprehensive report on groundwater use and supply, was updated in 2003 to reflect the most up-to-date information and data available regarding the con-

5. Press Release, Cal. Dep't of Water Res., Sierra Nevada Snowpack Is Virtually Gone; Water Content Now Is Only 5 Percent of Historic Average, Lowest Since 1950 (Apr. 1, 2015), available at <http://www.water.ca.gov/news/newsreleases/2015/040115snowsurvey.pdf>.

6. *Id.*

7. See Cal. Dep't of Water Res., *Conditions for Selected Reservoirs*, CAL. DATA EXCHANGE CTR., <http://cdec.water.ca.gov/cdecapp/resapp/getResGraphsMain.action> (click the "Change Date" calendar icon for a dropdown menu and select September 30, 2015, then click the "Refresh Data" button).

8. Drought State of Emergency, *supra* note 1. This water conservation mandate was later extended through May 31, 2016. See Press Release, Office of Governor Edmund G. Brown Jr., Executive Order B-28-14 (Dec. 22, 2014), available at <https://www.gov.ca.gov/news.php?id=18815>.

9. Press Release, Office of Governor Edmund G. Brown Jr., A Proclamation of a Continued State of Emergency (Apr. 25, 2014), available at <http://ca.gov/Drought/topstory/top-story-6.html>.

10. Press Release, Office of Governor Edmund G. Brown Jr., Executive Order B-29-15 (Apr. 1, 2015), available at https://www.gov.ca.gov/docs/4.1.15_Executive_Order.pdf.

11. An acre-foot is the amount of water it would take to fill an acre of land with one foot of water. One acre-foot is equivalent to 325,851 gallons of water.

12. Press Release, Cal. Water Bds., Californians Meet Governor's Water Conservation Mandate for Fourth Consecutive Month (Oct. 30, 2015), available at http://www.waterboards.ca.gov/press_room/press_releases/2015/pr103015_sept_waterconservation.pdf.



ditions of groundwater basins throughout the state.¹³ This report estimated that groundwater provides 30% of the state's water supply in an average year, with some regions dependent on groundwater for over 60% of its water needs.¹⁴ The report further stated that many groundwater basins are experiencing overdraft, where the withdrawal rate is faster than the recharge rate, and estimated that annual overdraft could be as high as two million acre-feet.¹⁵ The report issued recommendations to encourage management of groundwater basins by local or regional agencies and to promote continued involvement from state agencies through improved information gathering and cooperation with local agencies.¹⁶

Bulletin 118 provided a detailed evaluation of individual groundwater basins throughout California. In the South Coast region, there are several large sub-basins that provide usable water to primarily urban areas. The Central Subbasin occupies 277 square miles of land in the inland Los Angeles metropolitan area.¹⁷ This sub-basin has an estimated storage capacity of 13.8 million acre-feet of groundwater.¹⁸ Groundwater levels in this sub-basin have varied dramatically over time, and in 1999 the water level was in the upper historical range.¹⁹ The West Coast Subbasin lies on the coast of the Los Angeles metropolitan area, covering 142 square miles of land with an estimated capacity of 6.5 million acre-feet.²⁰ A recent groundwater update for the South Coast region as a whole has designated the Central Subbasin, West Coast Subbasin, and many

13. See CAL. DEP'T OF WATER RES., CALIFORNIA'S GROUNDWATER: BULLETIN 118 (2003) [hereinafter BULLETIN 118], available at http://www.water.ca.gov/pubs/groundwater/bulletin_118/california's_groundwater__bulletin_118_-_update_2003_/bulletin118_entire.pdf.

14. *Id.* at 2. A more recent update estimated that in the South Coast region, groundwater encompassed about 34% of the total annual water supply from 2005 to 2010. See CAL. DEP'T OF WATER RES., CALIFORNIA'S GROUNDWATER UPDATE 2013, CHAPTER 6: SOUTH COAST HYDROLOGIC REGION GROUNDWATER UPDATE, at 3 (2015) [hereinafter SOUTH COAST HYDROLOGIC REGION 2013 UPDATE], available at http://www.waterplan.water.ca.gov/docs/groundwater/update2013/content/hydrologic_region/GWU2013_Ch6_SouthCoast_Final.pdf.

15. BULLETIN 118, *supra* note 13, at 2.

16. *Id.* at 8-11.

17. See CAL. DEP'T OF WATER RES., BULLETIN 118: COASTAL PLAIN OF LOS ANGELES GROUNDWATER BASIN, CENTRAL SUBBASIN, at 1 (2004) [hereinafter BULLETIN 118 CENTRAL SUBBASIN], available at <http://www.water.ca.gov/groundwater/bulletin118/basindescriptions/4-11.04.pdf>.

18. *Id.* at 3.

19. *Id.*

20. See CAL. DEP'T OF WATER RES., BULLETIN 118: COASTAL PLAIN OF LOS ANGELES GROUNDWATER BASIN, WEST COAST SUBBASIN, at 1 (2004) [hereinafter BULLETIN 118 WEST COAST SUBBASIN], available at <http://www.water.ca.gov/groundwater/bulletin118/basindescriptions/4-11.03.pdf>.

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other large groundwater basins as “high priority” based on the amount of groundwater pumped from these sources for urban use.²¹

Groundwater basins in the Central Valley fare even worse. These basins are subject to intense overdraft for agricultural use, which has led to drastic subsidence.²² Subsidence results in irreversible compaction of fine-grained layers of underground sediment when water is withdrawn to a sufficiently low level.²³ When water is withdrawn from these sediments, recharge cannot occur and the storage capacity of groundwater in that layer is lost.²⁴ For some areas in the Central Valley, subsidence from groundwater overdraft has resulted in a decrease in ground level by up to two inches per month.²⁵ Despite significant storage potential in groundwater basins throughout California, many basins may be overdrawn to the point of permanently losing that storage capacity.²⁶

C. El Niño on the Horizon

While the drought narrative is alarming, the impending El Niño event has given Californians reason for optimism. An El Niño event is a positive feedback loop characterized by warmer sea surface temperatures in the eastern Pacific Ocean near the Equator.²⁷ During an El Niño year, trade winds blowing from east to west along the Equator become weaker than in normal conditions.²⁸ This creates a reduction in the amount of warm surface water trans-

21. SOUTH COAST HYDROLOGIC REGION 2013 UPDATE, *supra* note 14, at 21 tbl.6-3.

22. One example is the Eastern San Joaquin Subbasin, covering 1,105 square miles with a predicted storage capacity of around 42.4 million acre-feet. This subbasin experiences an average annual overdraft of around 113,000 acre-feet per year, resulting in a saline front from ocean inflows moving into the aquifer and degrading water quality. The continued overdrafts for over 40 years has led to reduced groundwater storage capacity by about 2 million acre-feet, and groundwater levels have dropped over 100 feet. See CAL. DEP'T OF WATER RES., BULLETIN 118: SAN JOAQUIN VALLEY GROUNDWATER BASIN, EASTERN SAN JOAQUIN SUBBASIN (2006), available at <http://www.water.ca.gov/groundwater/bulletin118/basindecriptions/5-22.01.pdf>.

23. See TOM G FARR ET AL., CAL. INST. OF TECH., PROGRESS REPORT: SUBSIDENCE IN THE CENTRAL VALLEY, CALIFORNIA, at 2 (2015), http://www.water.ca.gov/groundwater/docs/NASA_REPORT.pdf.

24. *Id.*

25. *Id.* at 1.

26. See NASA: *California Drought Causing Valley Land to Sink*, CAL. INST. OF TECH. (Aug. 19, 2015), <http://www.jpl.nasa.gov/news/news.php?feature=4693>.

27. Nat'l Oceanic & Atmospheric Admin., *What Is an El Niño?*, PAC. MARINE ENVTL. LAB., <http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html> (last visited Dec. 14, 2015).

28. *Id.*

ported toward the western Pacific.²⁹ With less conveyance of surface water, upwelling of colder, nutrient-rich water along the coasts of the eastern Pacific becomes less efficient.³⁰ This results in higher sea surface temperatures and reduced productivity along the western coasts of the Americas.³¹ Rainfall follows warm surface water eastwards, which produces higher precipitation in the eastern Pacific and alters the global atmospheric circulation patterns in a manner that can impact weather conditions in remote locations.³² El Niño events are difficult to predict, and they do not occur on a regular basis.³³ In the past fifteen years, slight warming events were observed during the four separate winter seasons.³⁴ However, the last significant El Niño event occurred during the 1997-1998 season, which set numerous climate- and weather-related records throughout the United States.³⁵

California is one of the most impacted regions in the world during an El Niño event. Precipitation can increase dramatically during the winter season; during the 1997-1998 El Niño, California experienced its second wettest Water Year in recorded state history.³⁶ Warmer ocean surface temperatures cause increases in average air temperatures in California during winter, but this was not as significant during the 1997-1998 El Niño.³⁷ California is also highly susceptible to intense flooding and mudslides during El Niño events; during the month of February, 1998, a series of storms caused an estimated \$550 million worth of damage and 17 storm-

29. *Id.*

30. *Id.*

31. *Id.*

32. See Nat'l Oceanic & Atmospheric Admin., *supra* note 27.

33. The National Oceanic and Atmospheric Administration ("NOAA") estimates that an El Niño event occurs every two to seven years. See Nat'l Oceanic & Atmospheric Admin., *Frequently Asked Questions about El Niño and La Niña*, PAC. MARINE ENVTL. LAB., <http://www.pmel.noaa.gov/tao/elnino/faq.html#often> (last visited Dec. 14, 2015).

34. See Nat'l Oceanic & Atmospheric Admin., *Cold & Warm Episodes by Season*, NAT'L WEATHER SERV. CLIMATE PREDICTION CTR., http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml (last modified Nov. 4, 2015).

35. See TOM ROSS ET AL., NATIONAL CLIMATIC DATA CENTER TECHNICAL REPORT NO. 98-02: THE EL NIÑO WINTER OF '97 - '98, at 3 (1998) [hereinafter TECHNICAL REPORT 98-02], <http://www1.ncdc.noaa.gov/pub/data/techrpts/tr9802/tr9802.pdf>.

36. See *Climate at a Glance: Time Series*, NAT'L CTRS. FOR ENVTL. INFO., *supra* note 2. The NOAA quantified the precipitation in California from December 1997 to February 1998 as within the top ten wettest seasons. See TECHNICAL REPORT 98-02, *supra* note 35, at 6 fig.3.

37. See TECHNICAL REPORT 98-02, *supra* note 35, at 6.

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related deaths.³⁸ Due to the reduction in upwelling off the California coast, El Niño also significantly impacts the marine environment. Without enough nutrients in the water, plankton that depend on these nutrients appear in smaller quantities.³⁹ Fish that rely on plankton as a food source either die or migrate to cooler areas, leading to similar effects up the food chain for birds and marine mammals.⁴⁰ Established fisheries in California therefore face reductions in available catch during these warmer winter seasons.⁴¹

An El Niño event is well underway as of November, 2015.⁴² In Southern California, precipitation through December at the onset of an El Niño event averages to be 127% of normal conditions along the coast and 137% inland.⁴³ From January through March, the same regions experience on average 140% of normal precipitation along the coast and 144% precipitation inland.⁴⁴ The rest of the state experiences on average between 99% and 140% of normal precipitation.⁴⁵ These averages, combined with the high sea surface temperature anomalies already recorded, predict this El Niño event to be more significant than the 1997-1998 record-breaking anomaly.⁴⁶

Unfortunately for California, while El Niño is expected to bring significant precipitation to the southern part of the state,

38. *Id.* at 12; see also Rong-Gong Lin II & Christine Mai-Duc, *The Great El Niño of 1997-98, and What It Means for the Winter to Come*, L.A. TIMES (Aug. 22, 2015, 9:01 AM), <http://www.latimes.com/local/california/la-me-0822-el-nino-1997-20150822-story.html>.

39. See *El Niño Information: How Does El Niño Affect Sea Life and Birds?*, CAL. DEP'T OF FISH & WILDLIFE, <https://www.wildlife.ca.gov/Conservation/Marine/El-Nino#26072342-how-does-el-nio-affect-sea-life-and-birds> (last visited Dec. 14, 2015).

40. *Id.*

41. See *Impacts of El Niño on Fish Distribution from NOAA Fisheries*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., <http://www.elnino.noaa.gov/enso4.html> (last visited Dec. 14, 2015).

42. See CLIMATE PREDICTION CTR., EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION (Nov. 12, 2015), available at http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_disc_nov2015/ensodisc.pdf.

43. See Nat'l Oceanic & Atmospheric Admin., *102-Year [1895-1996] Normal Vs. El Nino-Average Precipitation (Inches) by Climate Division, November-December*, CLIMATE PREDICTION CTR., <http://www.cpc.ncep.noaa.gov/products/predictions/threats2/enso/elnino/ndpstat/ca0.gif> (last visited Dec. 14, 2015).

