

Water



Infrastructure, Supply & Planning Study

A City of Tucson and Pima County Cooperative Project

Wastewater Systems

**Eric Wieduwilt, Acting Deputy Director,
Pima County Regional Wastewater Reclamation Department**

July 9, 2008

Key Elements of Local Wastewater Systems



Shaped by history, geography, and climate



Complex systems dependent on technology and energy



Expensive to build, operate, and maintain



Quantity and quality issues



Complex regulatory framework

Challenges for the Wastewater System



Aging infrastructure

- Ina Road WRF – initial facility built in 1970s
- Roger Road WRF – initial facility built in 1950s



Increasing regulatory standards



Growth and expansion

Regional Wastewater Reclamation Department

- Second largest wastewater system in Arizona
- 700-square-mile service area
- 260,000 customers
- 580 employees
- Conveyance
 - 3,400 miles of pipe
 - 73,000 manholes and cleanouts
 - 31 lift stations
- Treatment
 - 11 wastewater reclamation facilities
 - 70+ million gallons of wastewater per day

Public Health is the Mission



Water



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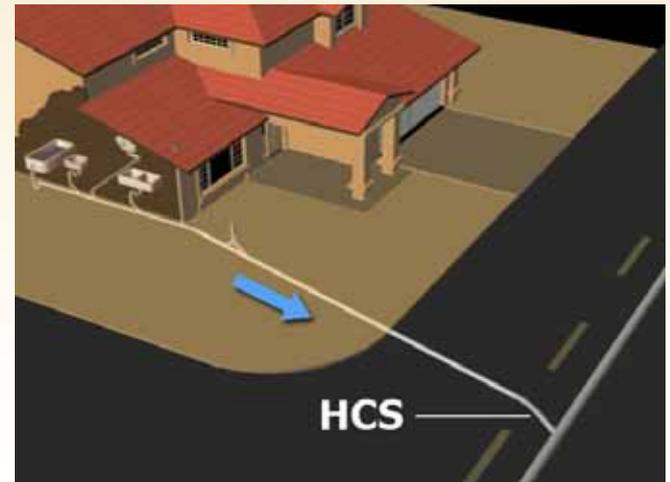
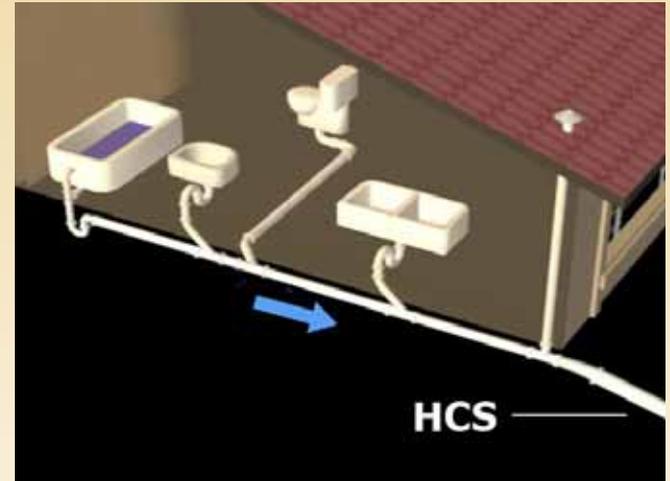
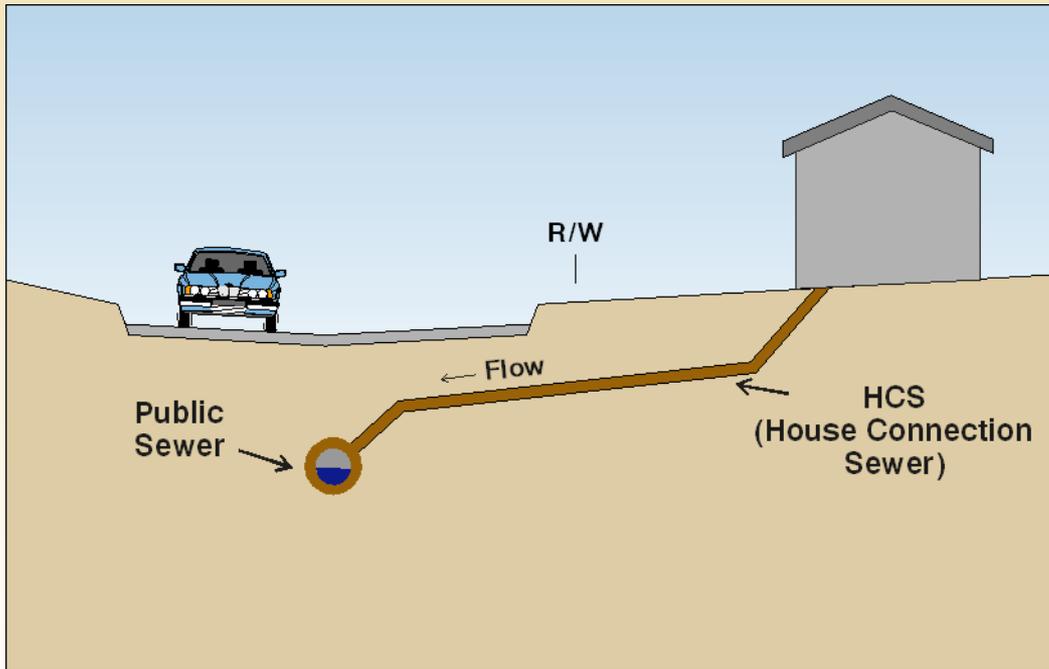
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Conveyance System

Homes and Apartments

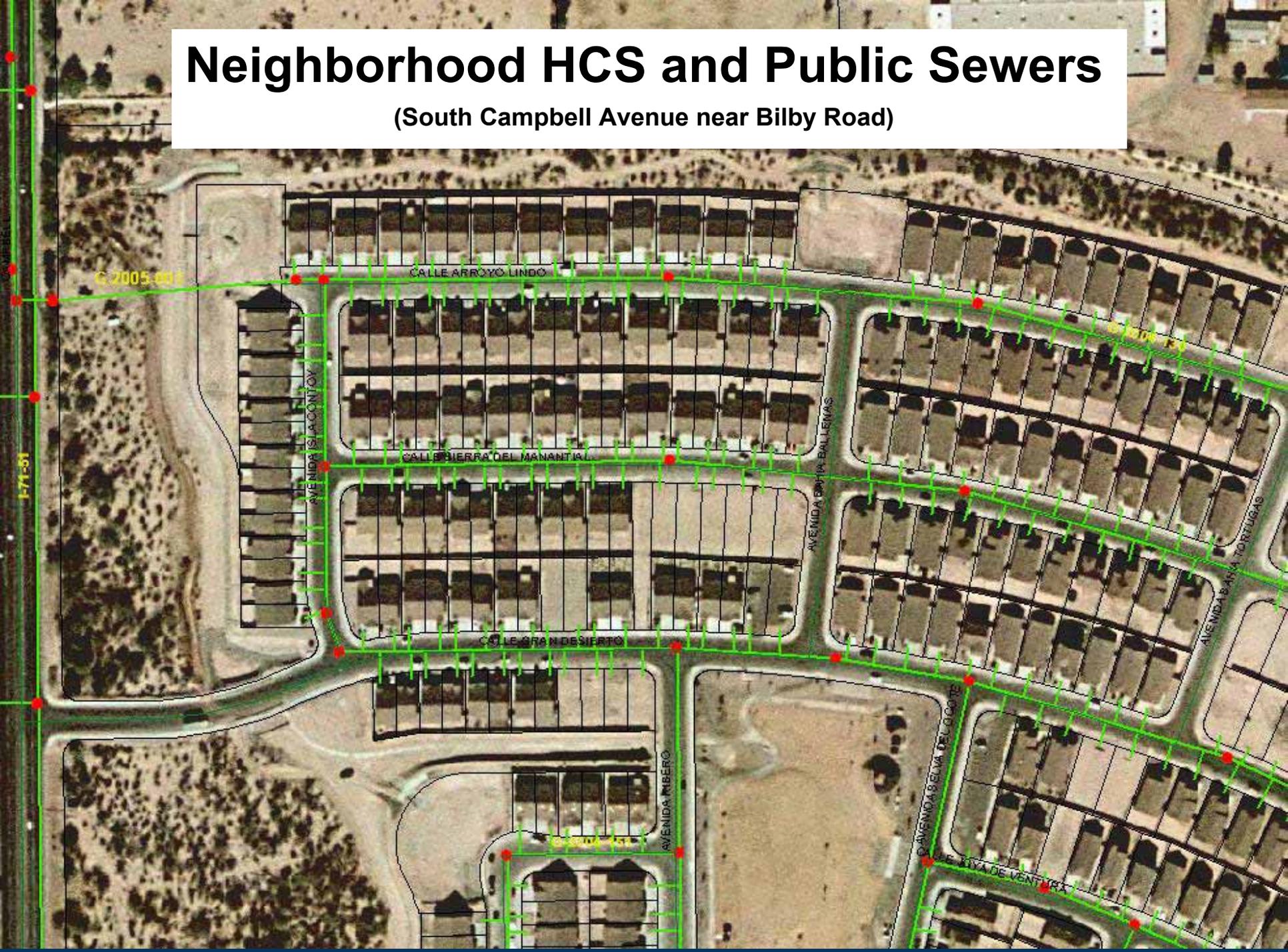


**Connected to public sewer
with house connection sewer (HCS)**

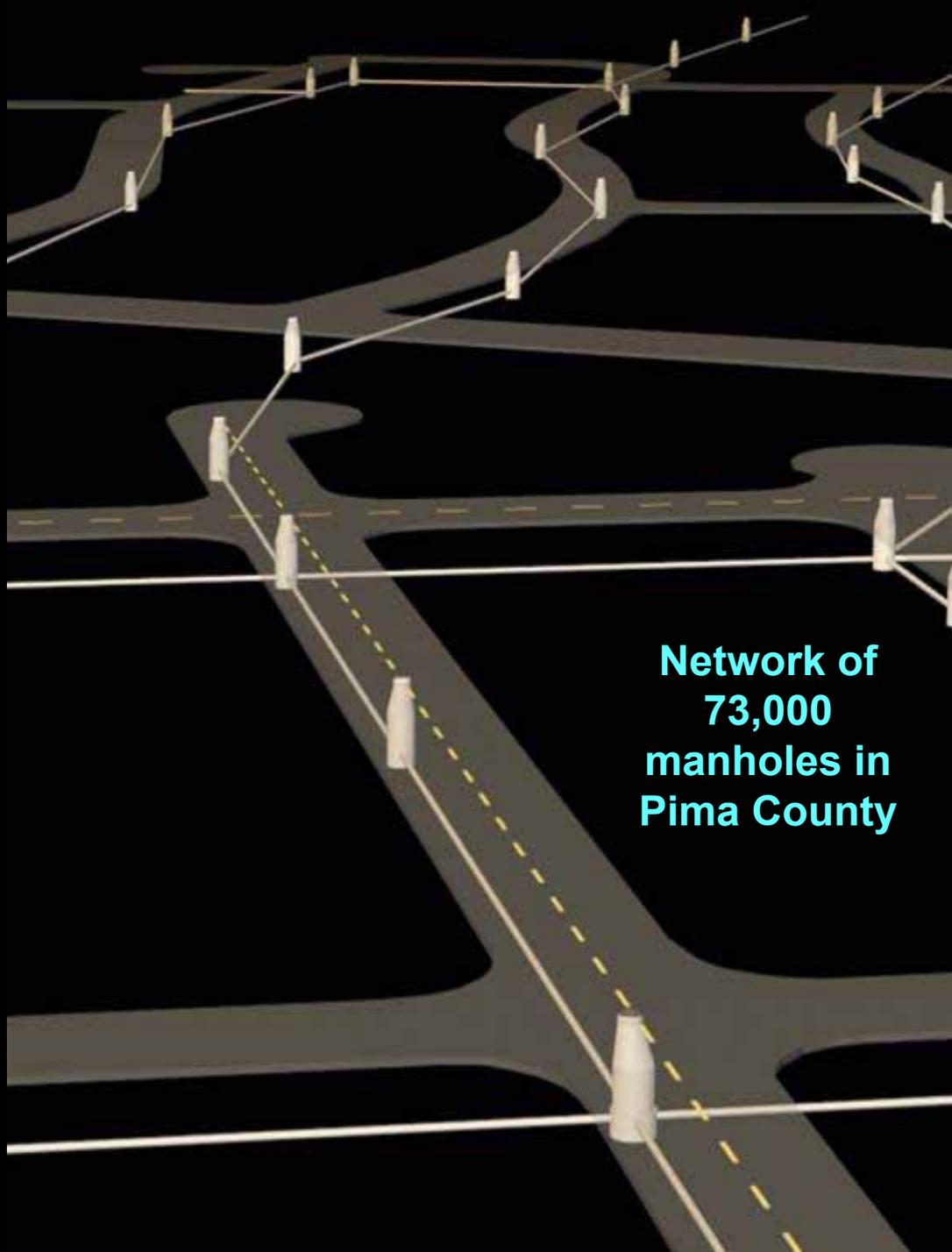
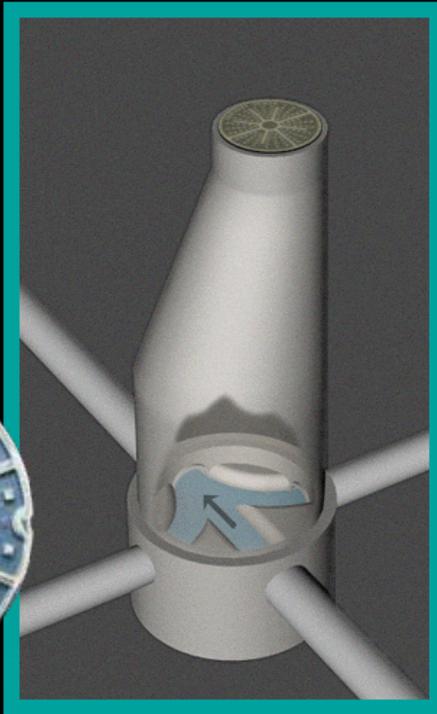


