Section 9 Technical Analysis

Stakeholders and other agencies within the NOC WMA have been working collaboratively on studies, programs, and projects to address water quality, ecosystem restoration, and water supply. The NOC WMA will develop science-based studies to analyze coastal water quality impacts and identify effective solutions. The planning approach and framework of the NOC WMA Plan ensures that solution-oriented projects are coordinated within the WMA and that funding and project benefits be leveraged to the greatest extent possible.

9.1 Technical Information

The planning studies identify opportunities and constraints for watershed projects, including habitat protection and restoration, restoration of ecosystem processes, creek restoration for flood control and water quality, stormwater programs to protect water quality, use of water quality treatment wetlands, runoff reduction through landscape conservation programs, and an array of other studies related to habitat, water quality, and water supply.

This extensive knowledge base incorporating planning studies, science-based technical studies, and engineering studies has enabled the NOC WMA Plan to be developed through an informed stakeholder process. Due to this valuable resource, watershed management issues and conflicts have been clearly identified, the objectives directly respond to those issues, and implementation of the strategies and projects have been selected based on the findings and recommendations of those studies.

9.2 Technical Analyses and Methods

The NOC WMA performs monitoring to obtain sound technical information, analyses, and methods. Monitoring is the intermittent surveillance to ascertain compliance with a standard or deviation from an expected norm with intent to:

- Determine compliance with standards,
- Construct, adjust and verify predictive models,
- Provide information to evaluate abatement measures and identify progress against control objectives, and
- Provide early warning of future problems

Many of the monitoring programs and activities within the NOC WMA region provide data that are useful to IRWM planning and management in the WMA. This section provides an overview and description of efforts thought to be of particular importance to integrated, regional planning, but is not intended as a comprehensive survey of all programs and activities.

Water Supply Monitoring

Operators of public water systems conduct routine monitoring to ensure the water produced complies with Safe Drinking Water Act standards. Results are reported to the State of California Department of Health Services (DHS). Monitoring broadly encompasses several categories of constituents, which are discussed under Section 3.

Samples are taken at treatment plants, within distribution systems, and at the tap. Monitoring results are evaluated to ensure that applicable drinking water quality standards are met. For regulated constituents, results are compared to Primary and Secondary MCLs, and unregulated contaminants are evaluated against DHS Detection Limits for Purposes of Reporting (e.g., color, corrosivity, and odor).

Small water systems (i.e., community water systems that serving 199 connections or less from groundwater supply wells) are also required to conduct routine monitoring and report to the County Department of Environmental Health (DEH).

Routine monitoring for constituents are conducted every three years for all water suppliers. Monitoring for bacteria and nitrates are conducted more frequently.

Surface Water Quality Monitoring

Numerous federal, state, and local agencies and organizations have conducted surface water quality monitoring in the WMA over the past several decades. WMA and site-specific surface water quality monitoring efforts are currently underway, including the following:

- **Core Monitoring** – Routine, ongoing water quality monitoring within the regulatory framework of the National Pollutant Discharge Elimination System (NPDES) and Total Maximum Daily Loads (TMDL) monitoring programs. This type of monitoring addresses clearly defined questions related to point, non-point and targeted pollutant levels with a commitment to improving our understanding of County specific environmental issues.

- **Unified Program Effective Assessment (PEA) report** - The Unified PEA is an annual report provided by the County of Orange as the Principle Permittee in collaboration with the cities / Co-Permittees within the County. The water quality data and their analyses are presented in Section C-11 of the Unified PEA.

- **Regional Monitoring** – Periodic, collaborative, and larger-scale multi-agency surveys.

    - **Southern California Bight Studies** – The Bight studies, coordinated by the Southern California Coastal Water Research

Project (SCCWRP), utilize standardized sampling and analytical methods to produce a wide range of data from both impacted and reference areas.

- **Stormwater Monitoring Coalition (SMC)** – The SMC often use exploratory data analysis methods to investigate new measurement methods, improve basic understanding, characterize problems, or provide one-time measurements of important parameters or processes.
- **Coastal Receiving Water Regional Program** – A model monitoring program that consolidates coastal receiving waters pathogenic indicator bacterial monitoring efforts for OC Public Works, OC Sanitation District, South Orange County Wastewater Authority, and OC Health Care Agency.

- **Special Studies/ Research** – OC Watersheds along with cities, governmental agencies, NGOs and universities have a strong commitment to advancements in water quality science through focused special studies to answer specific issues of concern related to Orange County. For further information on current studies or studies of interest, please visit the OC Watersheds website at www.ocwatersheds.com.