44. See Nat'l Oceanic & Atmospheric Admin., *102-Year [1895-1996] Normal Vs. El Nino-Average Precipitation (Inches) by Climate Division, January-February*, CLIMATE PREDICTION CTR., <http://www.cpc.ncep.noaa.gov/products/predictions/threats2/enso/elnino/jfmpstat/ca0.gif> (last visited Dec. 14, 2015).

45. *Id.*

46. See Rosanna Xia & Rong-Gong Lin II, *El Niño Is Here, and It'll Be 'One Storm After Another Like a Conveyor Belt'*, L.A. TIMES (Nov. 13, 2015, 5:24 AM), <http://www.latimes.com/local/weather/la-me-ln-el-nino-coming-20151113-story.html>.



most of the state's water supply is located elsewhere. Southern California has very few reservoirs that receive much water following a precipitation event.⁴⁷ Most of the region's water is imported from several external sources: 1) the Sacramento Bay Delta in Northern California via the State Water Project;⁴⁸ 2) the Owens Valley region through the Los Angeles Aqueduct;⁴⁹ and 3) the Colorado River from the east.⁵⁰ These deliveries are utilized to meet both municipal and agricultural needs in the Central Valley and Southern California.⁵¹ Increased precipitation from the coming El Niño is unlikely to have a sufficient impact on these inland or distant sources to offset the severe water shortages caused by the multi-year drought.⁵²

D. The Impermeability Problem

El Niño is also not expected to significantly increase groundwater levels throughout the state through natural means. In Southern California, where precipitation is expected to increase the most, very little of that water will be able to percolate into the water table because of the vast swaths of impervious cover in urban and suburban areas.⁵³ These impervious surfaces, including streets, side-

47. The California Department of Water Resources has calculated that the South Coast region has 29 reservoirs that can support a combined maximum reservoir capacity of about 2.1 million acre-feet, which is approximately 5% of the total reservoir capacity throughout the state. See Cal. Dep't of Res., *Summary of Storage in Major Reservoirs as of October 31, 2015*, CAL. DATA EXCHANGE CTR., <http://cdec.water.ca.gov/cgi-progs/reservoirs/STORSUM> (last updated Nov. 13, 2015).

48. See *California State Water Project Overview*, CAL. DEP'T OF WATER RES., <http://www.water.ca.gov/swp/> (last modified Aug. 11, 2010).

49. See *Los Angeles Aqueduct*, L.A. DEP'T OF WATER & POWER, <https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-losangelesaqueduct> (last visited Dec. 14, 2015). This water primarily originates from melting snowpack in the Sierra Nevada mountains, which fill reservoirs such as Lake Mead in the springtime. See *Facts & History: The Story of the Los Angeles Aqueduct*, L.A. DEP'T OF WATER & POWER, <https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-losangelesaqueduct/a-w-laa-factsandhistory> (last visited Dec. 14, 2015).

50. See *Facts & History: The Story of the L.A. Aqueduct*, L.A. DEP'T OF WATER & POWER, *supra* note 49; *Main: Colorado River Aqueduct*, METROPOLITAN WATER DIST. OF S. CAL., <http://www.mwdh2o.com/AboutYourWater/Sources%20Of%20Supply/Pages/Imported.aspx> (last visited Dec. 14, 2015).

51. See *supra* notes 48-50; see also *Water Resources: Imported Water*, L.A. CNTY. DEP'T OF PUB. WORKS, <https://dpw.lacounty.gov/landing/wr/watersupply/importedWater.cfm> (last visited Dec. 14, 2015).

52. See Rong-Gong Lin II & Shelby Grad, *As Huge El Niño Brews, California Fights to Keep Drought Mentality*, L.A. TIMES (Nov. 16, 2015, 8:09 AM), <http://www.latimes.com/local/weather/la-me-ln-as-huge-el-nino-brews-california-fights-to-keep-drought-mentality-20151116-story.html>.

53. NOAH GARRISON ET AL., NATURAL RES. DEF. COUNCIL & PAC. INST., *STORMWATER CAPTURE POTENTIAL IN URBAN AND SUBURBAN CALIFORNIA*, at 2 (June

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walks, other paved areas, and buildings or structures, prevent rain-water from being absorbed by soils and instead direct the water to flow into storm sewers.⁵⁴ This stormwater, also referred to as urban runoff, collects waste, trash, chemicals, or other pollutants as it flows through the Municipal Separate Storm Sewer System (MS4).⁵⁵

In the Los Angeles area alone, many thousands of acre-feet of stormwater are generated every day, even on days without precipitation.⁵⁶ In most cases, stormwater is conveyed through MS4s and flows directly into the ocean, without being treated or filtered.⁵⁷ About 180,000 acre-feet of stormwater is lost to the ocean every year from the Los Angeles County MS4.⁵⁸ A one-inch rain event in Los Angeles County can generate up to 30,000 acre-feet of stormwater runoff.⁵⁹ Given the expected rise in precipitation during El Niño events, this amount of uncaptured stormwater will increase without any significant effects on the rate of groundwater recharge.

E. Stormwater Collection – How It Works

Stormwater collection is a broad term for “the collection, treatment, storage and use of stormwater run-off from urban areas.”⁶⁰ The terms “green infrastructure” or “low-impact development”

2014), <http://pacinst.org/wp-content/uploads/sites/21/2014/06/ca-water-storm-water.pdf>.

54. *Id.*

55. *Id.* at 3. For an overview of stormwater quality concerns in California, see Robin Kundis Craig, *Urban Runoff and Ocean Water Quality in Southern California: What Tools Does the Clean Water Act Provide?*, 9 CHAP. L. REV. 313, 313-18 (2006).

56. GARRISON ET AL., *supra* note 53, at 3. Stormwater is generated not only from precipitation events, but also from excess irrigation, industrial processes, and other municipal water uses that generate runoff. *Id.*

57. See *Primary Stormwater Pollutants*, L.A. CNTY. DEP’T OF PUB. WORKS, https://dpw.lacounty.gov/prg/stormwater/Page_20.cfm (last visited Dec. 14, 2015); see also U.S. ENVTL. PROT. AGENCY, STORMWATER TO STREET TREES: ENGINEERING URBAN FORESTS FOR STORMWATER MANAGEMENT 3, available at <http://nepis.epa.gov/Exe/ZyPDF.cgi/P100H2RQ.pdf?Dockey=P100H2RQ.pdf> (last visited Dec. 14, 2015).

58. GARRISON ET AL., *supra* note 53, at 3. The MS4 system in Los Angeles County was originally developed in the 1930s by the U.S. Army Corps of Engineers. See Memorandum from Samuel Unger, P.E., Executive Officer, L.A. Reg’l Water Quality Control Bd. for Board Members of the L.A. Reg’l Water Quality Control Bd. 4 (Jan. 20, 2012), available at http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/la_ms4/MS4%20Memo%20012012.pdf. The rapid expansion of development in the area has led to a modern MS4 system “of approximately 120,000 catch basins, over 2,800 miles of underground pipes, and 500 miles of open channels.” *Id.* at 5. Most of the runoff from developed land in the county flows through one of approximately 60 storm drain outfalls. *Id.*

59. GARRISON ET AL., *supra* note 53, at 3.

60. DEP’T OF ENV’T & CONSERVATION NSW, MANAGING URBAN STORMWATER: HARVESTING AND REUSE 2 (Apr. 2006), available at <http://www.environment.nsw.gov.au/resources/stormwater/managestormwatera06137.pdf>.

(LID) are commonly used interchangeably with stormwater collection, referring to regional development practices on both private and public lands that improve water supplies at a more distributed scale.⁶¹ These programs typically include some of the following elements: 1) collection stormwater from a centralized body of surface water, such as a pond or drain; 2) storage of the stormwater either in a surface location or in a storage tank; 3) treatment to remove pollutants inconsistent with the intended use of the water; and 4) distribution of the stormwater to the locations of intended use.⁶² The most common distribution of this water is into the ground by infiltration, ultimately entering local groundwater sources, as opposed to on-site storage and use.⁶³

There are a wide variety of practices commonly used to reduce the generation of urban runoff. Green roofs seek to capture rainwater on the top of buildings by covering them with vegetation, which retains precipitation in the soil and biomass.⁶⁴ Permeable pavements have been developed to allow direct infiltration of rainwater into the soil beneath the roadways.⁶⁵ Roadside swales, which are dry or vegetated drainage paths, collect runoff from impermeable streets for infiltration instead of allowing that water to flow into storm sewers.⁶⁶ Similarly, wetlands can be a beneficial mechanism not only for infiltrating accumulated stormwater into the ground, but also for treating the water for pollutants through natural filtration.⁶⁷

61. See GARRISON ET AL., *supra* note 53, at 3; *Stormwater Management Practices at EPA Facilities*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/greeningepa/stormwater-management-practices-epa-facilities> (last updated Sept. 30, 2015).

62. DEP'T OF ENV'T & CONSERVATION NSW, *supra* note 60, at 2.

63. See, e.g., *Stormwater Management Practices at EPA Facilities*, U.S. ENVTL. PROT. AGENCY, *supra* note 61 (highlighting many common methods of stormwater collection, the majority of which result in stormwater infiltration into the ground).

64. *Id.*

65. *Id.*

66. *Id.*; see also *Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring – Vegetated Swales/Filter Strips*, U.S. DEP'T OF TRANSP., FED. HIGHWAY ADMIN., <https://www.environment.fhwa.dot.gov/ecosystems/ultraurb/uubmp3p4.asp> (last visited Dec. 14, 2015); MICHAEL L. CLAR ET AL., U.S. ENVTL. PROT. AGENCY, *STORMWATER BEST MANAGEMENT PRACTICE DESIGN GUIDE, VOL. 2: VEGETATIVE BIOFILTERS* (Sept. 2004), available at <http://nepis.epa.gov/Adobe/PDF/901X0B00.pdf> (providing detailed and specific design guidance for vegetative biofilters).

67. *Stormwater Management Practices at EPA Facilities*, U.S. ENVTL. PROT. AGENCY, *supra* note 61. These wetlands can be naturally occurring or artificially constructed to receive stormwater from urban environments. *Id.*; see N.J. DEP'T OF ENVTL. PROT., *NEW JERSEY STORMWATER BEST MANAGEMENT PRACTICES MANUAL: STANDARD FOR CONSTRUCTED STORMWATER WETLANDS 9.2-2 to 9.2-12* (Feb. 2004), available at http://www.njstormwater.org/bmp_manual/NJ_SWBMP_9.2%20print.pdf; WIL-

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The most direct method to recharge aquifers with stormwater is through percolation fields, also called spreading grounds.⁶⁸ This centralized form of stormwater collection functions by directing stormwater distributed over a large region toward a pond lined with sand or other organic filtering material.⁶⁹ The water then percolates into the groundwater table at a rapid pace given the high permeability of the lining material.⁷⁰ To accomplish the desired aquifer recharge, these spreading grounds facilities must be constructed in a geologically suitable area for the infiltrated water to enter the aquifer below.⁷¹ A similar mechanism for improving groundwater recharge rates is the construction of a rubber dam, which is an inflated tube atop a concrete foundation that creates a temporary reservoir in the riverbed to allow increased percolation and prevent excess river water from flowing into an unusable source (such as the ocean).⁷² These devices can be used to reduce water flow into a spreading field following a storm event to allow more time for the spreading field to infiltrate the accumulated water.⁷³

The benefits of stormwater collection for aquifer recharge in a drought-prone locality are quite apparent. While most urban runoff is normally lost to surrounding water sources, collecting that water in underground aquifers increases the water supply in a year-round water source that can be tapped when precipitation is inadequate to provide surface-water supplies. This significantly improves drought resistance and encourages more efficient use of local water resources. In particularly groundwater-dependent regions, stormwater can be an effective resource for combating subsidence

LIAM F. HUNT ET AL., STORMWATER WETLAND DESIGN UPDATE: ZONES, VEGETATION, SOIL, AND OUTLET GUIDANCE (2007), available at <http://www.bae.ncsu.edu/stormwater/PublicationFiles/WetlandDesignUpdate2007.pdf>.

68. See Ted Johnson, *Groundwater Replenishment at the Montebello Forebay Spreading Grounds*, WATER REPLENISHMENT DIST. OF S. CAL. TECH. BULLETIN 14 (Winter 2008), available at http://www.wrd.org/engineering/reports/TB14_Winter_2008_Spreading_Grounds.pdf; *Stormwater Capture*, L.A. DEP'T OF WATER & POWER, <https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-water/a-w-sourcesofsupply/a-w-sos-stormwatercapture> (last visited Dec. 14, 2015).

69. Johnson, *supra* note 68.

70. *Id.*

71. *Id.*

72. See Michael R. Markus et al., *Aquifer Recharge Enhanced with Rubber Dam Installations*, ROADS & BRIDGES (Dec. 28, 2000), <http://www.roadsbridges.com/aquifer-recharge-enhanced-ruber-dam-installations>.