Neighborhood HCS and Public Sewers

(South Campbell Avenue near Bilby Road)



**Typical
manhole
showing
invert
channels**



**Network of
73,000
manholes in
Pima County**



Confined space entry into manhole

Metropolitan Conveyance System

— Sewer lines – 3000 miles
(8" - 15")

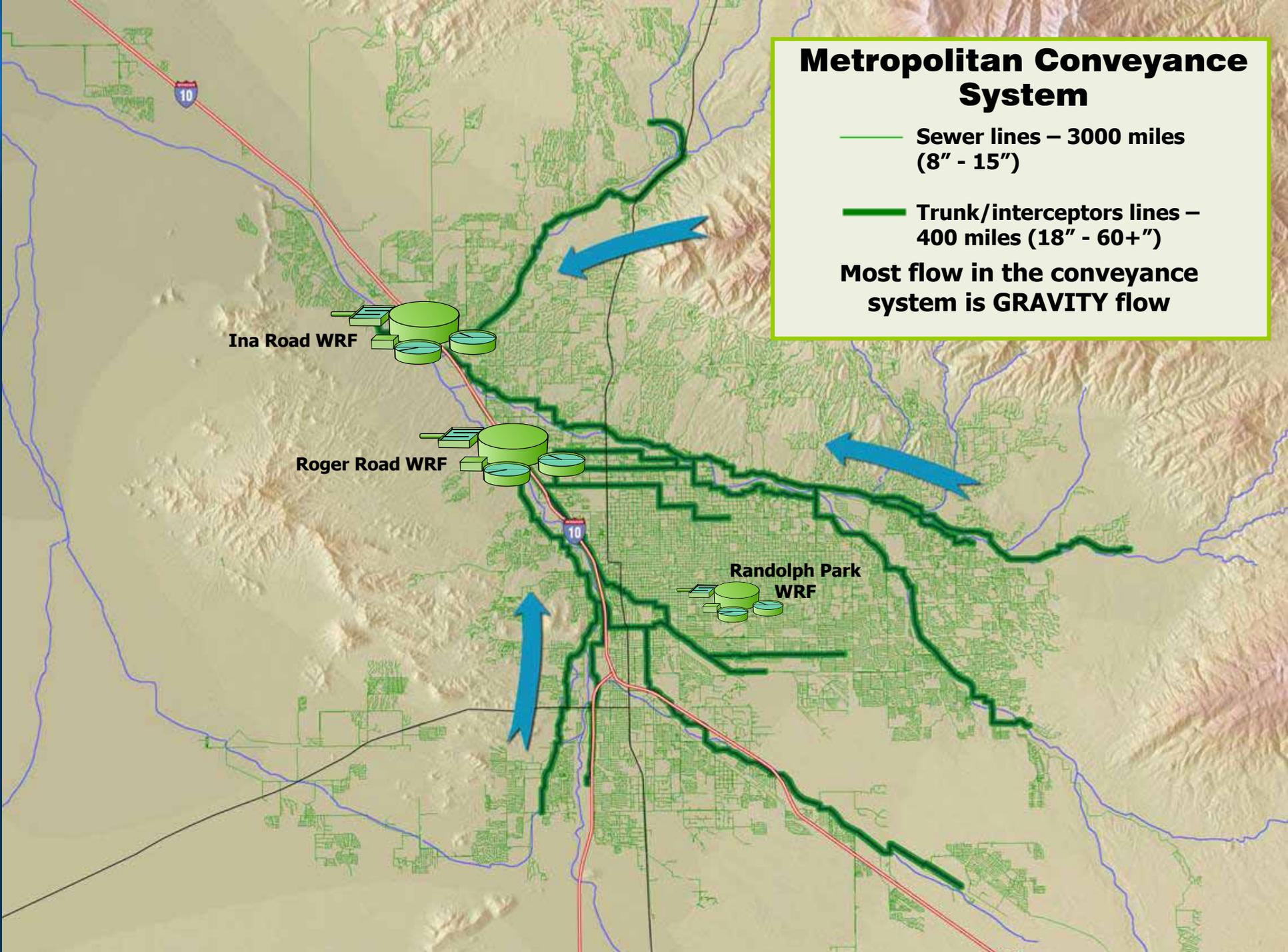
— Trunk/interceptors lines –
400 miles (18" - 60+")

Most flow in the conveyance system is **GRAVITY** flow

Ina Road WRF

Roger Road WRF

Randolph Park WRF



Interceptor System

ACS	Aviation Corridor (ACSC, ACSE)
CDO	Canyon del Oro
CRI	Continental Ranch Force Main
NRI	North Rillito
NWO	Northwest Outfall
PTI	Pantano
SC	Santa Cruz (SCC, SCE, SCI)
SEI	Southeast
SR	South Rillito (SRC, SRWC, SRWN, SRWS)
SWI	Southwest
TVI	Tanque Verde

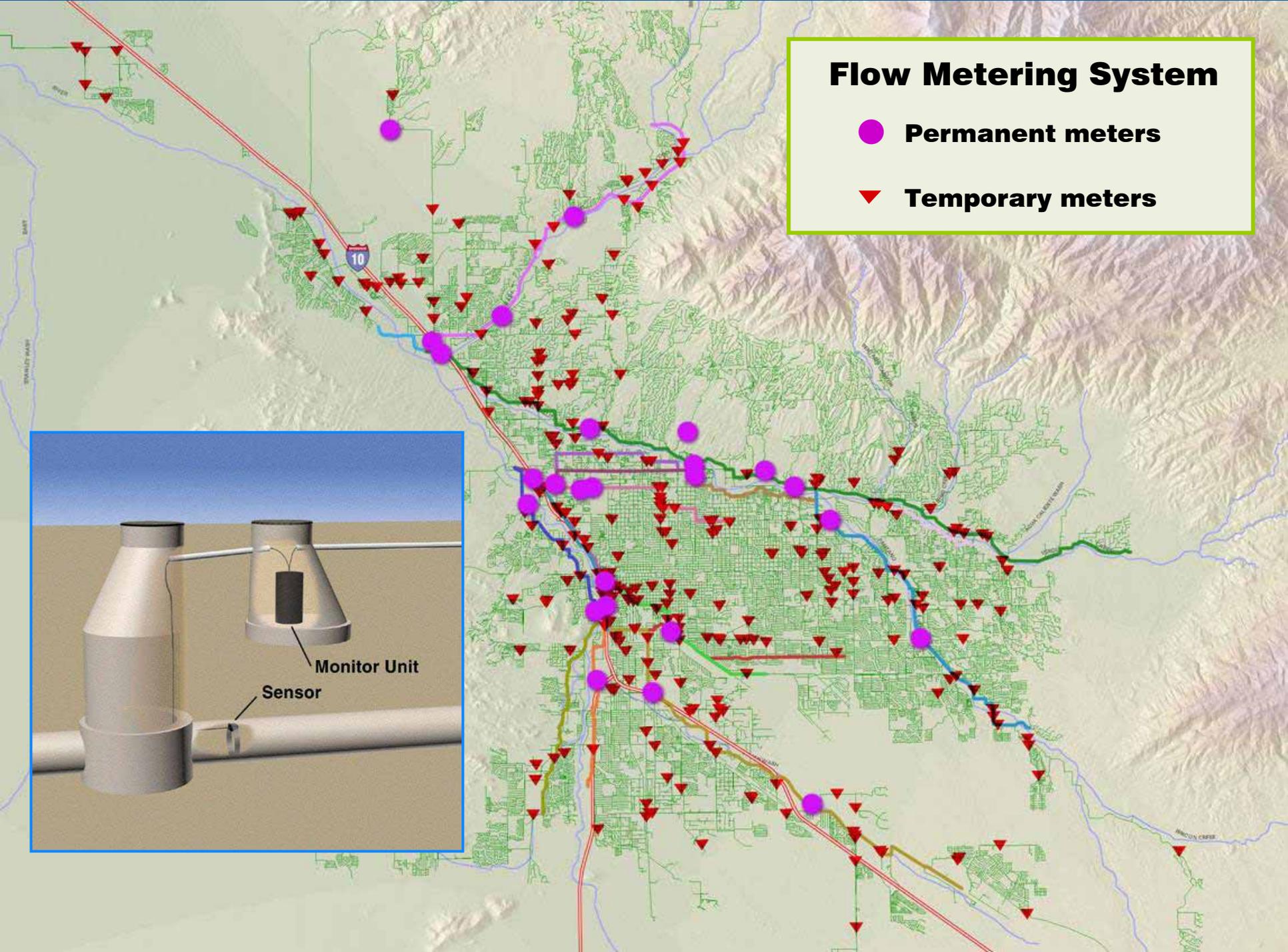
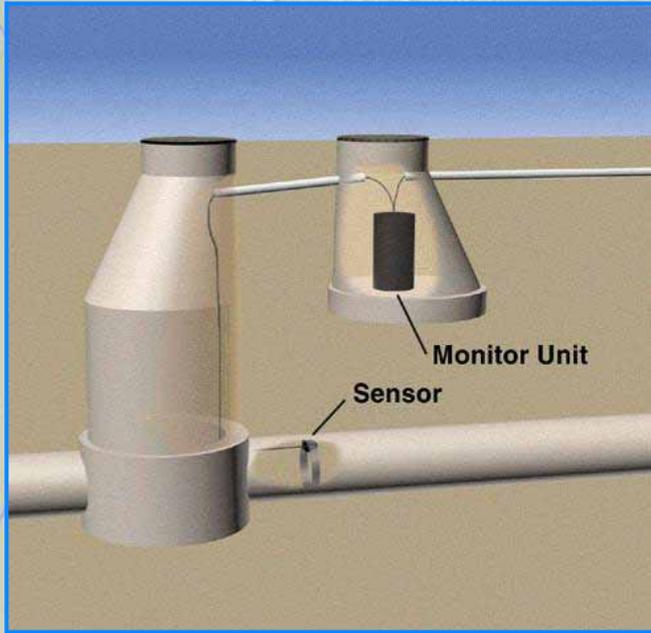


Construction of Santa Cruz Interceptor, 2007



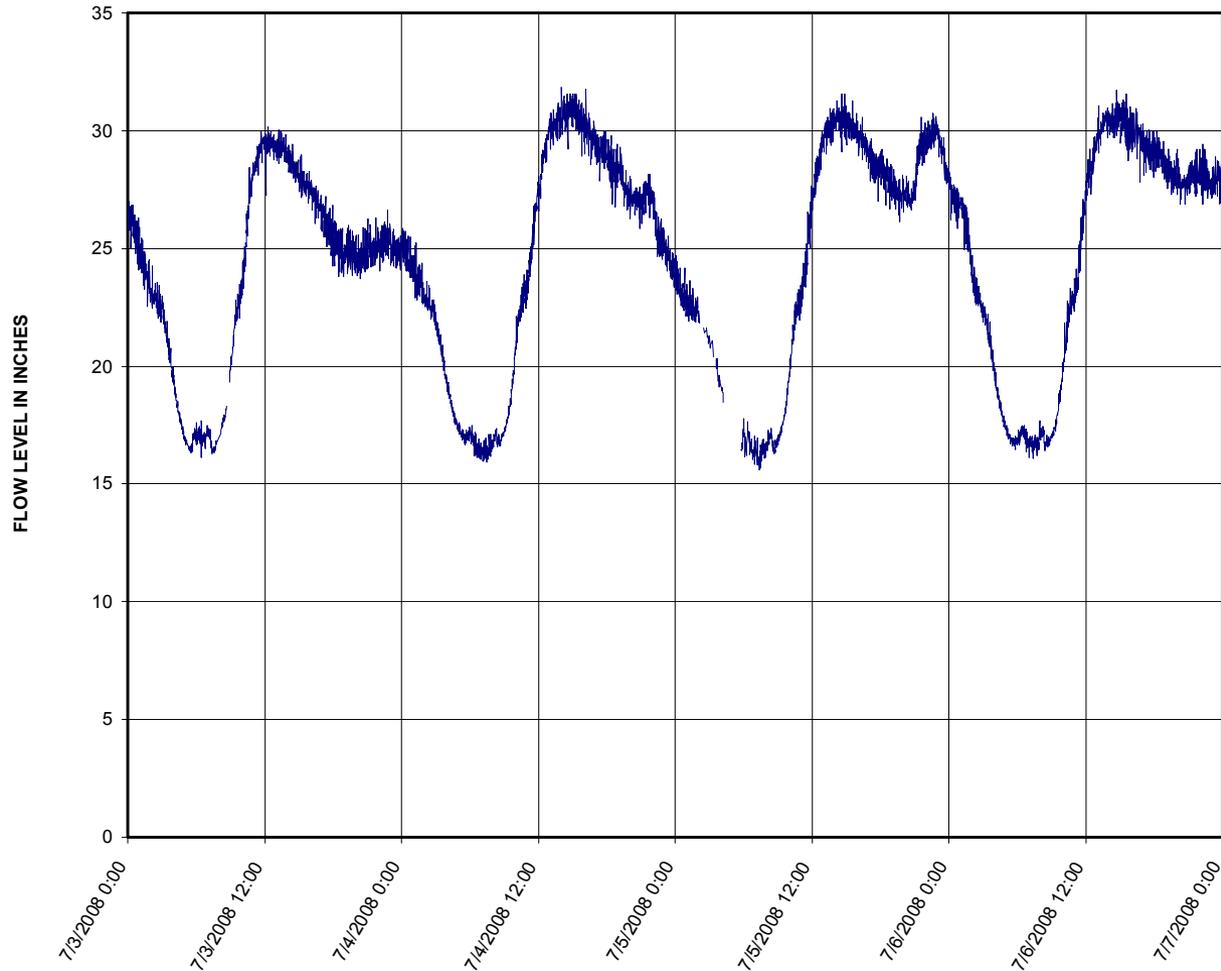
Flow Metering System

- Permanent meters
- ▼ Temporary meters

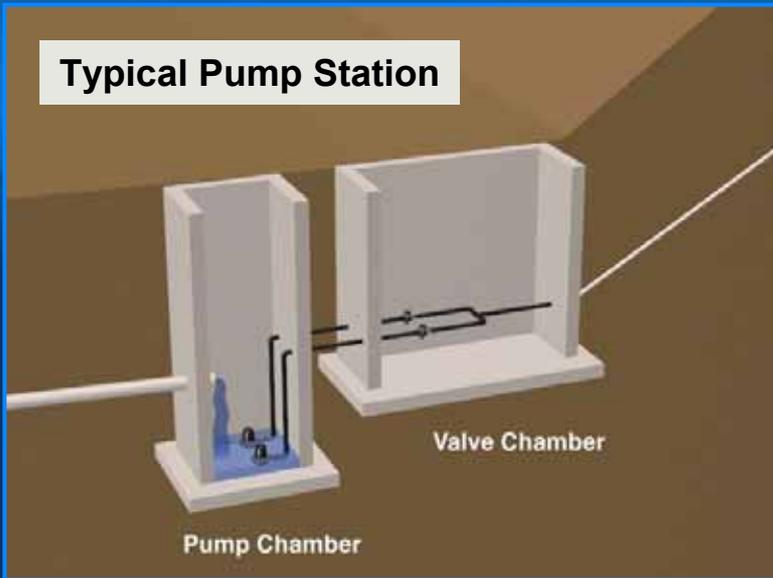


Sample Diurnal Flow

MH# 1703-05. WALKER RD./I-10. 42" LINE. NRI INTO THE INA RD. WPCF.