- **Watershed Sanitary Surveys** - Per the California Surface Water Treatment Rule (Title 22 of the California Code of Regulations), every public water system using surface water is required to conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of such a survey is to identify actual or potential sources of contamination or any other watershed-related factor which might adversely affect the quality of water used for domestic drinking water. Source water is analyzed for organic and inorganic constituents, microorganisms, and general physical characteristics, and results compared to the MCL and/or SMCL standards for drinking water. Potential sources of contaminants in the watersheds draining into reservoirs are examined through a review of various data sets including existing aerial photographs, GIS data, reports, water quality data and other record documents, then supplemented by field surveys.

- **Orange County Water District** - The Orange County Water District is a special district formed by the California legislature to manage the groundwater basin that underlies north and central Orange County. OCWD operates a system of recharge facilities to maximize groundwater recharge. The basin's primary source of water for groundwater recharge is flow from the Santa Ana River and its main Orange County tributary, Santiago Creek. Since the quality of the surface water that is used for groundwater recharge may affect groundwater quality, a routine monitoring program is maintained to continually assess ambient river water quality conditions.

Characterizing the quality of the Santa Ana River and its impact on the basin is necessary to verify the sustainability of continued use of river water for recharge and to safeguard a high-quality drinking water supply for Orange County. On-going monthly surface water monitoring of the Santa Ana River is conducted at Imperial Highway near the diversion of the river to the off-river recharge basins and at a site below Prado Dam. General minerals, nutrients, and selected other constituents are monitored monthly, and radioactivity constituents, metals, volatile organics, and semi-volatile organics (e.g., pesticides and herbicides) are monitored quarterly. Several points on the river and key tributaries to the river above Prado Dam are also monitored annually for general minerals and nutrients.

- **Southern California Coastal Water Research Project (SCCWRP)**. SCCWRP is a joint powers agency focusing on marine environmental research for the Southern California Bight. SCCWRP gathers scientific information so that member agencies can effectively and cost-efficiently protect the Southern California marine environment. Although SCCWRP has traditionally focused its efforts on wastewater discharges from Publicly Owned Treatment Works (POTWs), SCCWRP, in recent years, has developed and refined urban runoff and surface water quality monitoring programs. NOC WMA uses scientific data and information from SCCWRP to analyze the WMA.

Groundwater Monitoring - Groundwater monitoring data are available through a variety of sources in the WMA.

- **USGS National Water Information System (NWIS) -** The USGS National Water Information System (NWIS) supports the acquisition, processing, and long-term storage of water data. This system provides real-time data on depth to groundwater.

- **Waste Discharge Requirements (WDR) Compliance Monitoring** NPDES permits contain monitoring requirements to verify compliance with applicable conditions. NPDES permit requirements often include groundwater monitoring. For example, the Regional Board has established monitoring programs for recycled water and wastewater operations that discharge to groundwater. Dischargers must periodically collect and analyze groundwater quality samples from wells representative of the receiving groundwater. The Regional Board has established groundwater monitoring requirements for the watersheds within the WMA's.

- **Orange County Water District (OCWD)** – OCWD conducts an extensive groundwater monitoring program. The objectives of OCWD's monitoring program include:

- Establishing on an annual basis the safe and sustainable level of groundwater production.
- Determining the extent of seawater intrusion and subsequently building improvements to seawater barriers to prevent and reverse such intrusion.
- Discovering areas of groundwater contamination to protect public health and beneficial use of groundwater, and to begin remediation efforts at an early stage.
- Assuring that the groundwater basin is managed in full compliance with all relevant laws and regulations.

Data are collected through a large network of production and monitoring wells at frequencies necessary for short- and long-term trend analyses. The wells are located throughout the basin to enable not only analysis of the basin as a whole but also to focus on local or sub-regional investigations. Multi-depth monitoring wells provide depth-specific water level and quality data allowing analysis of the basin's multiple-aquifer configuration.

The network of nearly 700 municipal drinking water, private domestic, industrial, irrigation, and monitoring wells is used to collect data for a variety of purposes. Monthly individual well production rates for large-capacity wells have been collected since 1988. Monitoring wells are operated by OCWD to supplement the water quality data collected at production wells and to fill data gaps.

In 2008, nearly 14,000 groundwater samples were collected and analyzed to comply with state and federal regulations and to enable OCWD to monitor the water quality of the basin. The number of water quality samples varies each year in response to regulatory requirements and to gain a better understanding of the basin. Samples collected throughout the basin are used to monitor the impacts of basin extraction, determine the effectiveness of the seawater intrusion barriers, assess the impacts of historic and current land uses, and serve as a sentinel or early warning of emerging contaminants of concern.

Monitoring wells are sampled as frequently as quarterly in areas of localized high concentrations of solvents and annually at other locations. Other chemicals are added to the monitoring program when concern arises.