73. See *id.*

from excessive groundwater withdrawals, or to resist groundwater contamination from saltwater intrusion.⁷⁴

F. Rainwater Harvesting – How It Works

Rainwater harvesting is a similar program to stormwater collection that seeks to reduce urban runoff and convert precipitation into a usable source of water, albeit on a more distributed level. Rainwater harvesting is defined as “the capture, diversion, and storage of non-potable water for later reuse,” particularly for agricultural or domestic uses.⁷⁵ At minimum, rainwater harvesting systems must have a collection area over which rain falls, a system to capture the water, and a system to distribute the water toward the desired area.⁷⁶ More advanced systems may include filtering systems to elevate the potential uses of the water, or storage tanks to preserve the water for future use.⁷⁷

There are two primary types of rainwater harvesting systems: passive and active. Passive systems primarily rely on gravity to direct rainwater from areas like rooftops or parking lots toward a particular infiltration zone or rain barrel.⁷⁸ These passive systems generally require no maintenance cost and have significantly lower installation costs, given the simple technology required to direct rainwater (mainly comprising of gutters and downspouts).⁷⁹ In contrast, active systems include pumps, filters, and storage tanks that cumulatively attempt to allow collected rainwater to be applied to a particular use.⁸⁰ These systems are more costly to establish and

74. Los Angeles County maintains three saltwater intrusion barriers by injecting freshwater into aquifers near the coastline, which prevents the saltwater front from moving inland. The West Coast Basin Barrier Project, initiated along the coastline within Hermosa Beach, first began following the passage of a 1951 bill in California that allowed the State Water Resources Board to fund injection well experimental projects. The Dominguez Gap Barrier Project began in 1971 and operates 41 injection wells along the Dominguez Channel. The Alamitos Barrier Project was first constructed in 1964, comprising of 43 injection wells and four extraction wells to counteract the landward gradient of intruding seawater. See *Sea-water Barrier: Historical Perspective*, L.A. CNTY. DEP'T OF PUB. WORKS, <http://dpw.la.county.gov/wrd/barriers/historical.cfm> (last visited Dec. 14, 2015).

75. CITY OF SAN DIEGO, RAINWATER HARVESTING GUIDE 2, <http://www.sandiego.gov/water/pdf/conservation/rainwaterguide.pdf> (last visited Dec. 14, 2015) [hereinafter SAN DIEGO RAINWATER HARVESTING GUIDE].

76. *Id.* at 3.

77. *Id.*

78. Doug Pushard, *Passive Versus Active Rainwater Harvesting*, HARVESTH2O, http://www.harvesth2o.com/passive_active.shtml#.VJWPGxOml (last visited Dec. 14, 2015).

79. *Id.*

80. *Id.*

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maintain, but allow for indoor use of water for plumbing or other non-potable functions.⁸¹ Both of these systems can be applied at the single-home scale or a larger community or regional scale.⁸²

Effective use of rainwater harvesting techniques in Southern California can reduce the amount of urban runoff that ultimately flows to the ocean.⁸³ Any rainwater used for landscaping will also decrease the use of other water sources for that same purpose, thereby decreasing demand for imports of potable water from other regions.⁸⁴ Given the simplicity, rainwater harvesting has been frequently promoted as a beneficial tool for conserving scarce water resources. However, given the small amount of water that can be collected, installing these catchment systems in either residential or industrial complexes can be cost-prohibitive and usually requires rebates or other financial incentives.⁸⁵

III. STORMWATER COLLECTION AND RAINWATER HARVESTING IN CALIFORNIA LAW

While attempting to optimize the amount of water supply derived from precipitation seems like a universally beneficial approach in water-scarce regions, these practices were not always considered legally valid in the first-come, first-served water law regimes that developed in the arid Western states. In this section, I will provide a brief overview of the relevant state common law and statutes that govern rainwater collection and use in California, along with other federal laws that have implications for how municipalities address stormwater.

A. Diffuse Surface Water in California Common Law

“Diffuse” surface water is a vague term, but the classification of water as “diffuse” bears significant legal implications.⁸⁶ Diffuse water is generally defined as “water on or at the surface without being in a defined body of water.”⁸⁷ Diffuse water typically occurs

81. *Id.*

82. *Id.*; see also Katherine Cummings, *Adapting to Water Scarcity: A Comparative Analysis of Water Harvesting Regulation in the Four Corner States*, 27 J. ENVTL. L. & LITIG. 539, 541-43 (2012).

83. SAN DIEGO RAINWATER HARVESTING GUIDE, *supra* note 75, at 2.

84. *Id.*

85. Cummings, *supra* note 82, at 542; see also *infra* notes 191-94 and accompanying text.

86. Joseph W. Dellapenna, *The Legal Regulation of Diffuse Surface Water*, 2 VILL. ENVTL. L.J. 285, 286 (1991).

87. *Id.* at 288.



following precipitation events, snow melts, or even arising from springs.⁸⁸ Diffuse surface water does not flow regularly or consistently, unable to maintain a lasting identity as a water body.⁸⁹ The California Supreme Court has defined “surface water” to include “[w]ater diffused over the surface of land, or contained in depressions therein, and resulting from rain, snow, or which rises to the surface in springs.”⁹⁰ This water is “distinguishable from water flowing in a fixed channel . . . or water collected in an identifiable body.”⁹¹ According to these definitions, it is evident that urban runoff, and perhaps even stormwater within MS4 systems, are classified as diffuse surface water in California.

Diffuse-surface water has had sparse treatment in California water law, and as such it is unclear whether there exists a right to capture and use diffuse-surface water.⁹² In 1850, California statutorily adopted English common law, “so far as it is not repugnant to or inconsistent with” California law.⁹³ Under this English common law, diffuse surface water had no particular legal treatments other than the common-law right of capture.⁹⁴ With no specific statutory requirements, this is arguably what governs the use of diffuse surface water in California.⁹⁵

B. Storm Water Resource Planning Act of 2010

Despite the lack of a definite legal backdrop, current water conservation efforts have encouraged municipalities to collect and utilize diffuse surface water for a variety of beneficial purposes. In 2010, the California legislature enacted the Storm Water Resource Planning Act, which acknowledged that stormwater, as well as dry

88. *Id.* at 288-89.

89. *Id.* at 289.

90. *Keys v. Romley*, 64 Cal. 2d 396, 400 (1966).

91. *Id.* Provisions in the California Water Code similarly distinguish surface water from diffuse waters, and exclude diffuse water from regulation. *See* Cal. Water Code § 1200 (1943) (stating that any references to the terms “stream, lake or other body of water, or water” pertaining to applications for permits to appropriate water shall be limited to only surface water and subterranean streams flowing through defined channels); Cal. Water Code § 1201 (1943) (stating that all water “flowing in any natural channel” is the public water of the State and subject to appropriation).

92. *See* Susan Gilbert-Miller, *Low Impact Development Policies and Californian Water Rights: Natural Conflicts—Diminishing Returns*, 45 U.S.F. L. REV. 779, 792 (2011).

93. *Id.*; *see* An Act Adopting the Common Law, 1850 Cal. Stat. 219 (codified at Cal. Civ. Code § 22.2 (2007)).

94. *See* Gilbert-Miller, *supra* note 92, at 792.

95. *Id.* For a more in-depth analysis of how courts should treat diffuse surface water rights in the context of low-impact development, *see id.* at 797-804.

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weather runoff, are “underutilized sources of surface water and groundwater supplies”⁹⁶ and “can contribute significantly to local water supplies through onsite storage and use, or letting it infiltrate into the ground to recharge groundwater.”⁹⁷ The legislature declared a policy to encourage new development projects to implement low-impact development principles, which will allow for stormwater to be applied to a beneficial use.⁹⁸

To achieve this goal, the statute allows public agencies to develop a “stormwater resource plan.”⁹⁹ These plans are purely optional and left to the agency’s discretion;¹⁰⁰ however, if an agency does decide to adopt a stormwater resource plan, it “shall” meet certain requirements.¹⁰¹ Among these requirements are ensuring that the plan operates on a watershed basis, designing stormwater capture projects that maximize benefits to the watershed area, and allowing for community participation in plan development.¹⁰² Further, plans must identify opportunities to utilize stormwater to enhance water supplies, reduce water pollution, and improve habitat.¹⁰³ Agencies are directed to include in their plans “design criteria and best management practices” for new and upgraded infrastructure projects, including practices that reduce impermeability, increase on-site water storage or infiltration into groundwater, or achieve other low-impact development techniques.¹⁰⁴

Given the voluntary nature of these stormwater resource plans, and the substantial requirements that an agency would have to meet in developing one, it is unlikely that agencies would willfully take on the difficult administrative task. Substantial stormwater management projects could still go forward without adequate stormwater resource plans in place. For instance, Assembly Bill 1471, filed on August 13, 2014, authorized the issuance of bonds equivalent to \$7.545 billion in order to finance a water quality, sup-

96. Cal. Water Code § 10561(a) (2015).

97. *Id.* § 10561(e).

98. *Id.* § 10561(f).

99. *Id.* § 10562(a).

100. *Id.* (using the term “may”).

101. *Id.* § 10562(b).

102. *Id.* § 10562(b)(1)-(4).

103. *Id.* § 10562(d)(1)-(4).

104. *Id.* § 10562(d)(6). “Low-impact development” is defined by the statute as “new development or redevelopment projects that employ natural and constructed features that reduce the rate of stormwater runoff, filter out pollutants, facilitate stormwater storage onsite, infiltrate stormwater into the ground to replenish groundwater supplies, or improve the quality of receiving groundwater and surface water.” *Id.* § 10564.

ply, and infrastructure improvement program.¹⁰⁵ Of that amount, \$200 million was allocated toward stormwater management projects.¹⁰⁶ This funding would be subject to approval by voters in the ensuing November election, under Proposition 1.¹⁰⁷ To ensure sufficient management over those projects, in September, 2014 the legislature passed Senate Bill 985, amending the Storm Water Resource Planning Act to carry more force.¹⁰⁸ Newly enacted Section 10563(c) requires the development of a stormwater resource plan as a condition to receive grants for any stormwater capture projects from a bond act approved by the voters after January 1, 2014.¹⁰⁹ Further, the State Water Resources Control Board (“SWRCB”) was directed to establish guidelines for stormwater resource plans by July 1, 2016.¹¹⁰ The SWRCB issued a draft set of guidelines on August 26, 2015 for public comment.¹¹¹

C. Rainwater Harvesting Act of 2012

Rainwater harvesting is recognized in California as another potential source to increase statewide water supplies. In 2012, the state legislature passed the Rainwater Harvesting Act, which authorizes the collection of rainwater from rooftops without a water right permit under Section 1201 of the Water Code.¹¹² The statute does not provide for any additional resource management or a planning program, but does envision that augmenting water supplies through rainwater harvesting “will require efforts at all levels, from individual landowners to state and local agencies and watershed managers.”¹¹³ This provides a clear legal basis for municipalities to encourage programs to harvest rainwater for on-site use, whether by residential households or by industrial or municipal facilities.

105. See 2014 Cal. Legis. Serv. ch. 188 (A.B. 1471) (West).

106. *Id.*; see Cal. Water Code § 79747 (2014).

107. 2014 Cal. Legis. Serv. ch. 188 (A.B. 1471) (West); see *California Proposition 1, Water Bond (2014)*, BALLOTPEDIA, [https://ballotpedia.org/California_Proposition_1,_Water_Bond_\(2014\)](https://ballotpedia.org/California_Proposition_1,_Water_Bond_(2014)) (last visited Dec. 14, 2015).

108. See 2014 Cal. Legis. Serv. ch. 555 (S.B. 985) (West).

109. Cal. Water Code § 10563(c)(1).

110. *Id.* § 10565.

111. See CAL. STATE WATER RES. CONTROL BD., DRAFT STORMWATER RESOURCE PLAN GUIDELINES (Aug. 26, 2015), available at <http://www.calstate.edu/water/documents/Prop-1-stormwater-resources-plan-guidelines.pdf>.

112. Cal. Water Code § 10574 (2012). Section 1201 declares all surface water to be public water of the state and “subject to appropriation in accordance with the provisions of this code.” *Id.* § 1201.

113. *Id.* § 10571(d).

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D. Los Angeles County Low-Impact Development Standards

The County of Los Angeles had measures for low-impact development in place even prior to the passage of the Storm Water Resource Planning Act. In 2008, the county enacted Chapter 12.84 of the Los Angeles County Code that sought to implement low-impact development standards for all new construction projects.¹¹⁴ These statutes were later updated in 2013 to conform to the requirements of the county's stormwater discharge permit from the SWRCB under the Federal Clean Water Act.¹¹⁵

Section 12.84.430(A) identifies particular development projects of a certain size or environmental impact.¹¹⁶ These "designated projects" must retain 100% of the Stormwater Quality Design Volume ("SWQDv") on the development site, "through infiltration, evapotranspiration, rainfall harvest and use, or a combination thereof."¹¹⁷ If it is technically infeasible to retain 100% of the SWQDv on-site, the designated project must comply with one of a list of alternative measures that are intended to offset or mitigate any stormwater produced from the development.¹¹⁸ All other projects not designated in Section 12.84.430 are subject to different requirements, depending on the size and use of the development.¹¹⁹ For residential projects of four or fewer units that result in the addition or alteration of 50% or more of the impervious surfaces of an existing developed site, the developer must implement at least two best management practices identified in the "LID Standards Manual," which include disconnecting impervious surfaces, porous pavement, downspouts, dry wells, green roofs, or other irrigation and landscaping requirements.¹²⁰ For larger residential, or non-residential, projects, all excess volume of stormwater from the development site must be infiltrated into the ground either on-site

114. See L.A. Cnty. Code ch. 12.84, §§ 12.84.410-460 (2008).

115. See L.A. Cnty. Ordinance No. 2013-0044 (2013), available at <http://dpw.lacounty.gov/ldd/lib/pdf/Certified%20Revised%20LID%20Ordinance.pdf>.