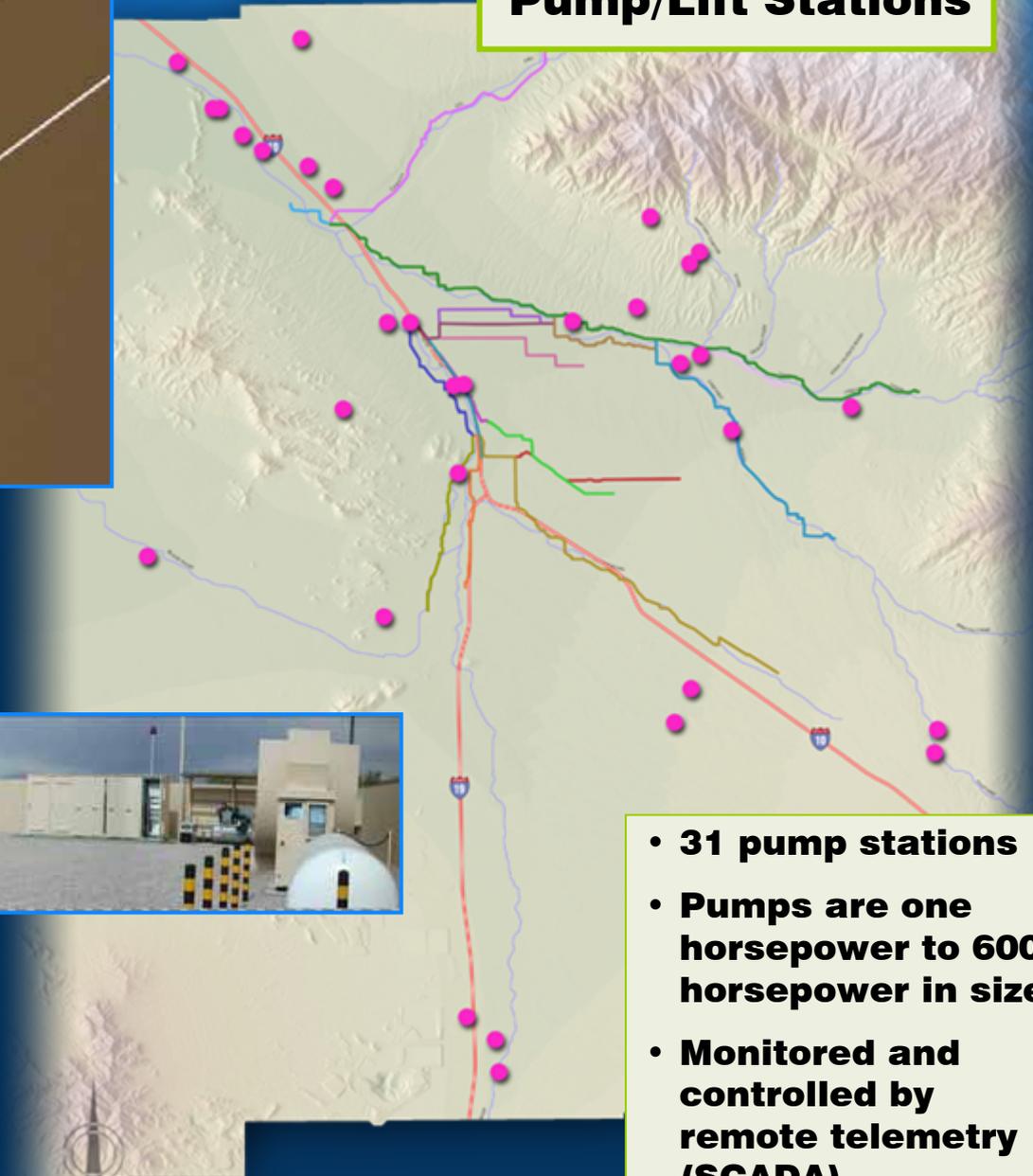
Typical Pump Station



Pump/Lift Stations



Rancho del Lago Pump Station



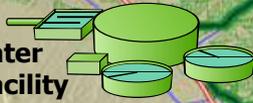
- **31 pump stations**
- **Pumps are one horsepower to 600 horsepower in size**
- **Monitored and controlled by remote telemetry (SCADA)**

Conveyance System
108 employees

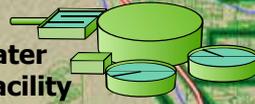
Preventive and Scheduled Maintenance



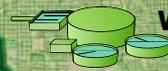
Ina Road Water Reclamation Facility



Roger Road Water Reclamation Facility



Randolph Park WRF



Operations



Roach Control



Odor Control



ISO/OHSAS Certifications

ISO 14001 - Environmental

CERTIFICATE

The Certification Body of
TÜV SÜD AMERICA INC.
Management Service Division

has audited

Pima County Regional Wastewater
Reclamation Department's Conveyance Division
3390 N. Richey Blvd.
Tucson, AZ 85716 USA

and found them to have a safety management system
in compliance with:

OHSAS 18001:1999

Occupational Health and Safety Management Systems - Specification

The scope of this Safety Management System includes:

The Pima County Public Sanitary Sewer System
Operations and Maintenance by Conveyance Division
of the Regional Wastewater Reclamation Department.

Certificate Expiry Date: January 31, 2011

Certificate Registration No: C 951 08 4825

Original Issue Date: February 5, 2008
Effective Date: February 5, 2008



G. M. J. J. J.
Gary W. Jinks
VP, Regulatory Affairs



TÜV SÜD AMERICA INC. • 10 Centennial Drive • Peabody, MA 01960 USA • www.TUVamerica.com

CERTIFICATE

The Certification Body of
TÜV SÜD AMERICA INC.
Management Service Division

heretby certifies that

Pima County Regional Wastewater
Reclamation Department's Conveyance Division
3390 N. Richey Blvd.
Tucson, AZ 85716 USA

has implemented an Environmental Management System
in accordance with:

ISO 14001:2004

The scope of this Environmental Management System includes:

The Pima County Public Sanitary Sewer System
Operations and Maintenance by Conveyance Division
of the Regional Wastewater Reclamation Department.

Certificate Expiry Date: January 31, 2011

Certificate Registration No: 951 08 4602

Original Issue Date: February 5, 2008
Effective Date: February 5, 2008



G. M. J. J. J.
Gary W. Jinks
VP, Regulatory Affairs



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CERTIFICATE

The Certification Body of
TÜV SÜD AMERICA INC.
Management Service Division

heretby certifies that

Pima County Regional Wastewater
Reclamation Department's Conveyance Division
3390 N. Richey Blvd.
Tucson, AZ 85716 USA

has implemented a Quality Management System
in accordance with:

ISO 9001:2000

The scope of this Quality Management System includes:

The Pima County Public Sanitary Sewer System
Operations and Maintenance by Conveyance Division
of the Regional Wastewater Reclamation Department.

Certificate Expiry Date: January 31, 2011

Certificate Registration No: 951 08 4601

Original Issue Date: February 5, 2008
Effective Date: February 5, 2008



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OHSAS 18001 - Safety

ISO 9001 - Quality

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Conveyance System Programs

Preventive Maintenance Program

- **Area Rodding Program**
 - 73,000+ sewer line reaches
 - All lines 15” and under are cleaned at least once every five years
 - Rodder trucks insert industrial “plumber’s snake” into lines to cut tree roots, break up debris and clear blockages



One of fifteen rodder trucks

Scheduled Maintenance Program

- Scheduled response to problem areas identified by crews and televising of sewers
 - Root growth, grease, debris that could cause sanitary sewer overflows
- Maintenance cycles vary from three months to 48 months



One of six combination vacuum/pressure trucks

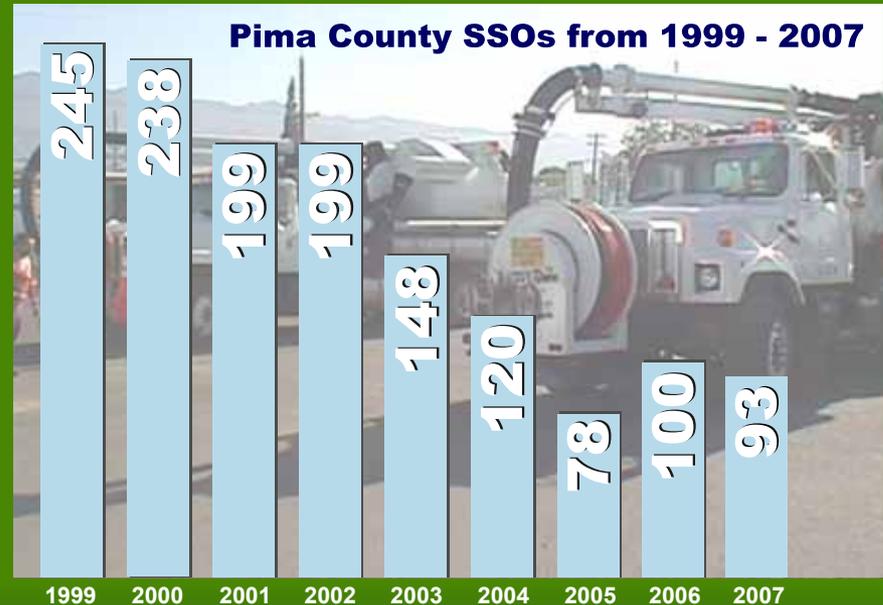


Roots removed from sewer

Emergency Response Plan

Contain, Remediate, and Mitigate

- Sanitary Sewer Overflow (SSO) Response Program
 - Rapid response to overflows caused by blockages and pipe breaks
 - Primary causes are roots, grease and vandalism
 - SSOs are reported as Clean Water Act exceedances – beginning with one drop

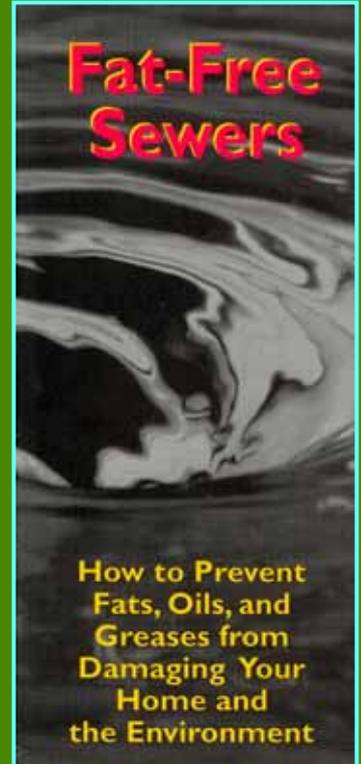


Fats, Oils and Grease Program

- Educational program
- Periodic grease collections/Grecycle



Recyclers at the 2007
Thanksgiving Grecycle Event



Roach Control Program

- Improved program is in third year
- FY 2007/08 – 15,337 manhole and 3,144 cleanouts were sprayed



Odor Control Program

- 12 chemical dosing units and 3 vapor phase units treat odors at problem areas identified throughout the conveyance system
 - Pump stations and gravity lines
- Chemicals are adjusted based on season, sampling and odor reports
- FY 2007/08 – added three units



Asset Management Program

- Computerized Maintenance Management System (CMMS)
 - Manages all conveyance system assets and maintenance activities
 - 1.5 million historical records



Work Order

Work Order # 998138
Asset SMH Unit ID 8476-04
Address 5240 E KNIGHT DR
Activity MHI MANHOLE INSPECTION

Initiated 08/29/2005 11:21 Source J
Scheduled / / : : Maint Type UI
Due / / : : Problem UNK
Initiated By 101057 Priority 2
Project Service # 0
Budget #

Started / / : : Result
Completed / / : : Condition
Comp By Quantity 0.000
Hours 0.00
Down Time 0.00 Major Failure

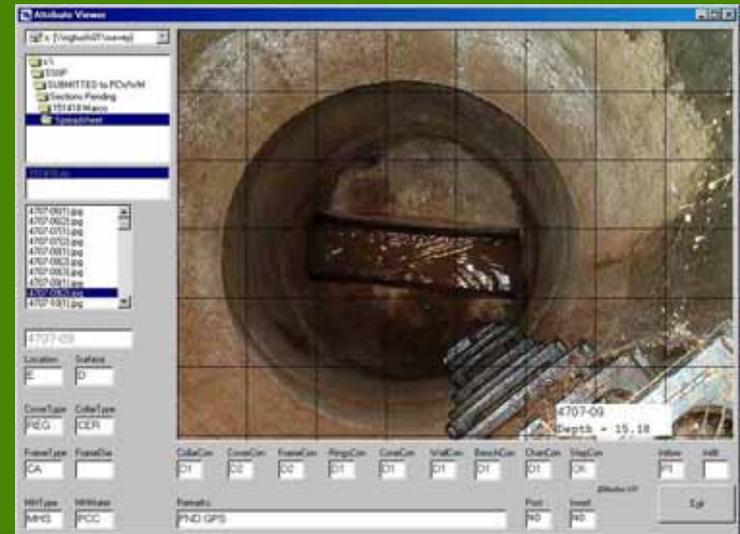
Assigned To
Crew
Inspection # 99102
 Out of Service
 Potential Service Request
Flow Depth 0.00