- **Underground Storage Tank Monitoring -** The Regional Board and DEH require groundwater monitoring as part of regulating compliance with underground tank regulations. Monitoring associated with underground storage tanks is normally limited to the immediate vicinity of the underground tank (to check for tank leaks). At documented remediation sites where leaks have been detected,

however, extensive groundwater monitoring is required to document site remediation and recovery.

- **Special Studies and Projects -** Groundwater quality data are also periodically collected or compiled as part of special studies, including CEQA evaluations, groundwater supply investigations, scientific studies conducted by government or research organizations.

9.3 Data Gaps

Many governmental and non-governmental organizations currently collect surface water quality, surface flow, groundwater, habitat, and water use data within the NOC WMA. Regional stormwater data collection efforts are coordinated and managed by the regional NPDES stormwater Co-Permittees, but no central or organized data management structure exists for the majority of the NOC WMA's water management data. Significant data gaps exist in the collection and assessment of regional surface water quality, groundwater quality, groundwater availability, and habitat data. Filling the data gaps and coordinating data collection and management within the NOC WMA will be required to assess regional water management needs and to assess the effectiveness of implemented water management projects.

Water Quality Monitoring

Despite the widespread ongoing water resources monitoring within the NOC WMA, opportunities exist for additional data gathering to close existing gaps. Monitoring is generally conducted to support specific organizational, regulatory, or research objectives rather than within a regional or integrated framework. As a result, many of the gaps discussed here are related to a general lack of regional, integrated planning and concomitant data support strategies.

An extensive number of studies have been completed for the Coyote Creek, Westminster and Santa Ana River Watersheds. These studies are being conducted to address identified data gaps, such as those described in the 2003 Drainage Area Management Plan.

As discussed in Section 7, the SWAMP has completed one round of monitoring in all watersheds in 2005. Currently, the Regional Board is having all watershed related data analyzed and prepared into reports to assess the magnitude and extent of existing data and to identify existing data gaps. Monitoring was conducted for conventional water chemistry, water and sediment toxicity, fish tissue contamination, and bioassessment. Future SWAMP monitoring will evolve to address the results of these assessments.

Pollutants and Sources

Data gaps exist within the WMA's programs to monitor pollutants and sources, as described below:

Characterization of Nonpoint Sources

Nonpoint source (NPS) pollution is considered to be the major contributor of pollution to impacted streams, lakes, wetlands, estuaries, marine waters, and groundwater basins, and the leading cause of water quality impairments, in California. Yet, despite the existence of a myriad of programs focused on various aspects of NPS management (e.g., State Board NPS Program, Municipal Stormwater Permit, TMDLs), ongoing efforts are hampered by a lack of specific knowledge about the individual sources within the WMA that collectively constitute NPS pollution. For instance, the Regional Municipal Stormwater Permit requires that local jurisdictions implement programs to address impacts from commercial and industrial business types; these sources are present by the tens of thousands throughout the WMA. In the long-term, effective management will require that data collection be focused on better characterizing the specific sources of priority pollutants in the WMA's watersheds. Not only must specific activities and processes occurring on-site be better understood, but our knowledge of how threats to water quality vary within broad categories of regulated sources (e.g., residences, restaurants, etc.) must also be increased.

Agricultural Runoff and Sources

Water quality monitoring of agricultural runoff has been identified as an additional data gap. Chemicals applied during agricultural operations (e.g., pesticides and fertilizers) may be carried into the ground, and to surface or groundwaters. The extent of contamination resulting from agricultural practices is currently unknown, and should be addressed in future data collection efforts.

Pathogen Impacts and Loading

Recreational uses are among the most important beneficial uses for many of the WMA's receiving waters. However, in recent years, section 303(d) listings for bacterial indicators have become increasingly common. The existing listings for bacterial indicators are problematic since the indicators are not thought to present a threat to humans, (i.e., their presence are merely an indicator of the potential presence of disease organisms). Future monitoring would benefit from the development of measures providing a better indication of actual risk, as well as a basis for the identification and assessment of specific management measures.

Evaluation of Source Load Reductions

While considerable data collection has focused on identifying water quality problems and impairments throughout the WMA, comparatively little is know about the effectiveness of specific management measures targeted to remedy these problems. The 2007 Municipal Stormwater Permit requires

that source load reductions be determined for a variety of sources regulated under the program. However, the current state-of-the-art method for conducting load reduction estimates, especially at a broad programmatic level, is poorly evolved. Considerable effort is currently being invested in the development of new methods, but data are generally not available to support estimation either of nonstructural BMP effectiveness or implementation frequency. This data gap must be addressed to improve the effectiveness and cost-efficiency of pollution management programs.