116. L.A. Cnty. Code § 12.84.430(A).

117. *Id.* § 12.84.440(C)(1). The definition of SWQDv is "the runoff generated by a water quality design storm event." *Id.* § 12.84.420(V). A water quality design storm event, in turn, is defined as "any of the volumetric or flow rate based design storm events for water quality [best management practices]" that were identified in the County's municipal stormwater discharge permit issued under the Clean Water Act. *Id.* § 12.84.420(X).

118. *Id.* § 12.84.440(C)(2).

119. *Id.* §§ 12.84.430(B), 440(D).

120. *Id.* § 12.84.440(D)(1); see *id.* § 12.84.430(E)(1) (exempting all such residential projects resulting in less than 50% alteration or addition of impervious surfaces).



or in sub-regional facilities within five acres of the site.¹²¹ If it is technically infeasible to infiltrate all of the excess volume, the developer is required to implement on-site storage, reuse, or other conservation uses of the water.¹²² Additionally, street and road construction projects of over 10,000 square feet of impervious surface area must follow guidance from the Environmental Protection Agency (“EPA”) on green streets development practices “to the maximum extent practicable.”¹²³

These county statutes exemplify the growing policy concerns about ineffective stormwater management, and limiting stormwater generation from future development projects can be an effective method for capping stormwater quantity at current levels. However, these provisions for low-impact development are not focused on solutions that capture stormwater to improve water supplies. The purposes of Chapter 12.84 include to reduce burdens imposed on drainage systems and receiving waters, to minimize pollution from urban runoff, and to minimize flooding and erosion.¹²⁴ Low-impact development is limited in its ability to eliminate stormwater; large storm events, especially during El Niño events, will still result in significant amounts of urban runoff that will discharge directly into the ocean through the MS4 system. Therefore, additional controls are necessary to ensure that this water can be collected and reused.

E. Sustainable Groundwater Management Act of 2014

Groundwater has received little attention and regulation in the California legal system. The Water Commission Act of 1913, codified at California Water Code §§ 1003 *et seq.*, created an appropriation permit system for only surface water, excluding groundwater from the regulatory regime.¹²⁵ Groundwater in California is governed by the correlative rights doctrine, which treats overlying landowners with priority over off-tract users and restricts riparian use to a reasonable share of water in relation to the other uses.¹²⁶ How-

121. *Id.* § 12.84.440(D)(2). “Excess volume” is defined as the difference in volume of runoff, after a water quality design storm event, from before and after the development. *Id.* § 12.84.420(I).

122. *Id.* § 12.84.440(D)(2).

123. *Id.* § 12.84.430(C).

124. *See id.* § 12.84.410.

125. *See* 1913 Cal. Stat. §§1022, 1033. There is a narrow exception to this general divide, in that “subterranean streams flowing through known or definite channels” are also subjected to permitting requirements. *See* Cal. Water Code § 1200 (1943).

126. *See Katz v. Walkinshaw*, 141 Cal. 116 (1903) (establishing the correlative rights doctrine in California and acknowledging it as a deviation from English

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ever, this reasonableness standard is quite amenable and essentially allows for cumulative riparian users to deplete groundwater resources.

Despite the absent legislative directives regarding groundwater management, disputes regarding groundwater use have been resolved through court adjudication. Aggrieved parties can seek to adjudicate and gain quiet title to their claimed rights to water in the basin, as well as injunctive relief against excessive withdrawals.¹²⁷ The court handling the adjudication identifies the relevant extractors, determines how much groundwater each landowner can extract, and appoints or confirms a “Watermaster” tasked with managing the groundwater basin in accordance with the judgment.¹²⁸ Additionally, the Watermaster must periodically report to the court to ensure that the groundwater resources are being managed appropriately.¹²⁹ By 2014, 26 groundwater areas in California have been adjudicated by a court to determine each respective party’s right to use groundwater.¹³⁰ As such, local jurisdictional authorities have been the primary entities responsible for any groundwater management activities.¹³¹ Both sub-basins beneath Los Angeles County, the West Coast and Central Subbasins, were adjudicated in the 1960s and are managed by the California Department of Water Resources (“DWR”) acting as the Watermaster.¹³²

The state legislature has been more active in the last several decades to encourage more efficient groundwater management. Assembly Bill 3030, dubbed the Groundwater Management Act, was passed in 1992 to provide management guidance to local authori-

common law); *Pabst v. Finmand*, 190 Cal. 124, 129 (1922) (describing how correlative rights operate).

127. See, e.g., *Chronology of the Raymond Basin*, RAYMOND BASIN MGMT. BD., http://raymondbasin.org/?page_id=42 (last visited Dec. 14, 2015) (describing the chronology and initiation of the first adjudication over a groundwater basin in California, including the City of Pasadena’s action to quiet title over its water rights).

128. Cal. Dep’t of Water Res., *Groundwater Management*, GROUNDWATER INFO. CTR., http://www.water.ca.gov/groundwater/groundwater_management.cfm (last modified Nov. 26, 2014).

129. *Id.*

130. See Cal. Water Code § 10720.8(a)(1)-(26) (2015) (listing the 26 adjudicated groundwater areas); see also Cal. Dep’t of Water Res., *List of Adjudicated Basins and Subbasins*, http://www.water.ca.gov/groundwater/docs/List%20of%20adjudicated%20basins%20and%20subbasins_01012014.pdf (last updated Jan. 1, 2014) (identifying 24 court judgments over groundwater basins).

131. See John J. Perona, *A Dry Century in California: Climate Change, Groundwater, and a Science-Based Approach for Preserving the Unseen Commons*, 45 ENVTL. L. 641, 646-47 (2015).

132. See BULLETIN 118 CENTRAL SUBBASIN, *supra* note 17, at 5; BULLETIN 118 WEST COAST SUBBASIN, *supra* note 20, at 5.



ties.¹³³ However, the act did not require any local administration to actually adopt a management plan.¹³⁴ Ten years later, Senate Bill 1938 added a provision that required local entities requesting state funds for groundwater projects to implement a groundwater management plan that meets particular requirements, including establishing basin-wide objectives, groundwater monitoring, and coordination with other local agencies in the planning process.¹³⁵ In 2009, Senate Bill X7 6 (“S.B.X.7 6”) required local or state agencies to monitor all groundwater basins or sub-basins throughout the state, with state regulation acting only as a backdrop in the event that no local agency steps forward.¹³⁶ Local entities that decline to exercise monitoring authority will not receive state water grants, providing a powerful incentive to actively monitor local resources.¹³⁷ S.B.X.7 6 also provided a framework for prioritizing groundwater basins based on numerous factors, including the population utilizing groundwater from that basin, the degree of reliance on that water as a primary source, and any existing negative impacts on the basin.¹³⁸

These pieces of legislation indicate an intent to more deeply involve local agencies in groundwater management, but together they left numerous regulatory gaps. In 2014, the legislature created a comprehensive regime to fill those gaps in the form of the Sustainable Groundwater Management Act (“SGMA”).¹³⁹ SGMA is composed of three separate bills (Assembly Bill 1739,¹⁴⁰ Senate Bill 1168,¹⁴¹ and Senate Bill 1319¹⁴²), a central message of which is that “groundwater management in California is best accomplished lo-

133. Act of Sep. 28, 1992, ch. 947, 1992 Cal. Stat. 4514 (codified at Cal. Water Code §§ 10750 *et seq.*).

134. *See* Cal. Water Code § 10750.4 (1992) (“Nothing in this part requires a local agency overlying a groundwater basin to adopt or implement a groundwater management plan . . .”).

135. Act of Sep. 16, 2002, ch. 603, 2002 Cal. Stat. 3365 (codified at Cal. Water Code §§ 10753, 10795.4); *see* Cal. Water Code § 10753.7.

136. Act of Nov. 6, 2009, ch. 1, 2009 Cal. Stat. 5367 (codified at Cal. Water Code §§ 10920-10936, 12924); *see also* Josh Patashnik, *All Groundwater Is Local: California’s New Groundwater Monitoring Law*, 22 STAN. L. & POL’Y REV. 317, 322-23 (2011).

137. Cal. Water Code § 10933.7.

138. *Id.* § 10933(b). For a list of the groundwater basins and their designated priority levels, *see* CASGEM *Groundwater Basin Prioritization Results*, CAL. DEP’T OF WATER RES., http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewidePriority_Abridged_05262014.pdf (last visited Dec. 14, 2015).

139. Cal. Water Code §§ 10720-10736 (2015).

140. *See* Assemb. B. 1739, 2013-2014 Leg. (Cal. 2014).

141. *See* S.B. 1168, 2013-2014 Leg. (Cal. 2014).

142. *See* S.B. 1319, 2013-2014 Leg. (Cal. 2014).

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cally.”¹⁴³ Continuing where S.B. 1938 and S.B.X.7 6 left off, SGMA requires the formation of groundwater sustainability agencies (“GSAs”) from local agencies or entities for all basins throughout the state.¹⁴⁴ SGMA does not apply to adjudicated areas managed according to the judicial decree by a designated agency, but it does require the agency to submit annual groundwater reports to the DWR.¹⁴⁵

GSAs are directed to develop and implement groundwater sustainability plans (“GSPs”) for each medium-priority or high-priority basin, covering in scope the entire basin.¹⁴⁶ A GSP must include numerous requirements, most importantly including clear objectives to achieve a sustainability goal in the basin within 20 years.¹⁴⁷ However, the SWRCB can grant two extensions of five years each to the GSA if there is good cause for the extension, thus potentially making sustainability a 30-year target for some basins.¹⁴⁸ GSAs have significant authority to implement GSPs in its jurisdiction, including the ability to “adopt rules, regulations, ordinances, and resolutions for the purpose of this part.”¹⁴⁹ GSAs are authorized to acquire real and personal property rights, including water rights, and can conserve or store water for any purpose, such as groundwater recharge.¹⁵⁰ GSAs can also require registration of pumping wells, impose pumping limits, request data on groundwater extrac-

143. See Letter from Edmund G. Brown Jr., Governor of Cal., to Members of the Cal. Legislature (Sept. 16, 2014), available at https://www.gov.ca.gov/docs/Groundwater_Signing_Message.pdf.

144. Cal. Water Code § 10723(a) (2015).

145. See *id.* § 10720.8.

146. *Id.* § 10727. GSPs are intended to achieve “sustainable groundwater management,” which is defined as “the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.” *Id.* § 10721(u). The term “undesirable results,” in turn, is defined as one of the following: (1) chronic lowering of groundwater levels resulting in depletion of water resources; (2) reduction in groundwater storage; (3) intrusion of seawater; (4) impairment of water quality; (5) land subsidence; or (6) depletion of interconnected surface water that interferes with surface uses. See *id.* § 10721(w).

147. *Id.* § 10727.2; *id.* § 10727.2(b)(1). The term “sustainability goal” is defined as a GSP that seeks to achieve sustainable groundwater management by implementing measures designed to “ensure that the applicable basin is operated within its sustainable yield.” *Id.* § 10721(t). “Sustainable yield” is defined as “the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result.” *Id.* § 10721(v).

148. See *id.* § 10727.2(b)(3).

149. *Id.* § 10725.2(b).

150. *Id.* § 10726.2(a)-(b).

tions, and assess fees to support implementation of the groundwater sustainability program.¹⁵¹

SGMA provides for optional state backstop management in the event that GSA management is inadequate. If a GSA is formed and fails to submit a satisfactory GSP by a particular deadline, depending on the priority designation of the basin, then the SWRCB may designate the basin as probationary.¹⁵² The local GSA would then have 180 days to fix the deficiencies in its planning process and produce a sustainable GSP.¹⁵³ If the GSP fails to remedy the deficiency, the SWRCB may develop an interim plan that must include a GSP to achieve the sustainability goal for the basin.¹⁵⁴

While SGMA makes no mention of stormwater or rainwater, the expansive power bestowed upon GSAs allows for these local entities to seek greater groundwater recharge in any manner they see fit. In many localities where recharge is heavily dependent on precipitation, stormwater or rainwater collection may be necessary to ensure that the basin's GSP achieves sustainability within the timeframe provided by SGMA. However, the long-time period for compliance creates a potential regulatory lag, where efforts to prevent further overdraft and subsidence in the near future may require immediate action. Until regional management agencies are in place and implement adequate GSPs to achieve groundwater sustainability, alternative outlets should be pursued to mobilize efforts to reduce urban runoff and improve the collection of precipitation for groundwater recharge.