Work Order Comments Activities Failures Costs Standard Log Schedule

CMMS database

Conveyance Condition Assessment

- Sanitary Sewer Inventory and Inspection Program (SSIP) – completed in 2007
 - GPS location and condition data for 60,000 manholes
 - Program continuing to collect data for new and outlying manholes





	Pima County Wastewater Management Department Sewer Inspections and Inventory Project Tetra Tech Inc Project No: PPCWWM4455		ATTENTION: SURVEY DEPT. Fax: 325-2832
	DAILY SURVEY FOLDER		
DOWNLOAD PDA TO FOLDER	ISSIPL: _____		
DOWNLOAD HP315 DIGITAL CAMERA TO FOLDER	ISSIPL: _____		
DOWNLOAD TDS DATA COLLECTOR TO FOLDER	Filename: _____		
NUMBER OF MANHOLES, CLEANOUTS, ETC INVENTORIED	_____		
NUMBER OF MANHOLES, CLEANOUTS, ETC SURVEYED	_____	14 14 20	
SPECIAL NOTES for dBASE			
MANHOLES NEEDING SPECIAL ATTENTION			
8893-56 LID BROKEN 10%			
WM Notified: <i>Paul Carlson 8:30AM</i>	Response: _____	W.O. # _____	
8893-54 Debris in channel (BRK)			
9833-20 Debris on bench (morning)			
PCWWM Notified: _____	Response: _____	W.O. # _____	
9833-02 Full of Dirt.			
9833-08 Debris on bench & channel. (DUNC)			
9833-02 Debris on bench (conc)			
PCWWM Notified: _____	Response: _____	W.O. # _____	
9833-05 MH NEEDS ATTENTION D3 bench & channel			
It is possible, from surface observation, that there is no longer ANY			
PCWWM Notified: _____	Response: _____	W.O. # _____	
8868-18A Lid BROKEN 5% ± 26"			
8868-02 Lid BROKEN 5% ± 26"			
WM Notified: _____	Response: _____	W.O. # _____	
Survey: 5 JWH JMV	Date: 3/18/03		



(1-6) Eroded manhole, corroded brick manhole, illegal connection, Africanized honeybee colony, daily report, vandalized manhole

Conveyance Condition Assessment

- **Closed-circuit Television Program (CCTV)**
 - All large diameter pipes have been inspected and are on scheduled inspection intervals
 - 189 miles of pipe televised in FY 2007/08
- **Pipeline Assessment Condition Program (PACP)**
 - RWRD requires PACP-certified operators
 - International standards for defect codes
 - Grades/evaluation
 - Graded from 1 (very good) to 5 (needs immediate attention)





Examples of defects in sewer pipe shown on CCTV footage

Conveyance Rehabilitation

FY 2006/07 and 2007/08

- \$6.4 million spent for rehabilitation of sewer pipe and manholes



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Treatment System

Regional Wastewater System – Treatment

252 employees

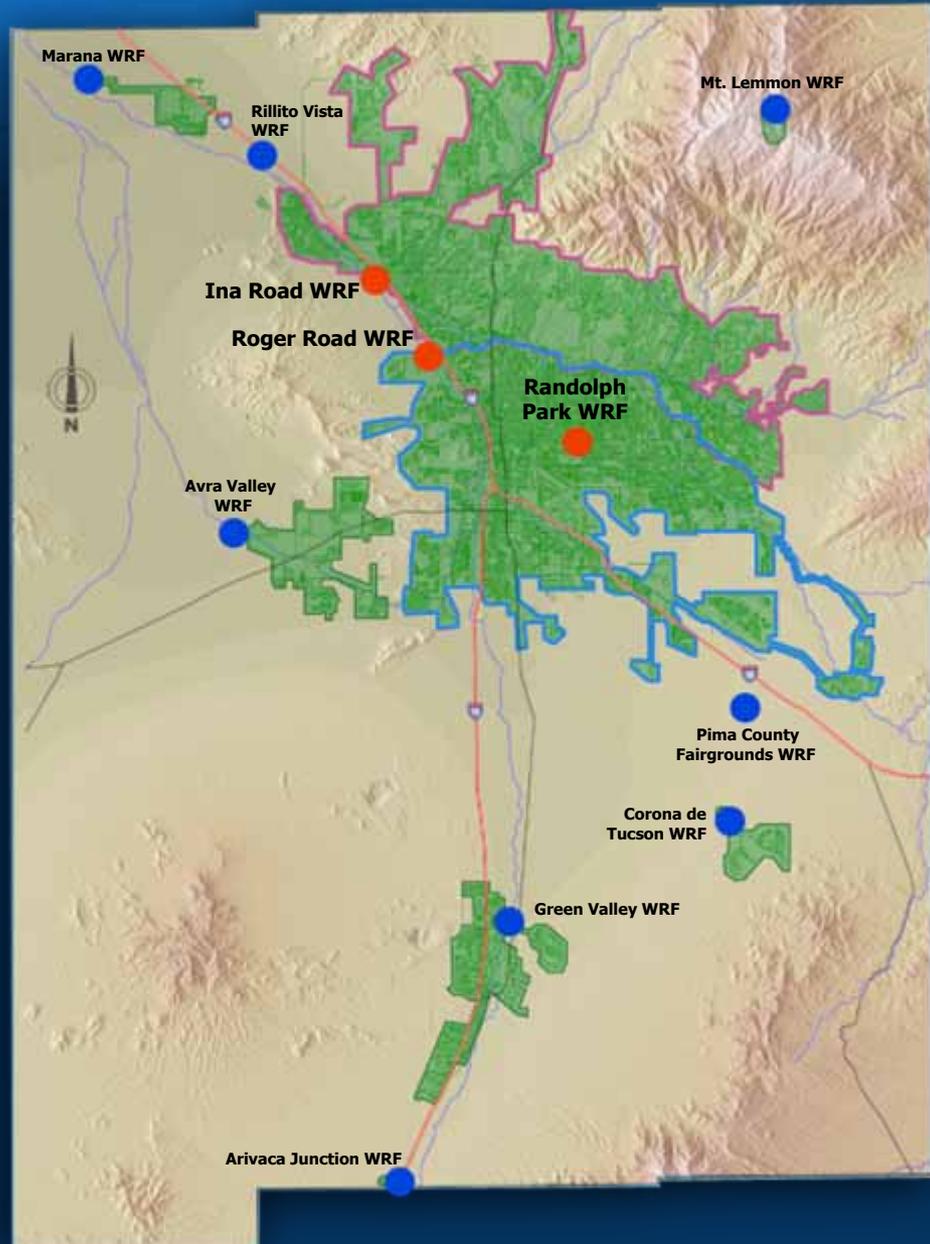
 Existing System Area

 Ina Road WRF System Area – 198 sq. miles

 Roger Road WRF System Area – 275 sq. miles

 Metropolitan Wastewater Reclamation Facilities

 Sub-Regional Wastewater Reclamation Facilities



Water



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Treatment System Programs

Operations

- **73 operators with Grade 1 to Grade 4 state certifications**
 - **Ina Road WRF, Roger Road WRF, and Sub-Regional Facilities each have 24 operators (1 for lagoons)**
- **Supervisory Control and Data Acquisition (SCADA) – remote telemetry**
 - **SCADA Control Center monitors SCADA information at all sites**
 - **New and improved SCADA systems are being installed**
 - **SCADA employees – 10 for Treatment and 10 for Conveyance**



Maintenance

- Roger Road WRF – 18 employees
- Ina Road WRF – 19 employees
- Sub-regional Facilities – 9 employees
- Electrical, mechanical and specialty crafts
- Multiple journeyman skill sets –
pipe fitters, pump repair specialists



Corrosion Control Program

- Painters are industrial coating specialists
- Preventive Maintenance Program includes cleaning and painting to prevent corrosion
- Odor control also helps capture corrosive gases



Murals painted by staff as part of corrosion control efforts

Odor Control Program

- System-wide Odor Control Plan developed short-term, interim and long-term solutions to odor problems
- All short-term projects have been completed with substantial reductions in odors
- Approximately \$7 million spent on projects in FY 2007/08
- Long-term solutions are integrated into the Regional Optimization Master Plan – \$39 million



Ina Road WRF – Centrifuge scrubber

Odor Control Program – Roger Road WRF



Primary clarifiers weir trough covers



Installation of scrubbers for headworks and clarifiers

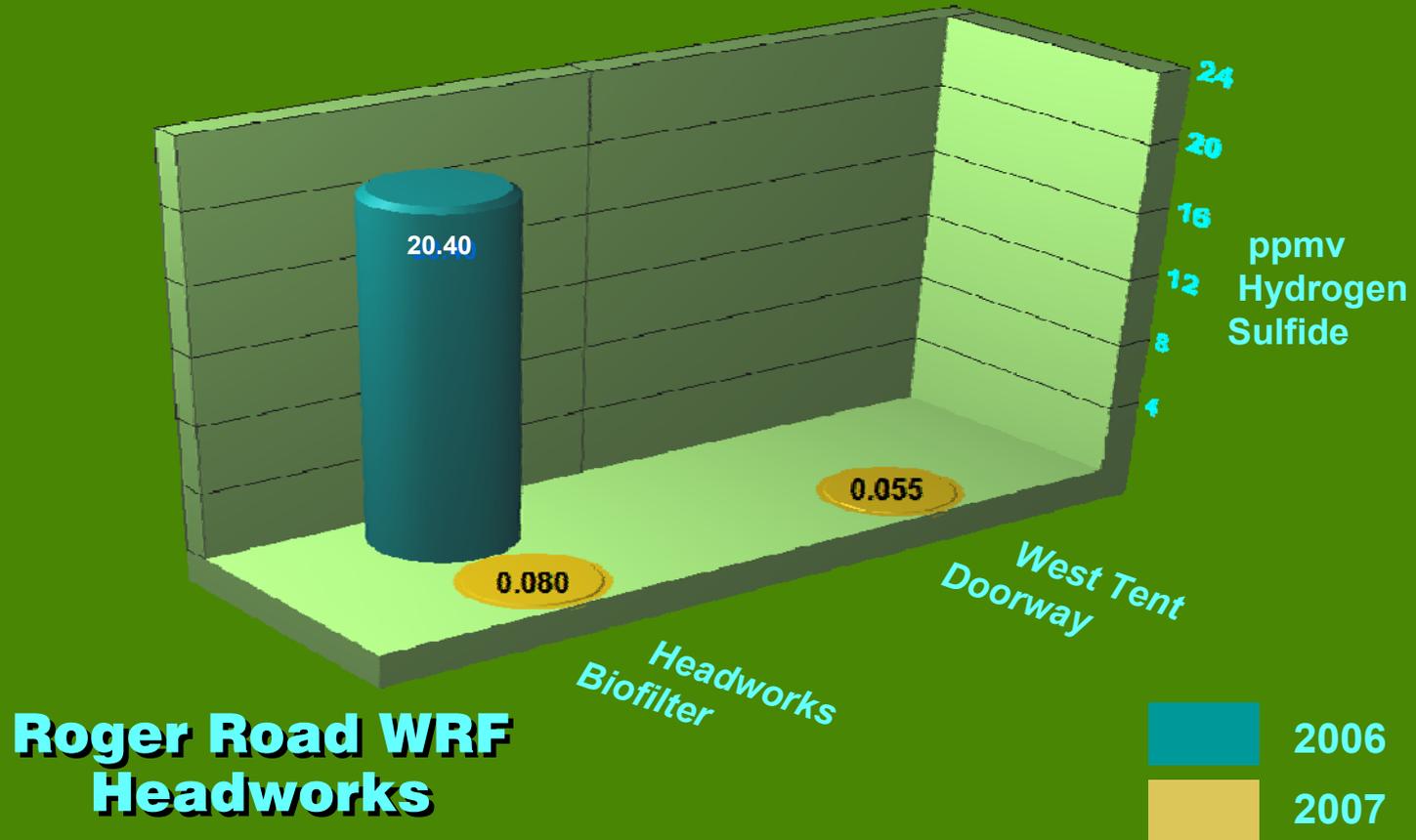


Tent over headworks



Headworks compactors

Odor Control Program Results



Odor Control Program Results

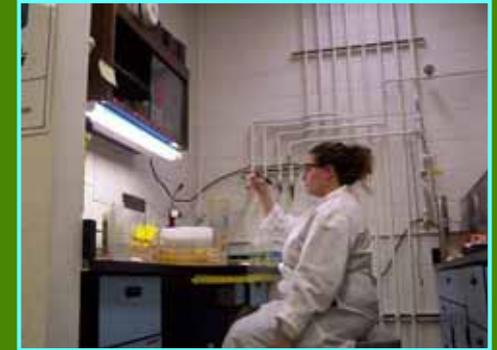


**Roger Road WRF
Primary Clarifiers**



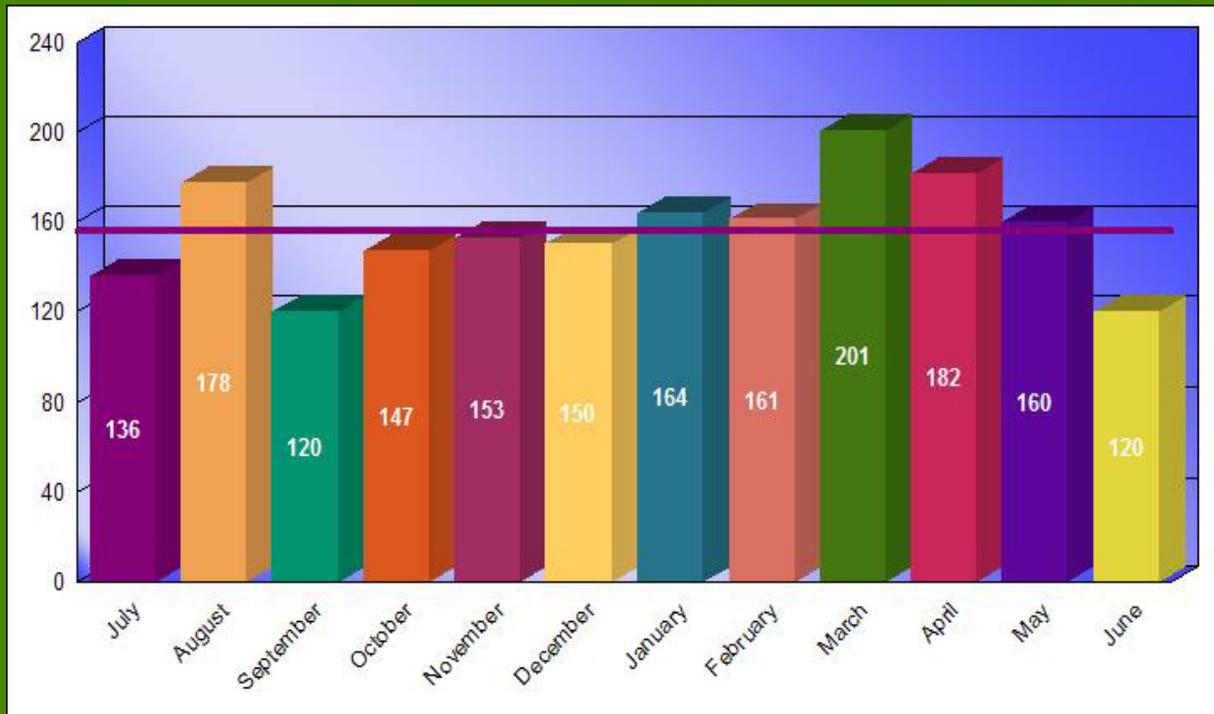
Support Programs

- Industrial Wastewater Control
- State-certified laboratory
- Compliance and Regulatory Affairs Office
- In-house training center