Representative Watershed Sampling

Water quality monitoring not included for the upper portions of many of the watersheds presents a spatial data gap. Stormwater programs have conducted mass loading monitoring at the base of the watersheds since 1993-94. However, while useful for focusing and prioritizing efforts regionally, this approach is limited in its ability to provide a representative characterization of the quality of receiving waters within these watersheds. The addition of Temporary Watershed Assessment Stations in the 2007 Municipal Stormwater Permit will begin to address this data gap, but additional focus on augmenting upstream data sets will be required in the future. Expanding the numbers and locations of monitoring stations would provide a more representative assessment of water quality for completing updates of the 303(d) list of water quality impairments in the WMA, and better support source identification and management efforts.

Streamflow Monitoring

Ongoing streamflow monitoring provides a basic statistical understanding of surface water flows within major streams and rivers in the WMA. A larger number and greater geographical distribution of streamflow gauging stations, would provide additional data to assess streamflow recharge of groundwater, and to provide a better understanding of streamflow within smaller watersheds and lesser tributaries.

Groundwater Monitoring

Although the Orange County groundwater basin is extensively monitored as explained above, data collected should continuously be evaluated to identify potential data gaps in order to properly manage groundwater production, identify potential areas of groundwater contamination, and to protect the basin from seawater intrusion.

Monitoring gaps for regulated and unregulated chemicals occur in areas within Irvine where drinking water wells were not operating on a regular basis. OCWD's fills the data gaps with the non-potable well monitoring program. Monitoring wells and accessible agricultural wells are sampled for volatile organics, general minerals, and selected chemicals of concern to provide water quality information in this area of the basin

Monitored Constituents

Because monitoring strategies are often driven by regulatory mandates, the selection of monitored constituents tends to be broad, inclusive (e.g., all EPA Priority Pollutants), and static. In the past several years, watershed and water quality management in the WMA has evolved to become increasingly focused on specific issues and problems. Likewise, watershed sources of pollution are in continual flux. For instance, it is estimated that there are currently more than 85,000 chemicals in commerce the U.S., with more than 2,000 new chemicals being added to this mix annually (a rate of seven per day).

Although the nature of water and environmental pollution generally remains the same over time, the details clearly do not. Monitoring and data collection must therefore become increasingly focused on newly identified priorities, as well as "emerging chemicals of concern" (e.g., pyrethroid pesticides, brominated flame retardants, nanoparticles, and pharmaceutical wastes).

Habitat and Natural Resource Monitoring

Habitat mapping efforts within the WMA are incomplete, significant data collection is needed to better address habitat health and viability and to develop habitat maps. Additional habitat health, species composition, and invasive species data are required in all watersheds to provide for a greater understanding of geographic-, temporal-, and water quality-related trends. Although several federal, state and local agencies collect data with respect to the quantity and quality of habitat, no single entity can currently provide a comprehensive assessment of such data.

Monitoring and Assessment Approaches

In some instances, data gaps could be addressed through modifications to existing monitoring and assessment approaches. For instance, monitoring approaches that better focus on water quality or environmental "risk," rather than static regulatory benchmarks such as chemical concentrations, could better and more cost efficiently focus management efforts toward solutions. Likewise, considerable benefit, including cost-savings, could be achieved through data gathering approaches that are designed to assess cumulative impacts rather than those of a single source or project. Another key issue with respect to monitoring approaches is that of linkages between media. Although the cycling of many constituents between water supply systems, surface waters, groundwater, and potentially biota, is well understood from a theoretical perspective, little real world data exist to support the development of effect management approaches.

Finally, an increased understanding of the dynamics of the systems within which existing monitoring is conducted would be beneficial. The WMA has a strong commitment to advancements in water quality science through focused special studies to answer specific issues of concerns including participation in regional monitoring programs that involve Southern

California as a whole. Special studies useful to better understand our watersheds focus on the following issues:

- Pathogenic and Fecal Indicator Bacteria Contributions
  - Coastal urbanized streams
  - Beaches and closed embayments
- Natural Source Contributions
  - Geologic Contributions to Urban Stormwater Runoff
- Stream Ecology Alteration Source Characterizations
  - Hydromodification Effects on Water Quality
  - Trash and Litter Monitoring Programs
- Invasive Aquatic Species
  - New Zealand Mudsnails
  - Giant Reed (Arundo donax)
- Environmental Toxicity Identification Evaluations
  - Water quality impairment pollutant source characterization
  - Sediment quality habitat degradation in coastal estuaries
- Effects of Urbanization on Stream Physical Habitat
  - Hydromodification
- Biological Objectives
  - Coastal stream benthic macroinvertebrate assemblages

However, more monitoring data is needed to asses the integration of the pollutants and how the NOC WMA region can more effectively address water quality issues.