F. Los Angeles Municipal NPDES Stormwater Permit

The Clean Water Act, originally enacted in 1972, establishes a permitting structure for regulating discharges of pollutants into receiving waters of the United States, as well as providing ambient water quality standards for surface waters.¹⁵⁵ The standards only apply to "point sources," a term which is broadly defined as "any discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged."¹⁵⁶ This definition explicitly excludes agricultural stormwater discharges or return flows from

151. *See id.* §§ 10725.6, 10726.4(a), 10725.8(c)-(d), 10730, 10730.2.

152. *See id.* § 10735.2(a).

153. *Id.* § 10735.4(a).

154. *Id.* §§ 10735.4(c), 10735.6(b); *see id.* § 10735.8.

155. *See* Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816 (codified at 33 U.S.C. §§ 1251-1387 (2012)).

156. 33 U.S.C. § 1362(14).

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regulation.¹⁵⁷ Since urban stormwater runoff is diffuse water not originating from a discrete conveyance, it is also considered a non-point source under the act.¹⁵⁸ However, when that stormwater is concentrated into drains and stormwater outfall systems, it arguably falls under the definition of a point source.¹⁵⁹

In recognizing the importance of reducing urban stormwater pollution, Congress enacted the Water Quality Act of 1987 to include urban stormwater discharges from industrial or municipal stormwater systems under the National Pollution Discharge Elimination System (“NPDES”) permitting requirements.¹⁶⁰ The primary goals of the amendment regarding stormwater discharge were to clarify what stormwater systems constituted a point source and to progressively require both industrial and municipal stormwater facilities to obtain NPDES permits for their discharge.¹⁶¹ Under the new Clean Water Act Section 402(p), industrial stormwater discharges became subject to all relevant NPDES requirements.¹⁶² Municipal facilities were required to prohibit non-stormwater discharge into storm sewers and include “controls to reduce the discharge of pollutants to the maximum extent practicable.”¹⁶³ This was not a strict effluent limit like for other permitted sources, but instead pushed for best management practices and other techniques to eliminate easy pollution targets.¹⁶⁴

The Environmental Protection Agency (“EPA”), tasked with administering the NPDES program, was directed to issue regulations setting forth permit application requirements for both industrial and MS4 discharges,¹⁶⁵ as well as substantive regulations over other to-be-designated stormwater discharges,¹⁶⁶ by different deadlines depending on the source. For MS4s serving a population more than 250,000 people, the EPA was given two years to adopt permit

157. *See id.*

158. *See* Craig, *supra* note 55, at 319-20.

159. *See id.* at 320-21 (citing sources to support this claim).

160. *See* Pub. L. No. 100-4, § 405, 101 Stat. 7, 69 (codified at 33 U.S.C. § 1342(p)). For a history of how stormwater discharge was treated under the Clean Water Act prior to this amendment, see Craig, *supra* note 55, at 344-47.

161. 33 U.S.C. § 1342(p); *see* Craig, *supra* note 55, at 343. When originally enacted, Section 402(p) exempted five classes of stormwater discharges from regulation until several years later. *See* 33 U.S.C. § 1342(p)(2).

162. 33 U.S.C. § 1342(p)(3)(A).

163. *Id.* § 1342(p)(3)(B)(ii)-(iii).

164. *Id.* § 1342(p)(3)(B)(iii); *see also* Melissa K. Scanlan & Stephanie Tai, *Marginalized Monitoring: Adaptively Managing Urban Stormwater*, 31 UCLA J. ENVTL. L. & POL'Y 1, 19 (2013).

165. 33 U.S.C. § 1342(p)(4).

166. *Id.* § 1342(p)(6).

application regulations.¹⁶⁷ Applications for those permits were required to be submitted within three years after the amendment was enacted, and the EPA had to issue or deny a permit within four years after the amendment.¹⁶⁸ The EPA's regulations were finalized two years past the deadline, and they required that MS4s include in their application a proposed management program to reduce pollutants in permitted discharges and to detect and remove illicit discharges into the storm sewers, along with other provisions for monitoring and best management practices.¹⁶⁹

Following the Clean Water Act's Section 402(p) stormwater discharge permitting requirements, the SWRCB has taken the initiative to encourage greater stormwater collection in approving the municipal stormwater permit for the City of Los Angeles.¹⁷⁰ On June 16, 2015, the SWRCB issued Order WQ 2015-0075 that amended the MS4 discharge permit issued to Los Angeles County in 2012.¹⁷¹ The Order upheld the 2012 permit but made several revisions based on comments made by numerous challengers.¹⁷² In the Order, the SWRCB affirmed that all regional water boards should strive to implement green infrastructure or low impact development principles, and should encourage projects that "capture, infiltrate, and reuse storm water and support a local sustainable water supply."¹⁷³ However, this language merely contains general

167. *Id.* § 1342(p)(4)(A). These regulations over large MS4s were referred to as the EPA's Phase I stormwater permitting rules.

168. *Id.*

169. *See* National Pollutant Discharge Elimination System Permit Application Regulations for Storm Water Discharges, 55 Fed. Reg. 47,990, 48,052-58 (Nov. 16, 1990) (codified at 40 C.F.R. pt. 122, 123, 124); 40 C.F.R. § 122.26(d)(2)(iv) (1990).

170. Under the NPDES permit program, states were allowed to voluntarily assume permitting authority, subject to EPA oversight. *See* 33 U.S.C. § 1342(b), (d), (i). California has assumed this authority, naming the SWRCB and other Regional Water Boards as the agencies in charge of managing NPDES permits. *See NPDES State Program Information*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/npdes/npdes-state-program-information> (last visited Dec. 14, 2015); *National Pollutant Discharge Elimination System (NPDES) – Wastewater*, CAL. STATE WATER RES. CONTROL BD., http://www.swrcb.ca.gov/water_issues/programs/npdes/ (last updated Oct. 8, 2015).

171. Order WQ 2015-0075, 2015 WL 4071332 (Cal. State Water Res. Control Bd. June 16, 2015) [hereinafter Order WQ 2015-0075]; *see also* CAL. REG'L WATER QUALITY CONTROL BD., L.A. REGION, ORDER NO. R4-2012-0175 AS AMENDED BY STATE WATER BOARD ORDER WQ 2015-0075: NPDES PERMIT NO. CAS004001 (2015) [hereinafter AMENDED ORDER NO. R4-2012-0175], *available at* http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/la_ms4/2015/OrderR4-2012-0175-FinalOrderasamendedbyOrderWQ2015-0075.pdf.

172. Order WQ 2015-0075, *supra* note 171, at *1.

173. *Id.* at *34.

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principles that must be considered at the planning stage, without any enforceable mandates to carry out particular stormwater or rainwater collection actions.¹⁷⁴ The Order also states that allowing limited degradation of many high quality water sources is necessary to accommodate economic development, and capturing all stormwater following a storm event would not be in the best interest of the public given the resources and costs that it would require.¹⁷⁵ The Order received backlash from environmental groups, who thought that the SWRCB did not go far enough because it would allow some municipalities to develop rainwater capture systems without having to actually construct and operate them.¹⁷⁶

IV. CURRENT EFFORTS TO COLLECT RAINWATER AND STORMWATER IN SOUTHERN CALIFORNIA

Armed with the plethora of legal bases for regulating stormwater, many authorities and private entities in Southern California have initiated programs to reduce urban runoff and to capture more precipitation for on-site use or for infiltration into underground aquifers. Below is an outline of several of these programs.

A. Rainwater Harvesting in Southern California

The City of San Diego has released a guide for homeowners and landscapers that provides both simple and comprehensive techniques for reducing runoff and capturing rainwater on-site for later non-potable use.¹⁷⁷ The guide provides helpful background information about water conditions in the area, including the fact that up to 50% of water usage is for landscaping irrigation and that the city only receives an average of ten inches of rainfall each year.¹⁷⁸ The guide recommends directing water from gutters and down-

174. The revised permit requires municipalities to develop a Planning and Land Development Program for all new development and redevelopment projects, which must minimize the amount of impervious cover created by those projects and “mimic predevelopment hydrology through infiltration, evapotranspiration and rainfall harvest and use.” AMENDED ORDER NO. R4-2012-0175, *supra* note 171, at 98, 101. This mandate is largely the same as existing Los Angeles County ordinances that would require the same measures for most development projects for municipal stormwater systems. *See* discussion *supra* Part III.D.

175. *Id.* at *19.

176. *See* Monte Morin, *L.A. County’s Plan to Capture Stormwater Could Be State Model*, L.A. TIMES (June 17, 2015, 2:30 AM), <http://www.latimes.com/local/california/la-me-stormwater-runoff-20150617-story.html>.

177. *See* SAN DIEGO RAINWATER HARVESTING GUIDE, *supra* note 75.

178. *Id.* at 2-3.

sputs to infiltration zones instead of concrete areas to reduce the amount of stormwater generated after rain events.¹⁷⁹ The guide also includes a detailed overview of where to locate rain barrels and how to maintain them to effectively prevent negative effects such as overflow, mosquito breeding, or other causes of contamination.¹⁸⁰ The guide indicates that rainwater use would be limited to non-potable functions,¹⁸¹ but in light of the high water use in landscaping, adherence to the principles in the guide could greatly reduce the demand for potable water in times of shortage. The city also acknowledges some potential disadvantages of rainwater harvesting, including the potentially high cost of installation, the long duration of operation required to recover those costs, and the limited effectiveness of storing rainwater during wet seasons for dry periods, especially given the uncertainty of rainfall in the region.¹⁸²

Los Angeles has also taken the initiative to encourage rainwater harvesting by offering rebates for rain barrels. Pilot programs to test the effectiveness of rain barrels began back in 2009, where the city paid to install different sizes of rain barrels for hundreds of residents in Mar Vista and Hollywood.¹⁸³ Five years later, Mayor Eric Garcetti offered one thousand rain barrels of 45 or 55 gallon capacity, donated by Coca-Cola, for free to residents in the fall of 2014.¹⁸⁴ These barrels were claimed quickly, and demand for barrels persisted.¹⁸⁵ Mayor Garcetti extended the free barrel giveaway by 400 additional units and offered rebates of up to \$100 for barrels of at least 50 gallons.¹⁸⁶ This rebate program is still active, allowing for customers of the Los Angeles Department of Water and Power (“LADWP”) to acquire up to four free rain barrels through the Met-

179. *Id.* at 5, 8-12.

180. *Id.* at 13-18.

181. *Id.* at 4.

182. See *Rainwater Harvesting Information*, CITY OF SAN DIEGO, <http://www.sandiego.gov/water/conservation/rainwater.shtml> (last visited Dec. 14, 2015).

183. See Molly Peterson, *LA Residents Testing New Water Conservation Program*, S. CAL. PUB. RADIO (Oct. 12, 2009), <http://www.scpr.org/news/2009/10/12/7054/rain-barrel/>.

184. See City News Serv., *If It Ever Rains Again, Los Angeles Wants You to Catch It in Free Rain Barrels*, L.A. DAILY NEWS (Nov. 10, 2014, 2:28 PM), <http://www.dailynews.com/general-news/20141110/if-it-ever-rains-again-los-angeles-wants-you-to-catch-it-in-free-rain-barrels>.

185. See *Los Angeles Runs out of Free Rain Barrels, Offers \$100 Rebate to Buy Your Own*, L.A. DAILY NEWS (Nov. 13, 2014, 2:27 PM), <http://www.dailynews.com/environment-and-nature/20141113/los-angeles-runs-out-of-free-rain-barrels-offers-100-rebate-to-buy-your-own>.

186. *Id.*

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ropolitan Water District (“MWD”).¹⁸⁷ Rebates range from \$75-\$100 per barrel, or \$300-\$400 per cistern.¹⁸⁸ TreePeople, a non-profit organization dedicated to improving Los Angeles’s climate resilience and environmental resources, sells rain barrels at a reduced cost of \$85 per barrel, down from a retail price of \$130-\$150, to ensure that those eligible for the state rebate can acquire a barrel for free.¹⁸⁹ TreePeople has also installed a 216,000-gallon capacity cistern in its park in Coldwater Canyon, which is used to collect and filter rainwater for use in landscaping irrigation throughout the park during dry periods.¹⁹⁰

While the rain barrel program has gained traction among the environmental community, others are more skeptical of its effectiveness. The high cost of rain barrels equates to a price of \$654,000 per acre-foot of storage capacity, approximately over 300 times the cost of larger storage expansion projects at dams.¹⁹¹ If a 50-gallon rain barrel could be filled and emptied on an average of three times per year, that water use would amount to about 0.1% of a household’s annual water use.¹⁹² Ultimately, the cost of water harvested in rain barrels or cisterns could be up to 20 times the wholesale cost of water in Southern California, and up to 10 times the cost of desalination of seawater.¹⁹³ However, others have calculated rainwater harvesting costs as low as \$1,000 per acre-foot in certain scenarios, making rain barrels more affordable than alternative storage increases in those circumstances.¹⁹⁴ Even so, the limited capacity of rain barrel storage, and its dependence on uncertain precipitation, likely means that rainwater harvesting will be unable to provide long-term drought elasticity on its own without other significant water conservation measures. Regardless, rainwater harvesting

187. See *Rain Barrel and Tank Information*, TREEPEOPLE, <https://www.treepeople.org/resources/rain-barrels> (last visited Dec. 14, 2015); *Rebates and Programs*, L.A. DEP’T OF WATER & POWER, <https://www.ladwp.com/ladwp/faces/ladwp/residential/r-savemoney/r-sm-rebatesandprograms> (last visited Dec. 14, 2015).