Asset Management Program

Typical Report Data from CMMS: Work Tasks Completed by Month - Roger Road WRF



Treatment System Rehabilitation

FY 2006/07 and 2007/08

- Rehabilitation projects for Roger Road WRF
 - Spent to date – \$12,800,000
 - 9 odor control projects – \$6.1 M
 - 6 solids processing projects – \$2.5 M
 - 18 general rehabilitation projects – \$3.1 M
 - 2 aeration projects – \$1.1 M



Treatment System Rehabilitation

FY 2006/07 and 2007/08

- **Rehabilitation projects for Ina Road WRF & Sub-regional Facilities**
 - **Awarded to date – \$7,800,000**
 - **6 Ina safety projects – \$2.1 M**
 - **28 general Ina rehabilitation projects – \$4.1 M**
 - **7 Sub-regional Facilities projects – \$1.6 M**



Water

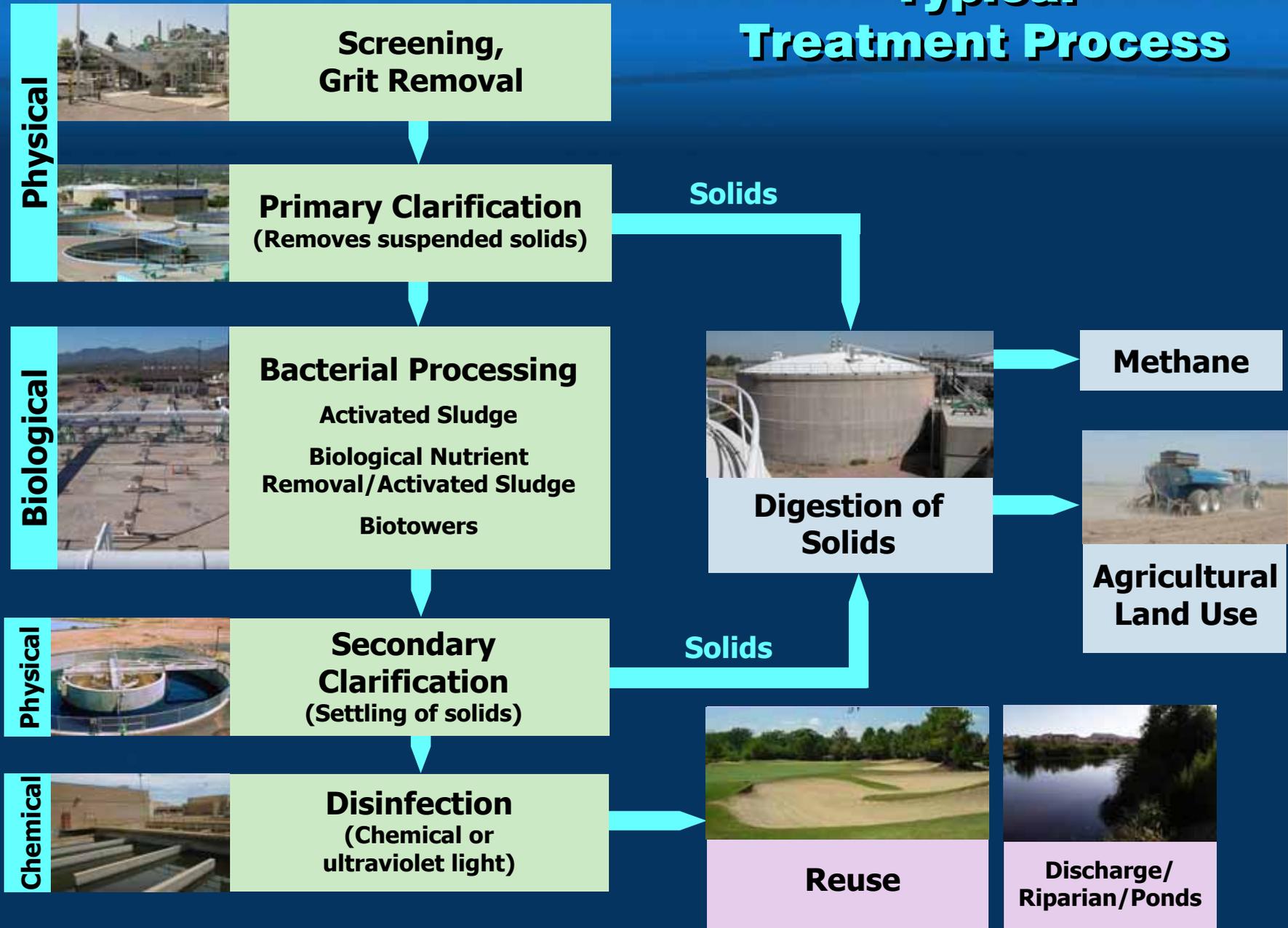


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Treatment System Processes

Typical Treatment Process



Typical Treatment Process

Physical

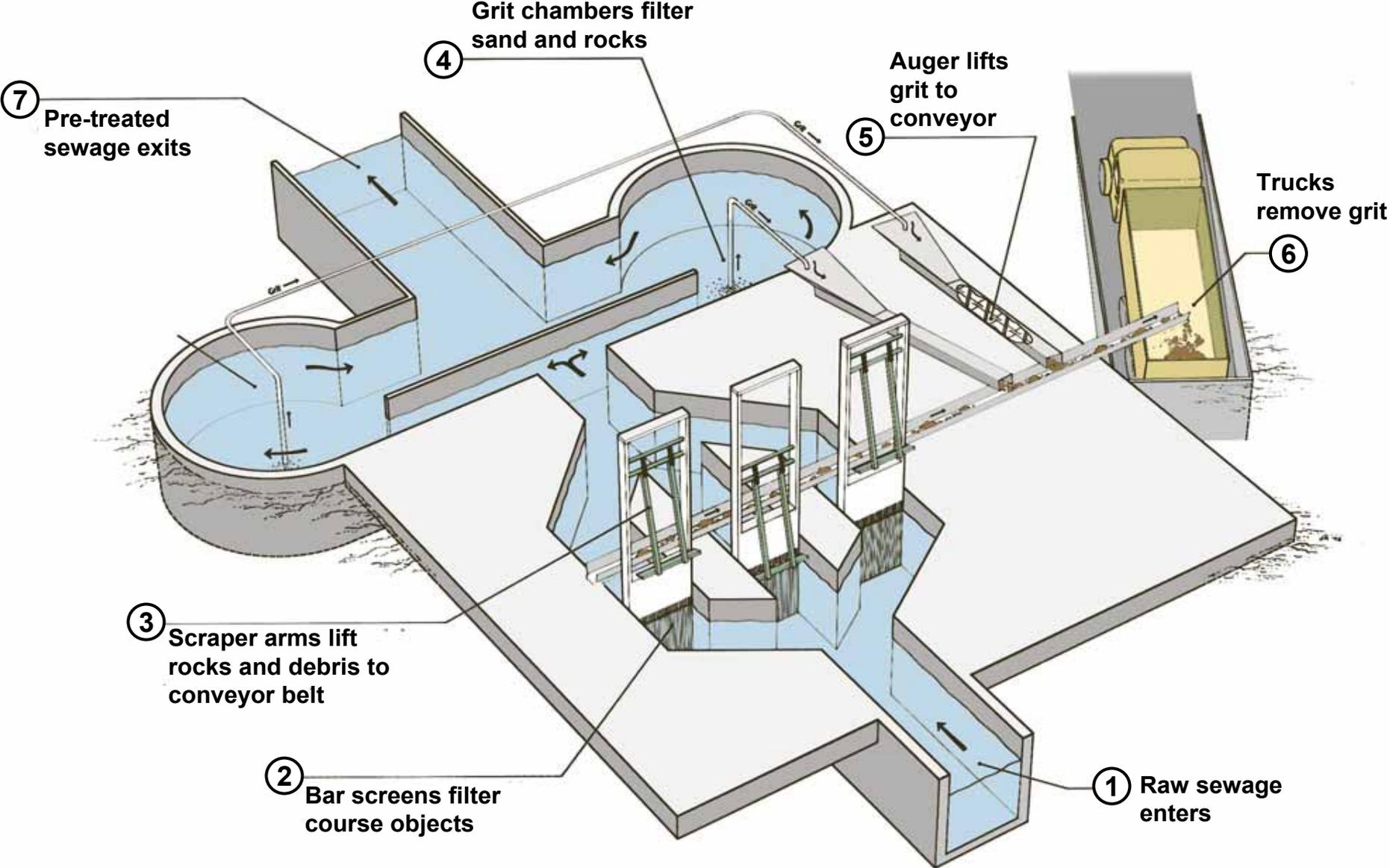


**Screening,
Grit Removal**



Headworks at Roger Road WRF

Headworks



Physical

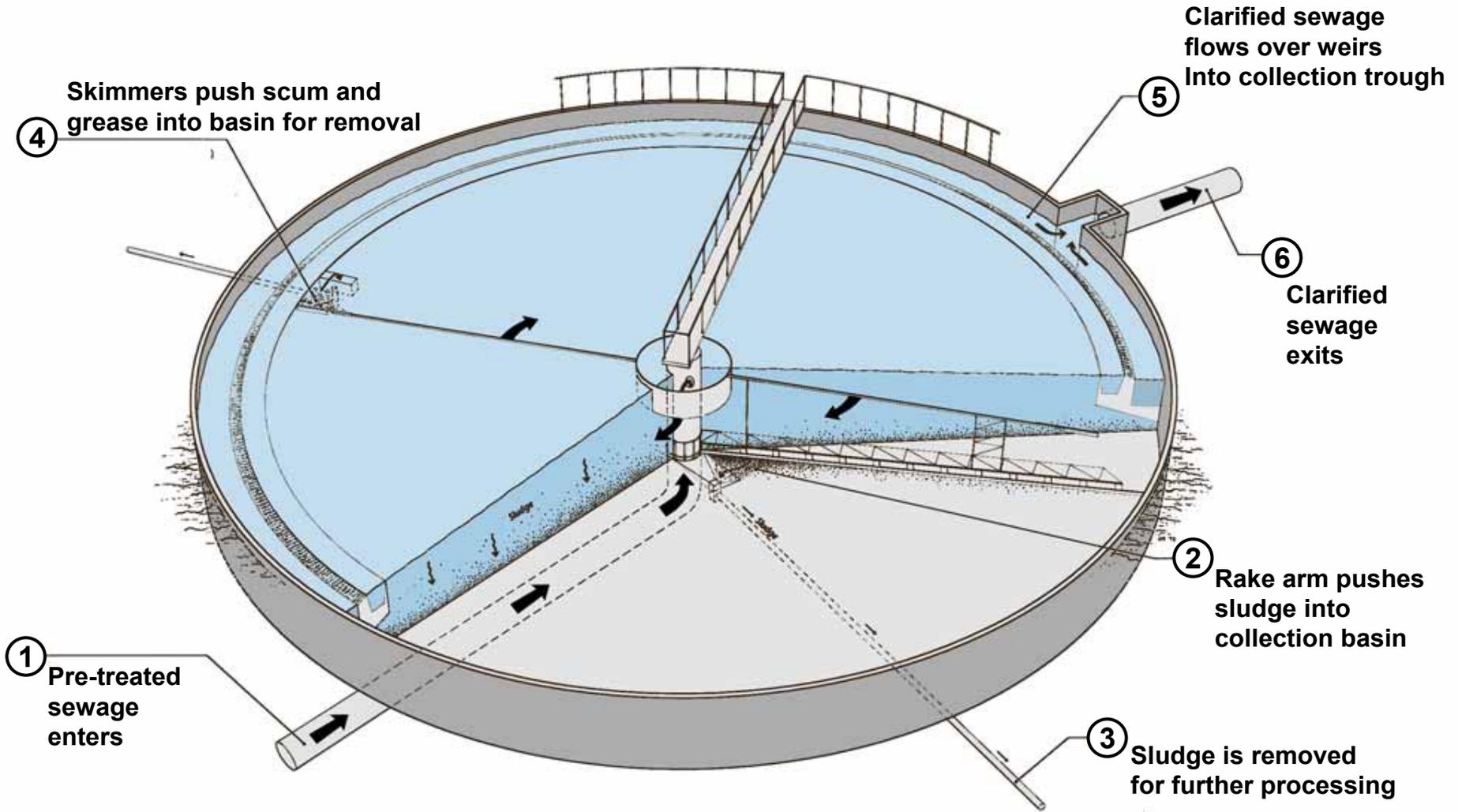
Screening,
Grit Removal

Primary Clarification
(Removes suspended solids)