188. See *Rebates and Programs*, L.A. DEP’T OF WATER & POWER, *supra* note 187; *Rain Barrels and Cisterns*, SOCAL WATERSMART, http://socalwatersmart.com/?page_id=2973 (last visited Dec. 14, 2015).

189. See TREEPEOPLE, *supra* note 187.

190. See *Visit Us*, TREEPEOPLE, <https://www.treepeople.org/visit> (last visited Dec. 14, 2015).

191. See Jay Lund, *The Romance of Rain Barrels*, CAL. WATERBLOG (Feb. 8, 2015), <http://californiawaterblog.com/2015/02/08/the-romance-of-rain-barrels/>.

192. *Id.*

193. *Id.*

194. See Molly Peterson, *California Drought: Are Rain Barrels Really a Good Idea?*, S. CAL. PUB. RADIO (Feb. 11, 2015), <http://www.scpr.org/news/2015/02/10/49745/are-rain-barrels-really-a-good-idea/>.

has been a productive indicator of the perception of, and reaction to, water scarcity among the public.

B. Los Angeles Agencies: Turning Stormwater into Groundwater

More importantly than distributed rainwater capture in Los Angeles is the significant amount of stormwater being captured for groundwater recharge. The Los Angeles County Department of Public Works (“LADPW”) currently manages twenty-seven spreading grounds facilities, several of which are rubber dams.¹⁹⁵ The two primary facilities for the Central and West Coast Subbasins are the Rio Hondo and the San Gabriel Coastal Spreading grounds, both located at the Montebello Forebay site and operating since the late 1930s.¹⁹⁶ The Rio Hondo facility spans 570 acres with a storage capacity of 3,694 acre-feet of water, and water percolates into the aquifer at a rate of about 400 cubic feet per second (equivalent to almost 800 acre-feet per day).¹⁹⁷ The San Gabriel facility includes 128 acres of spreading grounds and an additional 308 acres of river channel, the combination of which can store 1,463 acre-feet and percolates water at a rate of about 150 cubic feet per second, or almost 300 acre-feet per day.¹⁹⁸ Together, these two facilities account for almost half of the total recharge for the two groundwater basins, averaging about 150,000 acre-feet of recharge annually.¹⁹⁹

The Los Angeles County Flood Control District operates the Rio Hondo and San Gabriel facilities, seeking to maximize the amount of stormwater diverted into the grounds after a storm event.²⁰⁰ During dry periods, the Water Replenishment District of Southern California (“WRD”) purchases imported or recycled water for artificial groundwater replenishment via the spreading

195. See *Index of Spreading Facilities Owned and Operated by the Department*, L.A. CNTY. DEP’T OF PUB. WORKS, <http://dpw.lacounty.gov/wrd/spreadingground/information/> (last visited Dec. 14, 2015). For background information about spreading grounds, see notes 68-73 and accompanying text.

196. Johnson, *supra* note 68.

197. *Id.*; see also *Spreading Facility Information: Rio Hondo Coastal Spreading Grounds*, L.A. CNTY. DEP’T OF PUB. WORKS, <http://dpw.lacounty.gov/wrd/spreadingground/information/facdept.cfm?facinit=27> (last visited Dec. 14, 2015).

198. Johnson, *supra* note 68. See also *Spreading Facility Information: San Gabriel Coastal Spreading Grounds*, L.A. CNTY. DEP’T OF PUB. WORKS, <http://dpw.lacounty.gov/wrd/spreadingground/information/facdept.cfm?facinit=32> (last visited Dec. 14, 2015); *Spreading Facility Information: S.G. River (Montebello Forebay)*, L.A. CNTY. DEP’T OF PUB. WORKS, <http://dpw.lacounty.gov/wrd/spreadingground/information/facdept.cfm?facinit=28> (last visited Dec. 14, 2015).

199. Johnson, *supra* note 68; *Montebello Forebay Facilities*, L.A. CNTY. DEP’T OF PUB. WORKS, <https://dpw.lacounty.gov/wrd/publication/system/montebello.cfm> (last visited Dec. 14, 2015).

200. *Id.*

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grounds.²⁰¹ As a result, since 1962 about 40% of cumulative groundwater recharge at the Rio Hondo and San Gabriel facilities was stormwater, while recycled water was about 26% of recharge and imported water makes up the remaining 34%.²⁰² Currently, recycled water usage has increased to 40% while imported water has decreased to 20%.²⁰³ However, as the price of imported water continues to increase during times of drought, it will become increasingly important for the spreading grounds to improve groundwater recharge from local sources. This will also make those imports available for other uses throughout the state, which is crucial to resilience to drought at a broader statewide scope.

The WRD, formed in 1959 to manage the Central and West Coast basins,²⁰⁴ has embarked on a program called Water Independence Now (“WIN”), which seeks to eliminate reliance on imported water for groundwater recharge by developing local groundwater resources through stormwater and recycled water projects.²⁰⁵ One such project was the construction of a pipeline in 2011 to interconnect the Rio Hondo and San Gabriel Spreading Grounds.²⁰⁶ This pipeline gave the facilities more operational flexibility to manage incoming stormwater, allowing for an increase in stormwater recharge capacity by approximately 1,300 acre-feet per year.²⁰⁷ Downstream of the spreading grounds facilities on the San Gabriel

201. *Id.*

202. *Id.* Recharge from stormwater was about 2.23 million acre-feet of water. *Id.*

203. *Id.*

204. See *Water Replenishment District History*, WATER REPLENISHMENT DIST. OF S. CAL., <http://www.wrd.org/about/water-district-history.php> (last visited Dec. 14, 2015). The WRD is also the official Groundwater Level Monitoring Entity for the two basins under the California Statewide Groundwater Elevation Monitoring (CASGEM) program, which was developed by the DWR after the enactment of S.B.X.7 6. See *Water Replenishment District Receives Official Designation as Groundwater Monitoring Entity for Central and West Coast Sub-Basins*, WATER REPLENISHMENT DIST. OF S. CAL. (Oct. 27, 2011), <http://www.wrd.org/news/pdf/111027%20CASGEM%20Release.pdf>; *California Statewide Groundwater Elevation Monitoring (CASGEM)*, CAL. DEP'T OF WATER RES., <http://www.water.ca.gov/groundwater/casgem/> (last visited Dec. 14, 2015).

205. See *Planning for the Future with Water Independence Now (WIN)*, WATER REPLENISHMENT DIST. OF S. CAL., http://www.wrd.org/news/water-articles.php?url_nws=water-independence-network (last visited Dec. 14, 2015). WRD works extensively with LADPW on many of these projects.

206. See Ted Johnson, *The Increasing Role of Storm Water for Groundwater Recharge in the Central Basin, Los Angeles Coastal Plain, Southern California*, WATER REPLENISHMENT DIST. OF S. CAL. (2011) [hereinafter Johnson, *Storm Water for Groundwater Recharge Presentation*], available at <http://nwri-usa.org/pdfs/JohnsonPresentation-final.pdf>.

207. See *Planning for the Future with Water Independence Now (WIN)*, WATER REPLENISHMENT DIST. OF S. CAL., *supra* note 205.

River, numerous rubber dams are in place to increase infiltration rate of water moving along the river system.²⁰⁸ The Whittier Narrows Dam, constructed in 1957 by the U.S. Army Corps of Engineers, captures excess stormwater to prevent floods and directs it to the Rio Hondo and San Gabriel spreading grounds facilities.²⁰⁹ After the removal of adjacent oil wells, the storage capacity of the conservation pool at the Whittier Narrows Dam increased, allowing an additional 3,000 acre-feet of stormwater capture annually.²¹⁰ The Leo J. Vander Lans Water Treatment Facility, located by the Alamitos Gap Barrier project, was expanded in 2014 to allow for the injections of water to prevent seawater intrusion to be from 100% recycled sources.²¹¹ This reduces the need for approximately 3,000 acre-feet of imported water per year.²¹²

The SWRCB in 2009 passed Resolution No. 2009-0011, which adopted a State Recycled Water Policy that included goals for stormwater capture.²¹³ In particular, California was directed to increase stormwater use compared to 2007 levels by at least 500,000

208. Five rubber dams were constructed in the 1980s along the river. *See Montebello Forebay Facilities*, L.A. CNTY. DEP'T OF PUB. WORKS, *supra* note 199. One rubber dam built in 1994 created a 76-acre spreading area with storage capacity of 495 acre-feet. *See Downstream Facilities*, L.A. CNTY. DEP'T OF PUB. WORKS, <http://ladpw.org/wrd/publication/system/downstream.cfm> (last visited Dec. 14, 2015). Another rubber dam built in 1995 directs flows from the San Gabriel River into the Santa Fe Spreading Grounds. *Id.* This spreading grounds facility can store 540 acre-feet of water with an estimated recharge rate of 400 cubic feet per second. *See Santa Fe Spreading Grounds*, L.A. CNTY. DEP'T OF PUB. WORKS, <http://dpw.lacounty.gov/wrd/spreadingground/information/facdept.cfm?facinit=1> (last visited Dec. 14, 2015). In 2008, two new rubber dams were added in the San Gabriel River that increases stormwater capture and infiltration by about 3,600 acre-feet per year. *See Johnson, Storm Water for Groundwater Recharge Presentation*, *supra* note 206; *San Gabriel River Rubber Dams*, WATER REPLENISHMENT DIST. OF S. CAL., http://www.wrd.org/engineering/groundwater-los-angeles.php?url_proj=san-gabriel-river-rubber-dams (last visited Dec. 14, 2015).

209. *See Whittier Narrows Conservation Pool*, WATER REPLENISHMENT DIST. OF S. CAL., http://www.wrd.org/engineering/groundwater-los-angeles.php?url_proj=whittier-narrows-conservation-pool (last visited Dec. 14, 2015).

210. Johnson, *Storm Water for Groundwater Recharge Presentation*, *supra* note 206.

211. *See Leo J. Vander Lans Water Treatment Facility*, WATER REPLENISHMENT DIST. OF S. CAL., http://www.wrd.org/engineering/groundwater-los-angeles.php?url_proj=vander-lans-water-treatment (last visited Dec. 14, 2015).

212. *See Planning for the Future with Water Independence Now (WIN)*, WATER REPLENISHMENT DIST. OF S. CAL., *supra* note 205.

213. *See Res. No. 2009-0011: Adoption of a Policy for Water Quality Control for Recycled Water*, 2009 WL 6485137 (Cal. State Water Res. Control Bd. 2009); *Recycled Water Policy*, CAL. STATE WATER RES. CONTROL BD., http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/ (last updated Sept. 9, 2015). An amendment to the policy was passed in 2013. *See Res. No. 2013-0003: Adoption of an Amendment to the Policy for Water Quality Control for Recycled Water Concerning Monitoring Requirements for Constituents of Emerging Concern*, 2013 WL 492575 (Cal. State Water Res. Control Bd. 2013).

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acre-feet per year by 2020, and at least one million acre-feet per year by 2030.²¹⁴ The SWRCB considers stormwater to be crucial to sustainable groundwater development and maintenance, evident by the requirement that salt and nutrient management plans for groundwater basins include stormwater capture as a way to augment local water supplies.²¹⁵ The SWRCB committed to requesting priority funding for stormwater projects that increase local water resources, and encouraged water entities to provide financial incentives for similar projects.²¹⁶ This statewide policy indicates continued and growing support for stormwater capture projects in California.

C. LADWP Stormwater Capture Master Plan of 2015

In August of 2015, the LADWP, the leading municipal water and power utility for Los Angeles County, produced a Stormwater Capture Master Plan in collaboration with TreePeople that seeks to analyze methods for increasing stormwater capture in Los Angeles.²¹⁷ The plan was primarily intended to be a guide for policymakers about the LADWP's strategies for capturing stormwater over the following 20 years.²¹⁸ Much of the plan is focused on utilizing groundwater reservoirs as the best mechanism for storing stormwater for use during dry conditions.²¹⁹ The plan bases its projections for future stormwater capture projects on two different scenarios of supportive conditions, labeled the "Conservative Scenario" and the "Aggressive Scenario."²²⁰ Conditions that would support the implementation of the master plan include increased political will for stormwater projects, availability of funding, and new government mandates for water use or development.²²¹

214. CAL. STATE WATER RES. CONTROL BD., RECYCLED WATER POLICY 1 (Jan. 22, 2013), available at http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2013/rs2013_0003_a.pdf.

215. *Id.* at 6, 8.

216. *Id.* at 16.

217. See *Stormwater Capture Master Plan*, L.A. DEP'T OF WATER & POWER, https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-w-stormwatercaptureemp (last visited Dec. 14, 2015). Development of the plan began in the fall of 2013. *Id.*

218. *Id.*

219. See L.A. DEP'T OF WATER & POWER, STORMWATER CAPTURE MASTER PLAN 14 (Aug. 2015), available at https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB421767&RevisionSelectionMethod=LatestReleased.

220. *Id.* at 17.

221. *Id.*



The plan states that while existing stormwater capture of incoming flow to the city of Los Angeles²²² into water supply aquifers is about 6%,²²³ the long-term (by 2099) potential for stormwater capture was determined to be 22% for the Conservative Scenario and 31% for the Aggressive Scenario.²²⁴ The plan realistically sees a capture potential of between 68,000 and 114,000 additional acre-feet per year within the next 20 years.²²⁵ The plan then highlights a number of stormwater capture project alternatives, categorized as one of the following: 1) on-site direct use; 2) sub-regional direct use; 3) on-site infiltration; 4) green-street programs; 5) sub-regional infiltration; and 6) centralized projects.²²⁶ The plan quantifies the implementation potential for each type of project and analyzes the cost-effectiveness of the categorized projects, considering factors such as capture volume, tributary area covered, capital costs, and operation and maintenance costs.²²⁷

The plan determines that “centralized projects can provide the greatest opportunities for the most cost-effective means of capturing stormwater for water supply,” often because land ownership and other project-specific requirements are already in place.²²⁸ Each project category, except for on-site direct use (primarily rainwater harvesting), was found to contain projects that could be implemented at a cost less than or equal to the value of the saved water.²²⁹ The plan concludes that water collected and used for groundwater recharge has a value to the LADWP of \$1,100 per acre-foot, equivalent to the saved cost of buying an acre-foot of imported water from the MWD for the same purpose.²³⁰ The plan also concludes that water for direct use is worth \$1,550 per acre-foot.²³¹ Both of these figures make stormwater capture programs “a sound investment in the City’s future water supply portfolio.”²³² The plan

222. “Incoming flow” is defined as precipitation, run-on from tributary or neighboring areas, and applied irrigation. *Id.* at 19.

223. *Id.* The 6% currently being captured is composed of 29,000 acre-feet per year by active groundwater recharge by water agencies and 35,000 acre-feet per year by incidental or natural infiltration. *Id.* at 107.

224. The increase in stormwater capture under the Conservative Scenario would equate to about 115,000 acre-feet per year, while the increase under the Aggressive Scenario would be about 194,000 acre-feet per year. *Id.* at 19.

225. *Id.* at 77, 107.

226. *Id.* at ES-8–ES-11.

227. *See id.* at ES-10–ES-11.

228. *Id.* at ES-10.

229. *Id.* at ES-11.

230. *Id.* at 107.

231. *Id.*

232. *Id.*

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advises that “immediate, significant, and sustained efforts on behalf of LADWP and its partners . . . is required.”²³³ This includes persistent pursuit of funding opportunities, improved collaboration cooperation between similarly-tasked agencies, and exploration of new project implementation mechanisms.²³⁴

V. LEGAL SOLUTIONS TO EXPAND STORMWATER COLLECTION AND RAINWATER HARVESTING IN SOUTHERN CALIFORNIA

While existing measures to convert precipitation to a usable source of water show great promise, there is significant room to improve upon stormwater and rainwater collection in Southern California. The potential for converting most, if not all, of the catchable precipitation into groundwater recharge or non-potable use could eventually allow the region to become far less dependent on water imports. To achieve that goal, and in turn to improve drought resilience statewide, the legal regime governing stormwater collection and rainwater harvesting should be amended to increase obligations to prevent urban runoff. Below are several proposals for how this could be accomplished.

A. Amend Los Angeles County Ordinances to Prohibit Use of Potable Water for Non-Potable Purposes

Landscaping in Southern California urban areas remains a surprisingly large percentage of potable water use. San Diego uses between 30% and 50% of its water for landscaping.²³⁵ In Los Angeles County, up to 70% of daily water use is applied outdoors for watering plants or filling swimming pools.²³⁶ While many measures are in place to reduce the magnitude of outdoor water use during the drought,²³⁷ these are merely voluntary or short-term solutions. A

233. *Id.*

234. *Id.*

235. See SAN DIEGO RAINWATER HARVESTING GUIDE, *supra* note 75, at 2.

236. See *Drop Your Water Weight: Kick-Start Your Drought Diet*, L.A. CNTY. WATERWORKS DIST.S., <https://dpw.lacounty.gov/wwd/web/Conservation/WaterConservation.aspx> (last visited Dec. 14, 2015).

237. See *Water Conservation During the Drought Emergency*, L.A. CNTY. WATERWORKS DIST.S., <https://dpw.lacounty.gov/wwd/web/Conservation/Drought.aspx> (last visited Dec. 14, 2015) (highlighting programs to meet the conservation goals that include gray water systems, rain barrels, water-saving appliances, and reducing excess water use for lawns or landscaping). The California Water Commission also approved a landscaping ordinance in 2015 that significantly limits the cover of grass lawns for all new residential construction or major renovation projects, with even more stringent restrictions for commercial or industrial buildings. See Press Release, Cal. Dep’t of Water Res., Water Commission Adopts Model Water Efficient Landscape Ordinance; Public Comment Helped Shape Revisions (July 15,

drastic change to the law addressing landscaping water use may be necessary to overcome future uncertainty about climate, drought conditions and population change in the region that could otherwise cripple local water supplies.

The most direct solution to the excess landscaping water use is to prohibit the use of potable water for that purpose. This would prevent landowners from taking water that could otherwise be used to meet the critical needs of the population, such as for consumption and sanitation, and applying it outdoors when lower-quality water would suffice. With such a measure in place, Southern California could reduce the amount of imported water it must purchase, or could direct that water to more pressing uses. Landscaping is the most efficient when it matches the climate where it is located; when plants are not suited to a dry, hot environment like in California, water demand will increase due to evaporation and runoff.²³⁸ Requiring residents of Southern California to water their plants using only non-potable water will cause a dramatic shift toward climate-appropriate landscaping and away from the water-intensive lawns and plants that are currently in place. With only recycled water and rainwater available for landscaping, landowners will be forced to be more conscious about their choices in vegetation type and layout.

Expansion of rainwater harvesting for on-site direct use would be necessary to establish a sufficient water supply in Southern California for landscaping irrigation. This could be accomplished by tightening local ordinances on low-impact development and water conservation. In this regard, California would be wise to mimic some of the rainwater harvesting regulations in place in Australia. In the state of Queensland, construction projects for new residential buildings before February 1, 2013 were required to meet particular water-saving targets, which could be accomplished through rainwater tanks, stormwater re-use, or gray water use.²³⁹ If a developer decides to install a rainwater tank, there are stringent standards for tank installation. Tanks must collect rainfall from at least half of the available roof area or 100 square meters, whichever is

2015), *available at* <http://www.water.ca.gov/news/newsreleases/2015/071515b.pdf>. The ordinance exempts landowners using only gray water or rainwater for landscaping irrigation from most of the requirements. *Id.*

238. See JULIE SAARE-EDMONDS, CAL. DEP'T OF WATER RES., WATER EFFICIENT LANDSCAPES I (June 2002), *available at* http://www.water.ca.gov/wateruseefficiency/docs/water_efficient_landscapes.pdf.

239. See *Water Savings Targets*, QUEENSLAND DEP'T OF HOUSING & PUB. WORKS, <http://www.hpw.qld.gov.au/construction/BuildingPlumbing/Building/WaterSupplySystems/Pages/WaterSavingsTargets.aspx> (last updated Sept. 1, 2015).

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larger.²⁴⁰ For detached single homes, the tank must be a minimum of 5,000 liters (equivalent to over 1,300 gallons) in size; for non-detached homes, the tank must be a minimum of 3,000 liters (or almost 800 gallons).²⁴¹ The large size of these tanks makes it feasible to collect and use water year-round, despite the potential for significant drought conditions. Further, the tanks must be connected to the water system for internal use, including all toilet cisterns and cold water washing machine taps.²⁴² Together, these requirements significantly reduce the amount of potable water that will be applied toward non-potable uses.

Like Australia, Southern California could greatly tighten its regulations over new construction projects to require the installation of large rainwater tanks, for landscaping irrigation at the very least. Currently, under Chapter 12.84 of the Los Angeles County Code, new residential construction projects merely need to include two best management practices that together may not reduce much of the stormwater runoff produced by the property.²⁴³ Instead, new construction projects should be required to install a water system that limits potable water to only potable uses. All non-potable uses, such as outdoor watering or indoor toilet flushing, could be hooked up to a separate system that utilizes only rainwater or recycled water for those purposes.

The technology certainly exists for these systems, but the important consideration is the cost of installation. Until rainwater tanks can be made affordable for on-site direct use of water for landscaping, significant rebates may be required to subsidize these installation costs. However, larger rainwater tanks are more cost-efficient than the 50-gallon tanks offered in the Los Angeles rebate program mentioned above.²⁴⁴ For instance, 1,000-gallon rainwater tanks are being offered online at a price of under \$1,000, which is about half the cost per unit of water collected in a 50-gallon tank being sold for over \$100.²⁴⁵ Therefore, any rebate program to offer tanks for existing homes would be more cost-effective if applied to

240. *Id.*

241. *Id.*

242. *Id.*

243. See discussion *supra* Part III.D.

244. See discussion *supra* Part IV.A.

245. See, e.g., *1000 Gallon Poly-Mart Rain Harvesting Tank*, RAINHARVEST SYSTEMS, <http://www.rainharvest.com/1000-gallon-poly-mart-rain-harvesting-tank.asp> (last visited Dec. 14, 2015) (offering a 1,000-gallon tank for a list price of \$881.64, on sale as of the date visited for \$659.95).

tanks of a much larger size, even if installation costs for larger tanks may be somewhat higher.

Larger rainwater tanks are also far more effective for retaining water during El Niño years. A small 50-gallon tank will be limited in the amount of rainwater that can be stored in between storm events, whereas a larger tank could harness far more rainwater and maintain consistent watering schedules throughout the year. To better adapt to El Niño conditions, any laws or programs focused on increasing the amount of rainwater captured for on-site use should include significantly larger rain barrels.

In summary, Los Angeles County ordinances should be strengthened to require not only the incorporation of best management practices but instead to affirmatively prohibit the use of potable water for landscaping, or alternatively for any non-potable use. This will serve the dual purposes of 1) conserving potable water for other uses and 2) requiring new buildings to implement some form of rainwater catchment system or recycled water system. Expanding distributed rainwater harvesting would be a necessary step toward Southern California's push toward maximizing water resources from precipitation and would have the effect of reducing the demand for imported-potable water.

B. Amend SGMA to Require Agencies to Eliminate Imports of Water for Groundwater Recharge

SGMA has been seen as a substantial step forward for groundwater management throughout the state, but it does not come without its flaws. The long-term implementation horizons for groundwater sustainability plans, along with the uncertainty of whether state agencies will step in if local management is insufficient, make it possible that many groundwater basins will continue to be depleted over the ensuing decades. Further, there is some concern over whether groundwater rights will be impacted or whether the jurisdictional boundaries of groundwater sustainability agencies will not align with the physical boundaries of the relevant groundwater basins or sub-basins.²⁴⁶

One major concern with SGMA is the lack of any connection to stormwater-capture efforts. As stated above, SGMA does not contain the terms "stormwater" or "rainwater" in any of its provisions, leaving it up to each GSA to adopt any precipitation harvesting pro-

246. See Wesley A. Miliband, *Regulating Groundwater in California: Will Groundwater Sustainability Agencies Change the Landscape?*, 45 ENVTL. REP. NEWS & ANALYSIS 11,104 (2015).

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grams voluntarily. Any GSPs may work well in conjunction with the stormwater resource plans under the Storm Water Resource Planning Act, as a GSA wishing to implement such a project would need both types of plans in place in order to receive funding from the state.²⁴⁷ However, there is no requirement for the two types of plans to be linked together in order to foster more holistic management over the same resources. There are additional concerns for adjudicated basins such as those under Los Angeles County, where the lack of a GSA makes groundwater regulation even more divided among different entities. While GSAs should be fully authorized to develop plans that include stormwater capture projects to increase local groundwater resources, there is no directive that requires these projects to be pursued in the GSPs themselves.

Another looming issue is the availability of water imports as a mechanism for GSAs to achieve groundwater sustainability. Section 10726.2 of the Water Code authorizes GSAs to “import surface water or groundwater into the agency” in order to meet the objectives of the developed GSP.²⁴⁸ This might encourage GSAs to actively seek water transfers from other districts as a way to achieve a sustainable groundwater supply, instead of developing programs to achieve self-sustaining groundwater independence. Water imports are just another short-term solution that does not add to the cumulative state water supply, whereas maximizing the amount of rainwater used to recharge aquifers is a net addition that would otherwise be lost.