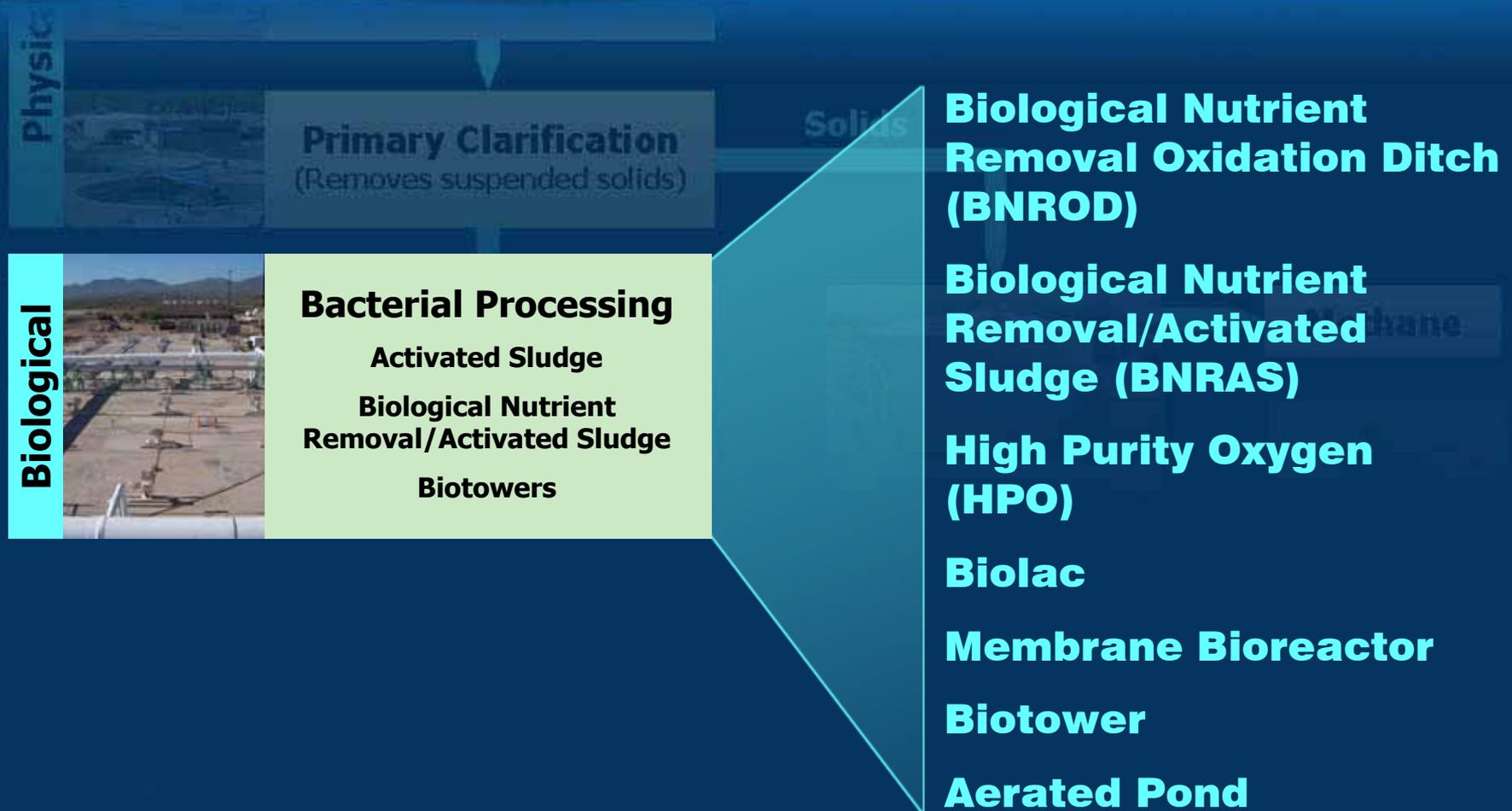


**Covered primary clarifier at
Ina Road WRF (above) and
primary clarifier with covered
weir at Roger Road WRF
(left)**

Primary Clarifier

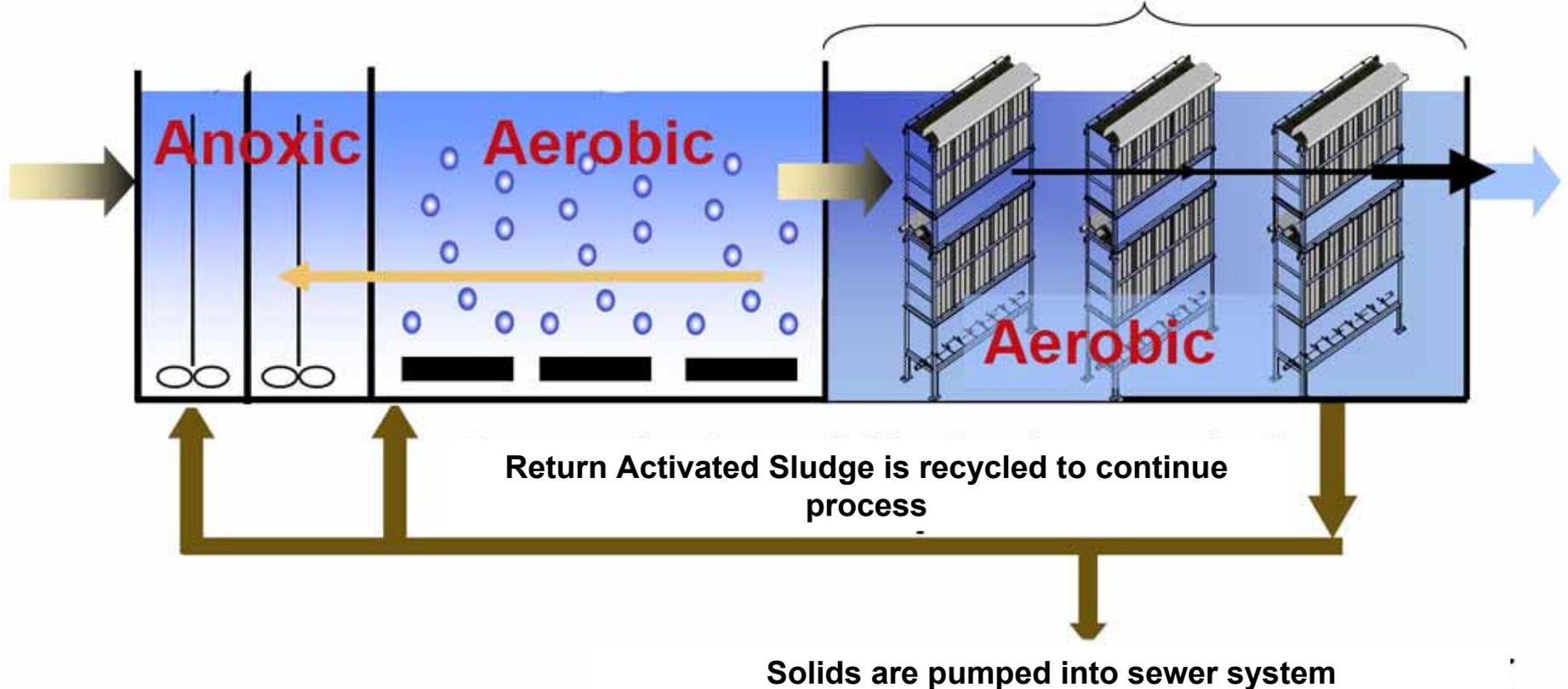


Biological Treatment Processes



Randolph Park Membrane Bioreactor

Membrane Solid/Liquid Separation





Ina Road WRF – BNRAS



Roger Road WRF – Biotowers



Randolph Park WRF – Membrane bioreactor (left), membrane removed for cleaning (right)



Green Valley WRF - BNROD



Marana WRF - Biolac



Corona de Tucson WRF – combined clarifier/oxidation ditch



Avra Valley WRF - BNROD

Chlorination and Discharge



Physical

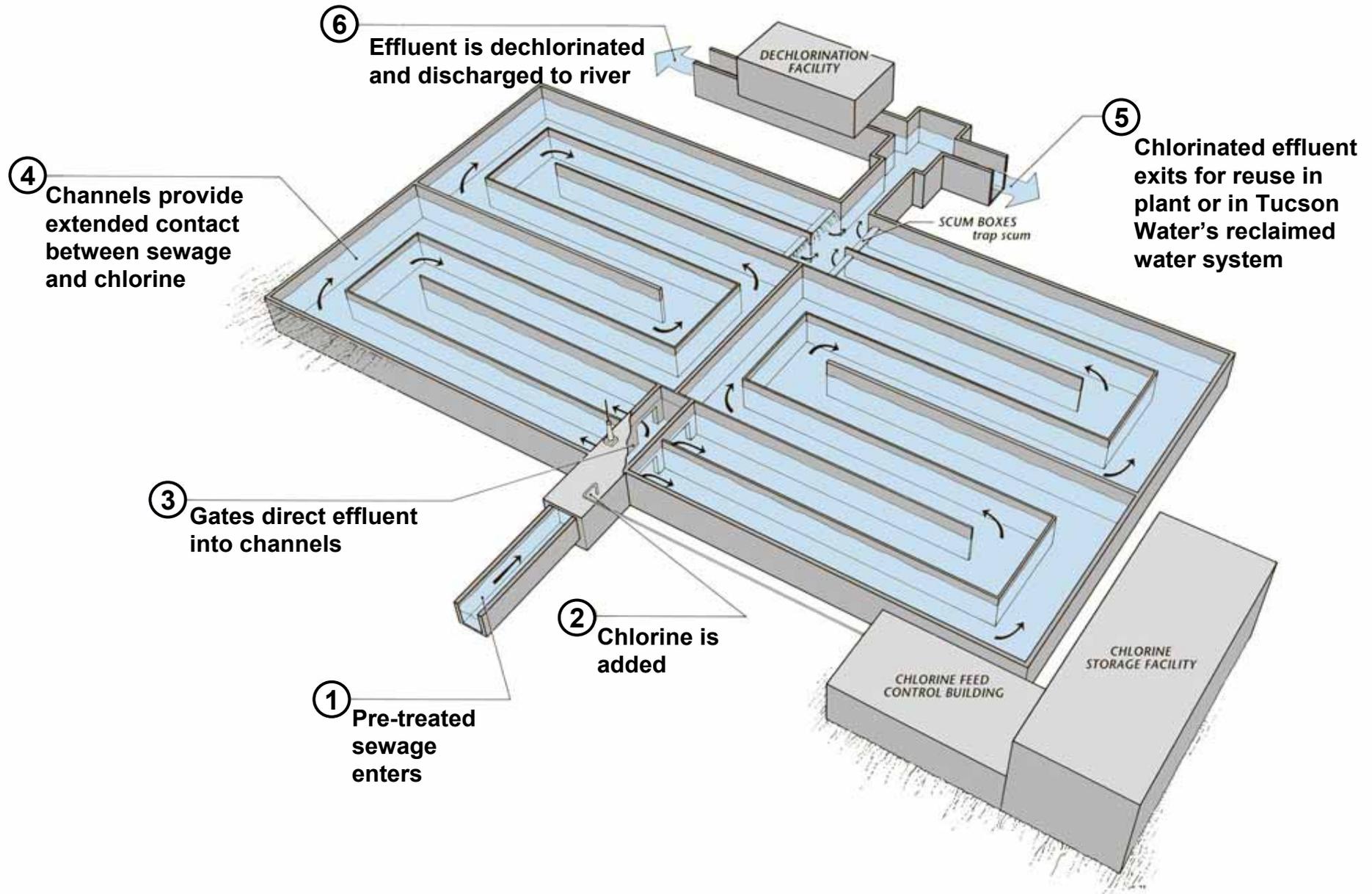
Chemical

Disinfection
(Chemical or
ultraviolet light)

**Chlorine Contact Chamber at
Ina Road WRF**

Reuse

Chlorine Contact Chamber



Biosolids Processing – Ina Road WRF

Sludge from Ina Road WRF process and sludge trucked from sub-regional WRFs

Biosolids from Roger Road WRF process



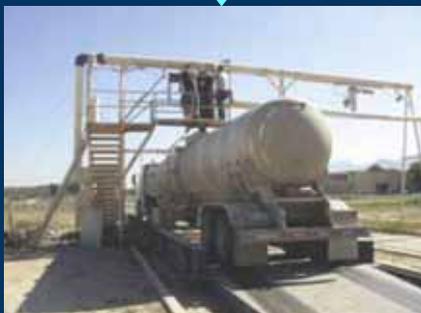
Gravity thickeners



Digesters



Centrifuges

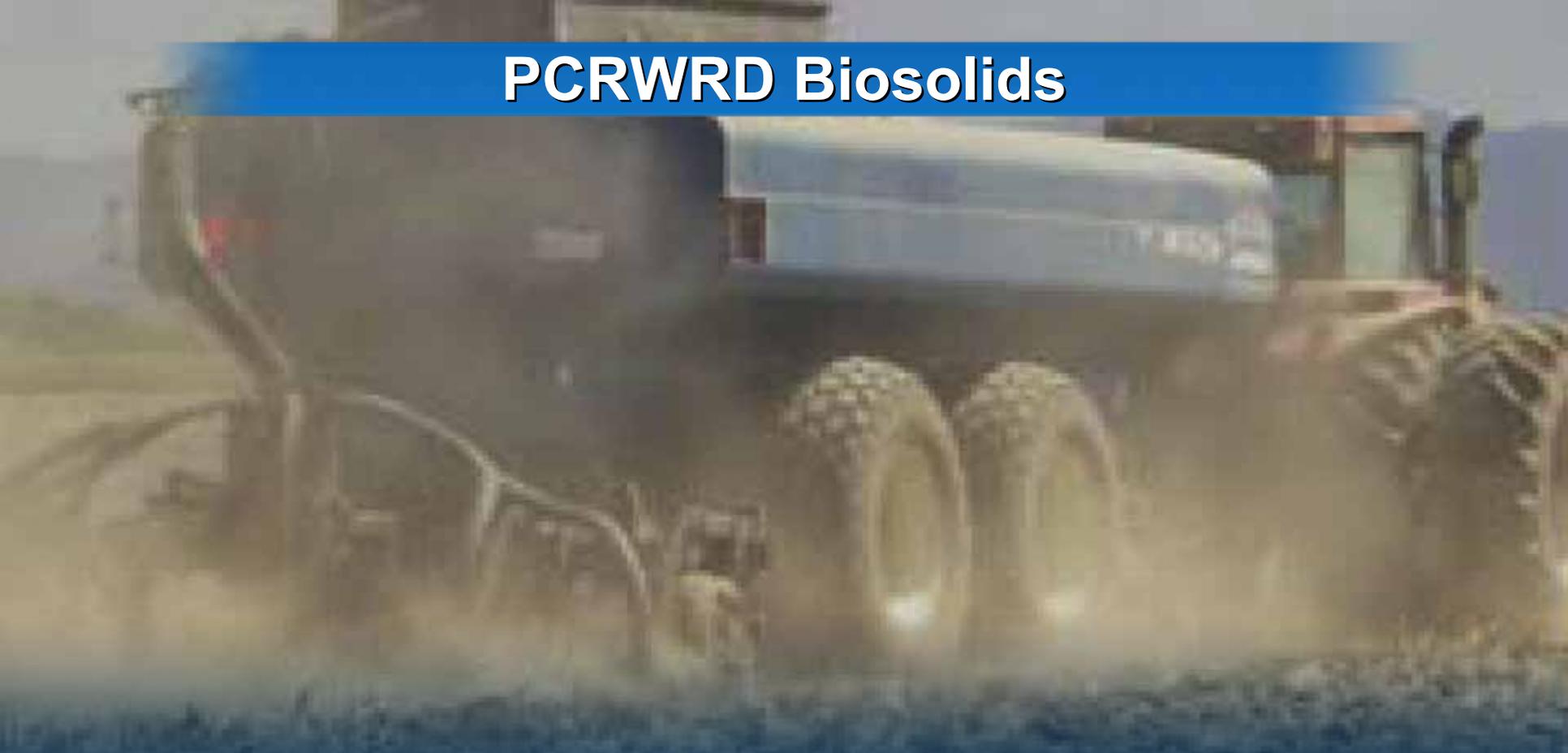


Loading bay



Storage / land application

PCRWRD Biosolids



**10,300 dry tons
produced in 2007**

- **5,851 truck loads**
- **Applied to non-food crops, primarily cotton**
- **3,053 acres amended in 2007**

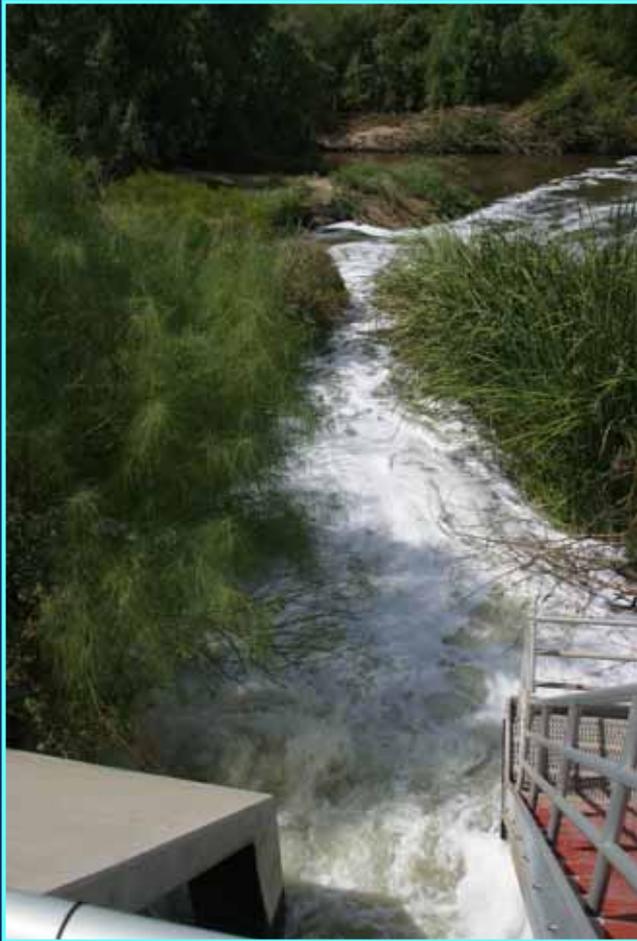
Effluent Disposal Processes

**Tucson Water Reclaimed
Water System (Roger,
Randolph)
Sweetwater Facility**

Discharge
Evaporation pond
Percolation pond
Spray field



Effluent Disposal Processes – Discharge



Discharge at Ina Road WRF



Discharge at Roger Road WRF



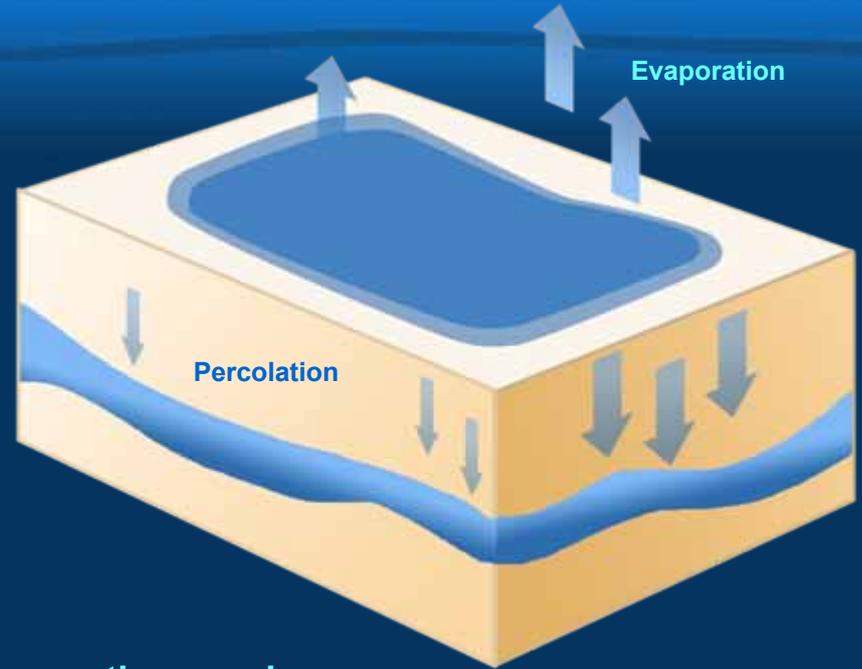
Annual
discharge to
Santa Cruz
River:

52,420 acre
feet

Effluent Disposal Processes – Other



Percolation / Evaporation pond



Spray field



Aerated lagoon

Water Quality Standards



**Aquifer Protection Program
Arizona Pollutant Discharge Elimination System
Reclaimed Water Standards**

Water Quality Standards

Reclaimed Water Standards

- **Class A**
 - Landscape and food crop irrigation, golf courses
- **Class A+**
 - Additionally, meets nitrogen standards
- **Class B**
 - Landscape irrigation (fenced), golf courses (fenced), dust control, concrete mixing
- **Class B+**
 - Additionally, meets nitrogen standards
- **Class C**
 - Irrigation and watering of non-food crops and animals

Water



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Wastewater Reclamation Facilities – A Virtual Tour

Water



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Ina Road Wastewater Reclamation Facility

Ina Road WRF

Capacity: 37.5 MGD



Location Map



Ina Road WRF

Headworks



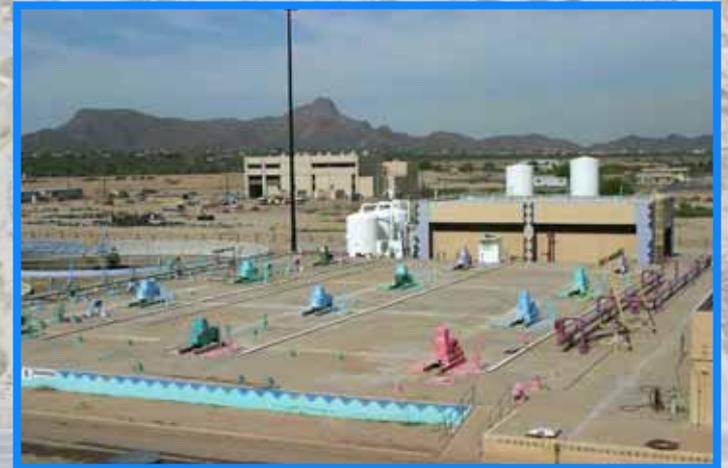
Ina Road WRF

Dual Treatment Trains

**Biological Nutrient
Removal/Activated
Sludge – 12.5 MGD**



**High Purity
Oxygen – 25 MGD**



Ina Road WRF

BNRAS Odor Control Scrubbers and Blower Building



Odor control scrubbers



Blower building for BNRAS



West Ina Road

Ina Road WRF

**Power Plant –
Co-Generation of Methane
for HPO plant**



Ande Highway

Ina Road WRF

Biosolids Production and Land Application



West Ina Road

Highway

Water



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Roger Road Wastewater Reclamation Facility

Roger Road WRF

Capacity: 41.0 MGD



Roger Road WRF

Headworks

Headworks with odor control cover



Headworks before odor control cover



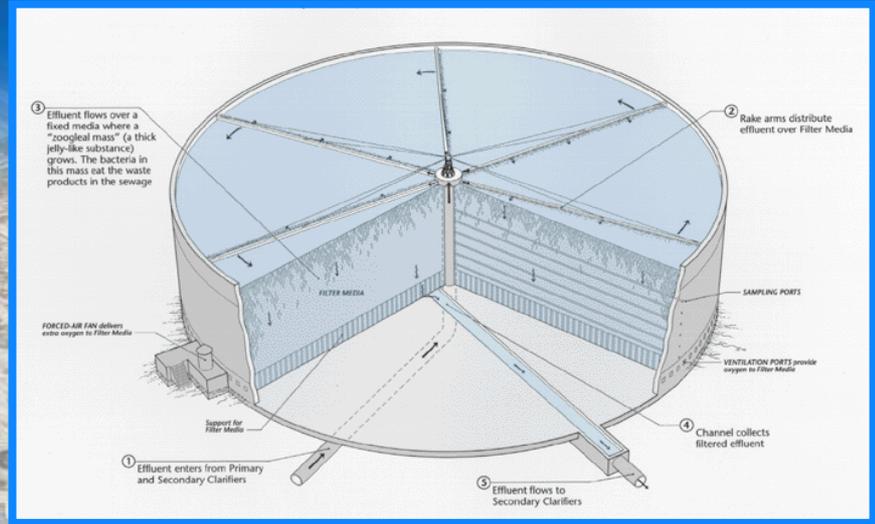
Roger Road WRF

Primary Clarifiers



Roger Road WRF

Biotowers



Roger Road WRF

Biosolids Production

Force Main to Ina Road WRF



Digesters

Water



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Randolph Park Wastewater Reclamation Facility

Randolph Park WRF

Capacity: 3.0 MGD

Campbell Ave.

Randolph Park Pump Station

Force Main

Randolph Park WRF

Alvernon Way

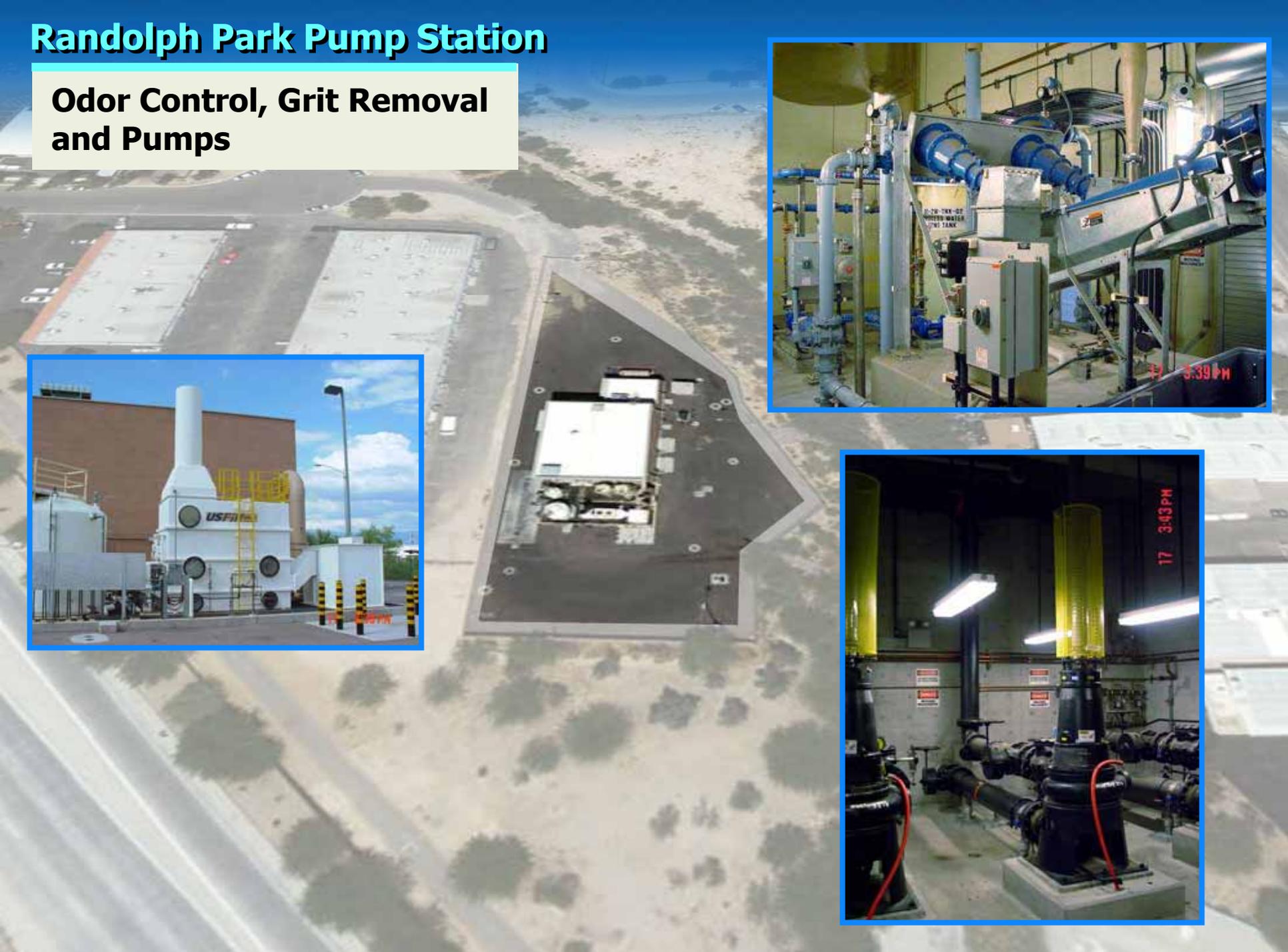
22nd St.