In tune with growing policy supports for developing local water resources, SGMA should be amended to include directives for GSAs to eliminate reliance on imported water for groundwater recharge by a certain deadline. This will force agencies to begin developing these programs now, instead of seeking to remedy declining water levels through water imports. Most, if not all, groundwater basins in California could significantly increase groundwater recharge rates by developing centralized or distributed infiltration from precipitation. It might take some groundwater basins more time to achieve sustainability through those sources alone, and that might also require reductions in pumping rates locally as well. However, a mandated target of no imports for groundwater recharge will force agencies to be highly proactive in developing these programs in the near future before further overdrafts occur.

247. See discussion *supra* Parts III.B, III.E.

248. See Cal. Water Code § 10726.2(b) (2015).



This proposal may have differing consequences depending on the locality. In Los Angeles County, any precipitation collected would otherwise be lost to the ocean and therefore unusable. However, if inland central California areas adopted significant stormwater collection projects, there may be reduced flows that are directed toward surface water sources. Due care would need to be taken by regulators to ensure that existing surface water rights are not impacted by any of these projects. Nevertheless, it is likely that in every region of the state, some precipitation that could be captured for recharge is instead lost to unusable sources.

Another potential consequence of this proposal is groundwater contamination, particularly in agricultural regions where groundwater reservoirs are already heavily polluted with nitrates.²⁴⁹ Requiring the capture of some of this agricultural runoff for aquifer recharge would further pollute these vital groundwater resources. Therefore, any requirements under SGMA for GSAs to eliminate water imports for recharge should include provisions that allow for treatment of that water before it is added to the aquifers. This could be unduly costly for many regions, and that cost should be weighed against the value of the imported water that is no longer needed for the same purpose. Costs of water imports will likely rise in future times of water shortage, so any investments made now toward water treatment may pay itself off years in the future. However, a prohibition against water imports could provide the necessary support for localities considering adopting water treatment measures to address contamination alone. For GSAs that simply do not have the capacity to expand precipitation-based recharge, it may be possible to instead require those areas to implement water recycling programs for groundwater replenishment. Cost is most likely the largest obstacle to expanding those programs as well.

It is likely that exceptions to a prohibition against water imports for groundwater recharge in SGMA would need to be available for GSAs that simply do not have the capacity to expand local groundwater resources sufficiently to meet the local pumping demand. In these circumstances, it would be necessary to perform detailed studies to quantify exactly how much imported water would be necessary to achieve sustainability, based on the maximum amount of local recharge that could be accomplished using the

249. Nitrate contamination from agricultural runoff is an especially serious problem in the Tulare Lake Basin and Salinas Valley areas. See CAL. STATE WATER RES. CONTROL BD., RECOMMENDATIONS ADDRESSING NITRATE IN GROUNDWATER: REPORT TO THE LEGISLATURE 11-15 (Feb. 20, 2013), *available at* http://www.swrcb.ca.gov/water_issues/programs/nitrate_project/docs/nitrate_rpt.pdf.

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above methods. Of course, what is not regulated by SGMA is the demand itself, which could be reduced through water conservation methods such as distributed rainwater harvesting. Under SGMA, GSAs should have the flexibility to rely on imports only to the extent that they are necessary to achieve groundwater sustainability once local groundwater sources are maximized.

Any exempted agencies under this proposal should be required to collaborate with other GSAs to cumulatively manage groundwater resources. One basin with potential excess groundwater following a large storm event, for example, could transfer that water to another basin that needs it to meet its demand. Inter-basin cooperation is another beneficial facet of statewide groundwater management that is missing from SGMA, and any restrictions on water imports would inherently require GSAs managing separate basins to communicate with each other to achieve the optimal water profile. This may allow for any water imports to be satisfied by groundwater from another basin, as opposed to surface water from a distant reservoir. Cumulatively, these groundwater basins could be considered to have achieved “sustainability” without relying on surface water for recharge. Therefore, inter-basin management plans should be required under SGMA for those basins that will need to rely on water imports for groundwater sustainability.

To summarize, SGMA should be amended to require GSAs to phase out water imports for groundwater recharge over a long period of time. This will incentivize the development of stormwater collection projects in the immediate future that will produce a net increase to the available water resources in the state, as opposed to allowing GSAs to simply import water from other jurisdictions through water transfers. Exemptions should be included for basins that would not be able to meet its groundwater pumping demands solely through local sources, but GSAs over those basins should be required to partake in inter-basin management plans with other agencies to first seek out a transfer of excess groundwater before falling back on surface water imports for groundwater recharge. These measures would significantly enhance support for existing and future stormwater collection efforts for recharging groundwater sources.

C. Build New Centralized Stormwater Capture Projects for MS4 Outfalls

For municipalities with MS4s instead of combined storm sewer systems, there is the potential to collect stormwater that has become



concentrated within the system before it is expelled at a defined point. Collecting these outfalls, particularly those that flow into an unusable body of water such as the ocean, could be a crucial source of stormwater that could instead be put to a beneficial use.²⁵⁰ Significant stormwater collection programs seek to reduce the amount of stormwater created at the source, through better development techniques or early diversions of runoff to prevent it from entering the MS4.²⁵¹ However, the stormwater outfall itself could be a usable source of water that could be collected and diverted to underground aquifers. Municipalities, particularly those in coastal regions, should consider installing centralized stormwater capture projects at the outfalls of large MS4 pipes or conveyances to utilize that water as a local resource for groundwater recharge.

Existing law in California would certainly allow municipalities to capture MS4 outfall for aquifer recharge. The high levels of contamination would require some kind of treatment before sending this water underground.²⁵² However, this level of treatment is already being performed at other water treatment plants before treated water is released into the environment. The Joint Water Pollution Control Plant in Carson City, one of the largest wastewater treatment plants in the world, treats wastewater with primary and secondary treatment before sending it 1.5 miles off the shore of the Palos Verdes Peninsula at a depth of 200 feet.²⁵³ The plant treats about 280 million gallons (or over 800 acre-feet) of effluent per day.²⁵⁴ The Hyperion Water Treatment Plant, located on the coast of the Pacific Ocean by El Segundo, treats about 350 million gallons (or almost 1,000 acre-feet) per day of wastewater and discharges much of it into the Santa Monica Bay five miles offshore.²⁵⁵

While the City of Los Angeles has been expanding its recycled water program to reclaim much of this wastewater through tertiary

250. See *supra* notes 56-59 and accompanying text.

251. See discussion *supra* Part II.E.

252. For a discussion of the effects of urban runoff pollution on coastal waters, see Craig, *supra* note 55, at 313-17.

253. See *Joint Water Pollution Control Plant (JWPCP)*, SANITATION DIST. OF L.A. CNTY., <http://www.lacsd.org/wastewater/wwfacilities/jwpcp/> (last visited Dec. 14, 2015).

254. *Id.*

255. See *Hyperion Water Treatment Plant*, L.A. SANITATION, http://www.lacitysan.org/lasewers/treatment_plants/hyperion/index.htm (last visited Dec. 14, 2015); *Treatment Plants and the Environment: Monitoring the Environment*, L.A. SANITATION, http://www.lacitysan.org/lasewers/treatment_plants/about/environment.htm (last visited Dec. 14, 2015).

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treatment,²⁵⁶ there are few, if any, similar programs in place to treat and restore urban runoff to a usable form. The Santa Monica Urban Runoff Recycling Facility is a water treatment facility that treats about 500,000 gallons of dry weather runoff per day to a level sufficient for many non-potable uses.²⁵⁷ The City of Santa Monica is currently undertaking a project to build an underground storage tank close to the ocean to collect an additional 1.6 million gallons, or around five acre-feet, of stormwater per day for treatment.²⁵⁸ This is a significant step in the right direction, but even this expansion represents only a small fraction of the 180,000 acre-feet of stormwater lost to the ocean every day in the greater Los Angeles area.²⁵⁹

New water treatment plants should be constructed to collect and treat stormwater in Southern California instead of allowing that water to be lost to the ocean. Treated water could then be directed toward an adjacent spreading grounds facility, like the Rio Hondo and San Gabriel facilities, to allow that water to infiltrate into the underground aquifers.²⁶⁰ Given the amount of contamination in stormwater that has already traveled entirely through the MS4, it is likely that additional tertiary treatment of water would be necessary before infiltration. This level of treatment is currently being employed at the Terminal Island Water Reclamation Plant in San Pedro, which was installed in 2002 at a cost of \$23 million.²⁶¹ This plant generates about 4.5 million gallons, or almost 14 acre-feet, of potable water per day for use in industrial boilers.²⁶² Similar tertiary treatment at a much larger scale might be cost prohibitive, but the technology is certainly available to construct such a plant. Combined with a spreading grounds facility of a similar size to the Rio Hondo and San Gabriel facilities, a large plant could capture close to 1,000 acre-feet of stormwater per day for groundwater recharge,

256. See *Treatment Plants and the Environment: Water Reclamation*, L.A. SANITATION, http://www.lacitysan.org/lasewers/treatment_plants/about/water_reclamation.htm (last visited Dec. 14, 2015).

257. See *SMURRF: Santa Monica Urban Runoff Recycling Facility*, SANTA MONICA PUB. WORKS, <http://www.smgov.net/departments/publicworks/contentciveng.aspx?id=7796> (last visited Dec. 14, 2015).

258. See Nicki Cervantes, *Santa Monica to Build Underground Storm Water Runoff Tanks*, SANTA MONICA LOOKOUT (Nov. 30, 2015), http://www.surfsantamonica.com/ssm_site/the_lookout/news/News-2015/Nov-2015/11_30_2015_Santa_Monica_to_Build_New_Storm_Water_Runoff_Tanks.htm.

259. See GARRISON ET AL., *supra* note 53, at 3.

260. See *supra* notes 195-208 and accompanying text.

261. See *Terminal Island Water Reclamation Plant*, L.A. SANITATION, http://www.lacitysan.org/lasewers/treatment_plants/terminal_island/index.htm (last visited Dec. 14, 2015).

262. *Id.*

around 200 times more than the capacity of the Santa Monica Urban Runoff Recycling Facility.

One other large obstacle to construction of new water treatment plants is land use regulations. Zoning in Southern California may make it difficult to find an adequate land parcel on which to build a new water treatment plant, especially if residential housing is located nearby.²⁶³ This is especially problematic for spreading grounds facilities, which can cover hundreds of acres.²⁶⁴ Nevertheless, GSAs under SGMA wishing to construct these facilities could use whatever powers they need to in order to acquire the requisite land, even if it involves exercising eminent domain powers.²⁶⁵ Additionally, locating these facilities at the point of discharge could save significant costs that would otherwise be required for extra management of water flow and construction of pipes or conveyances to transport water from the MS4 to the plant.

Ultimately, whether and where to construct one of these facilities is a policy choice to be made by the governing agency. However, existing laws could be strengthened to at least require agencies to perform studies about the feasibilities of these projects. For instance, in the Storm Water Resource Planning Act of 2010,²⁶⁶ stormwater resource plans require agencies to identify potential projects that mimic natural water drainage treatment.²⁶⁷ This provision could be amended to require agencies to perform detailed studies on whether collection and treatment of stormwater for groundwater recharge at the point of MS4 outfalls could be a cost-effective alternative. Municipalities may not be inclined to investigate these projects on their own and may find that the treatment facility and spreading grounds would be a sound investment from a financial standpoint. Another possible mechanism for encouraging the construction of these facilities would be through the Clean Water Act NPDES municipal stormwater permit issued by the SWRCB.²⁶⁸ Although the SWRCB already approved and amended the MS4 permit for Los Angeles County in 2015, future permits could be made to include requirements for greater treatment of

263. Water treatment plants are approved for construction in M3 Heavy Industrial Zones. See Case No. ZA-2003-4842 (ZAI), List No. 1 of Uses Permitted in Various Zones in the City of Los Angeles (effective Jan. 15, 2003), available at http://cityplanning.lacity.org/Code_Studies/Misc/uselist1.pdf.

264. The Rio Hondo Spreading Grounds facility covers 570 acres of land. See *supra* note 197 and accompanying text.

265. See Cal. Water Code § 10726.2(a) (2015).

266. See discussion *supra* Part III.B.

267. Cal. Water Code § 10562(d)(3).

268. See discussion *supra* Part III.F.

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stormwater discharges into the ocean. Tightening water quality restrictions for discharges would make it more likely that the water quality would be sufficient for recharging groundwater, and therefore the SWRCB could incidentally encourage the development of centralized stormwater capture projects at the point of MS4 outfalls.

VI. CONCLUSION

Southern California is one of the most progressive regions in the world when it comes to collecting precipitation as a method of supplementing local water supplies. That being said, there are still numerous ways to expand these programs to optimize the amount of precipitation that can be captured following storm events, particularly given their rarity in such a dry climate. Given the uncertainties of climate change and potential increases in water demand, future periods of drought may require even more drastic measures to conserve enough water to satisfy the basic needs of the people of California. Taking action now to increase the amount of stormwater and rainwater collected for direct use or groundwater recharge will go a long way toward establishing a drought-resilient and water-independent Southern California.