Aviation Corridor Interceptor



Randolph Park Pump Station

**Odor Control, Grit Removal
and Pumps**



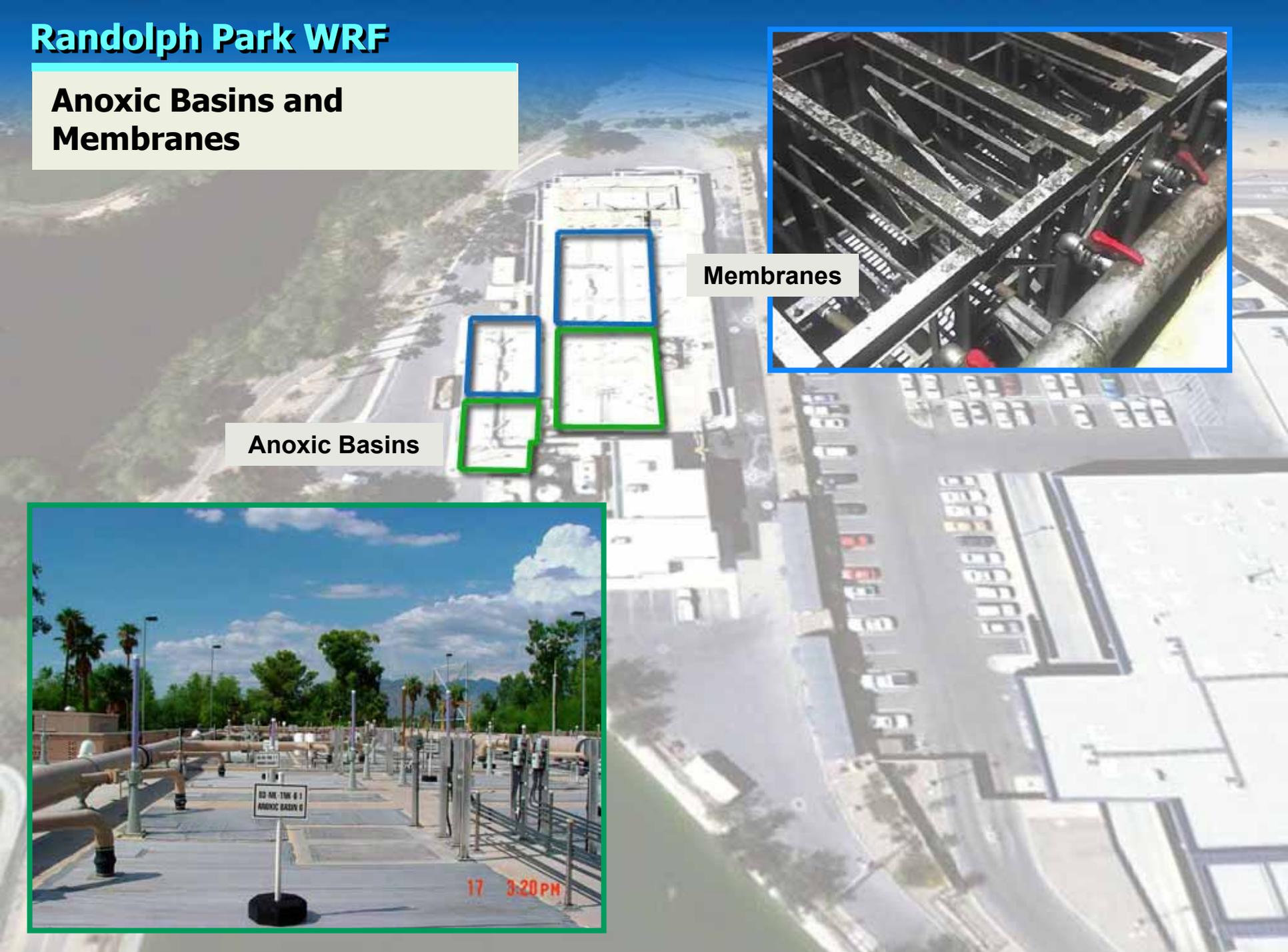
Randolph Park WRF

Capacity: 3.0 MGD



Randolph Park WRF

Anoxic Basins and Membranes



Membranes



Anoxic Basins



Randolph Park WRF

Reclaimed Water Utilization and Solids Disposal

To TW Reclaimed Water System



To 22nd Street Sewer



Water



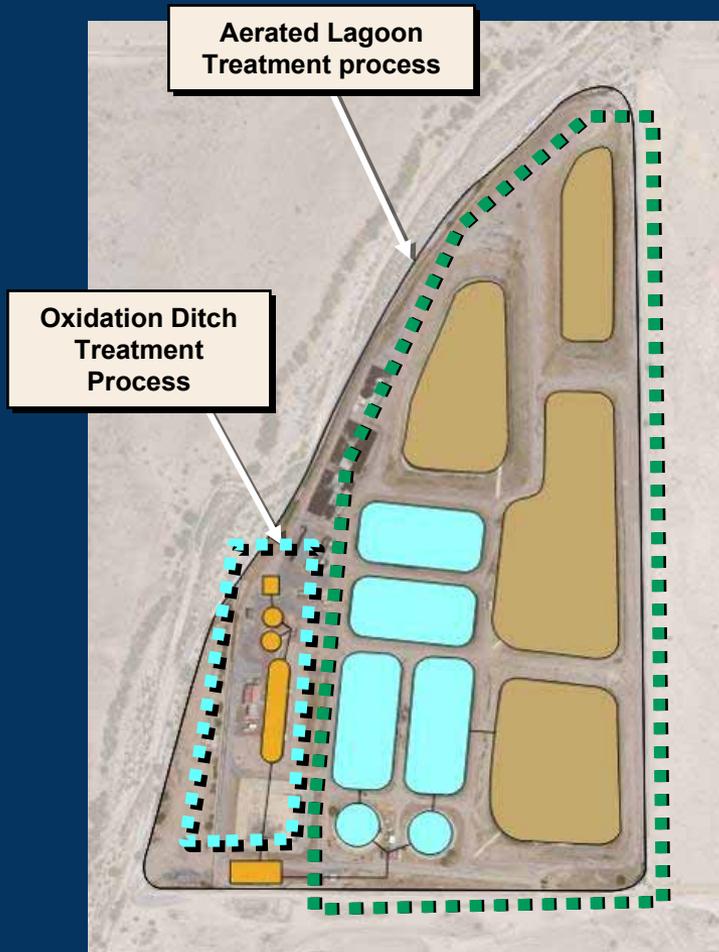
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Sub-Regional Wastewater Reclamation Facilities

Green Valley WRF

Capacity: 4.1 MGD



Aerated lagoon



Oxidation ditch (BNROD)

Avra Valley WRF

Capacity: 2.2 MGD (4.0 MGD under construction)



Renovated Percolation Ponds

Future Percolation Ponds and Birding Area



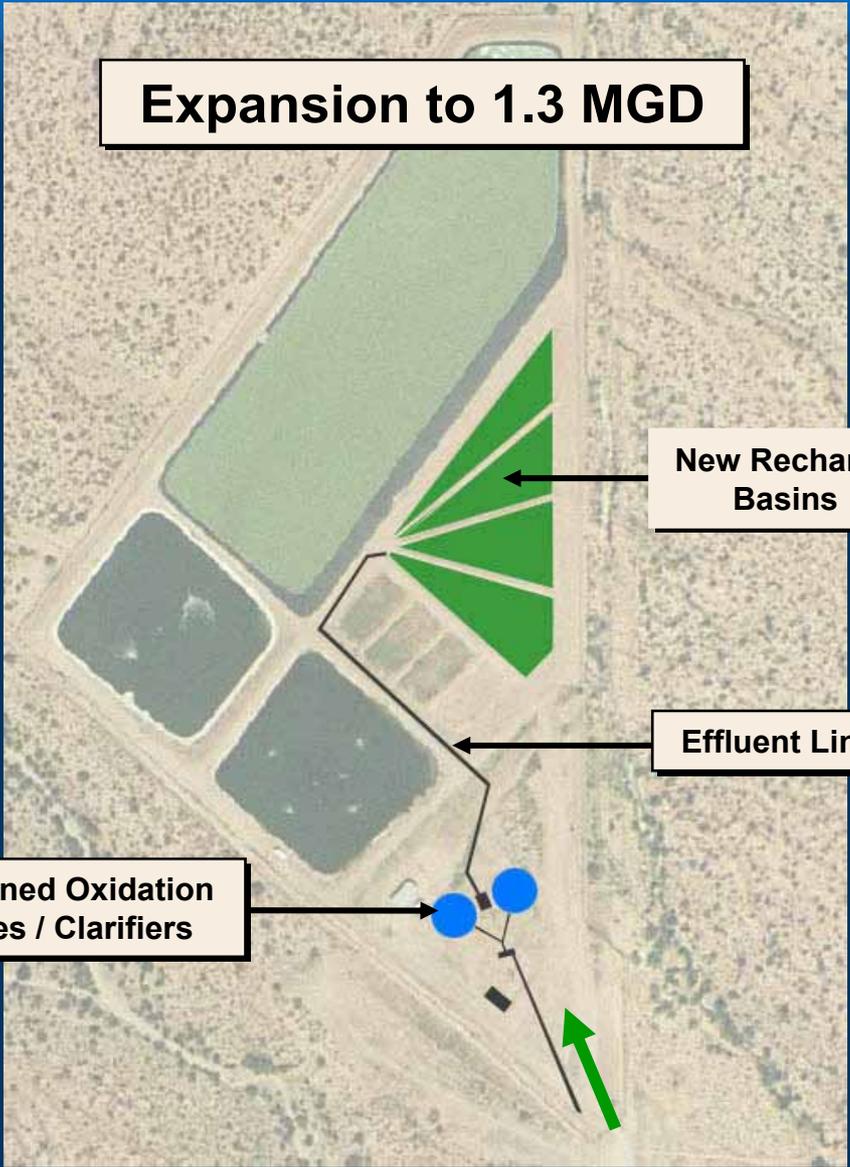
Avra Valley WWTF 4.0 MGD Expansion



BNROD

Corona de Tucson WRF

Capacity: 1.3 MGD



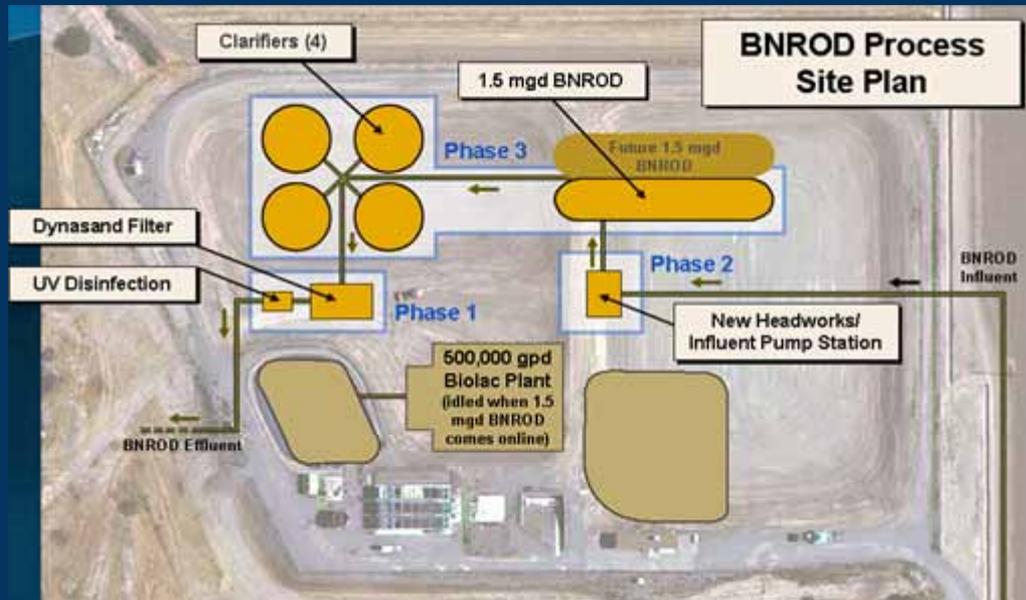
Marana WRF

Capacity: .7 MGD

**Treatment Process:
Four 50,000 GPD
biological nutrient
removal (BNROD)
package plants (currently
in reserve), and 0.5 MGD
Biolac facility**



BNROD Package Plants



Biolac Treatment Pond

Pima County Fairgrounds WRF

Capacity: 20,000 GPD



Mt. Lemmon WRF

Capacity: 12,500 GPD



Rillito Vista WRF

Capacity: 20,000 GPD



Arivaca Junction WRF

Capacity: 100,000 GPD



Water



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Questions