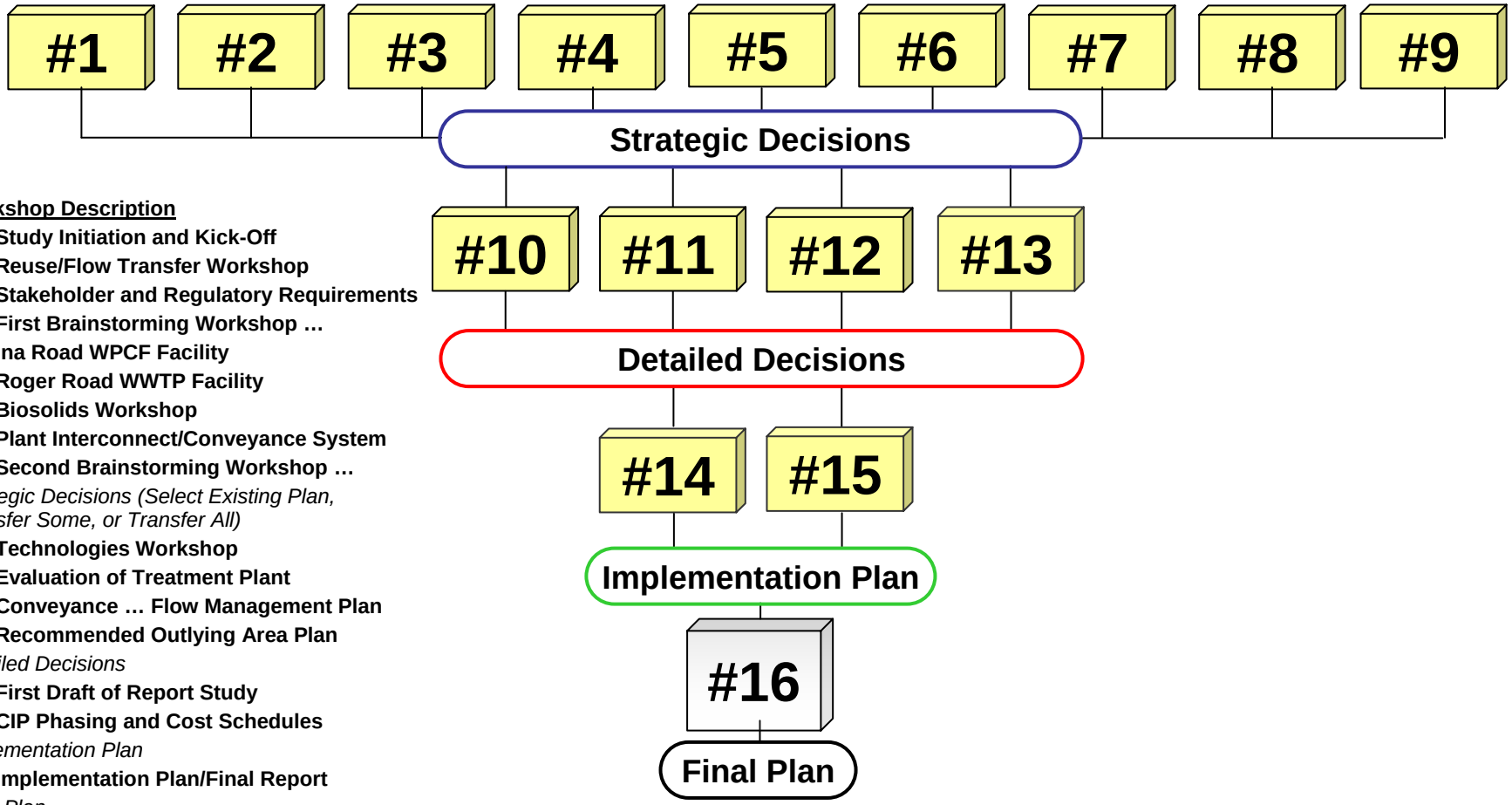
APPENDIX A

Workshop Summaries

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

GREELEY AND HANSEN

Project Workshops

The goal of the master plan is to serve as a broad road map. It will identify potential roads, as well as obstacles to the implementation of Pima County Wastewater Management Department's (PCWMD) Capital Improvement Program (CIP). Through the appropriate level of evaluation, the best option will be identified and selected for implementation, without precluding changes in direction that may be prompted by future needs. This master plan will forecast needs for wastewater treatment capacity throughout the PCWMD service area and the facilities required to meet those needs through the year 2030.

The master plan will build upon several planning and engineering efforts previously performed for or by the PCWMD. The plan will identify how and when wastewater treatment facilities will be upgraded and expanded, as well as how existing facilities will be integrated into future expansions or decommissions through the year 2030. The plan will be based on current and potential future regulatory and PCWMD customer requirements. The plan will recommend a comprehensive CIP with treatment component and system alternatives, phasing schedules and cost apportionments for future implementation of PCWMD wastewater facilities.

To implement this study a series of facilitated workshops (consisting of PCWMD staff, consultants and other stakeholders) will be conducted. The workshops are central to the decision making process for the development of the master plan. All key decisions and the development of consensus will be through the facilitated workshop process.

Sixteen workshops are planned to cover the issues and concerns necessary to develop a comprehensive plan.

Project Workshops

- Workshop #1: Study Initiation and Kick-Off
- Workshop #2: Reuse/Flow Transfer Workshop
- Workshop #3: Stakeholder and Regulatory Requirements
- Workshop #4: First Brainstorming Workshop & Background Data Review
- Workshop #5: Ina Road WPCF Facility
- Workshop #6: Roger Road WWTP Facility
- Workshop #7: Biosolids Workshop
- Workshop #8: Plant Interconnect/Conveyance System
- Workshop #9: Second Brainstorming Workshop & Facility Oriented Workshop
- Workshop #10: Technologies Workshop
- Workshop #11: Evaluation of Treatment Plant
- Workshop #12: Conveyance System Alternatives/ Recommended Flow Management Plan
- Workshop #13: Recommended Outlying Area Plan
- Workshop #14: First Draft of Report Study
- Workshop #15: CIP Phasing and Cost Schedules
- Workshop #16: Presentation of Implementation Plan/Final Report

Workshop attendance will be based on a particular workshop's subject matter. Accordingly, not all will be required to participate, or attend, all scheduled workshops. Subject matters to be covered at the workshops include regulatory and customer requirements, key issues, preferences and constraints, process approaches, identification and evaluation of alternatives and other topics relative to the completion of the study.

Workshops will be conducted by a facilitator to direct the workshop process and focus workshop participants on making decisions and holding to those decisions.

- Mutual project goals that define "success" and an action plan to address potential barriers to success will be developed during these workshops.

Major Topics of Each Workshop

Each workshop will have a central theme and will build upon key decisions arrived from the previous workshops. Therefore, the sequence of workshops is important and the workshops are viewed as additive in building results. A brief summary of the major topics of each workshop follows.

- **Workshop #1: Study Initiation and Kick-Off (1-Day)**
  - Study Schedule Review and Workshop Schedule Review
  - Study Approach and Scope of Services Review
  - Study Expectations
  - Preliminary Project Implementation Schedule, Delivery Options/Funding Options
  - Identify and Review of Initial Study Alternatives
  - Opinion of Probable Cost Level
  - Background Information Available
  - Study Report Outline Review
  - Develop Evaluation Criteria
  - Identify Stakeholders

- **Workshop #2: Reuse/Flow Transfer Workshop (1-Day)**
  - Impacts of Continuation of Existing Water Reuse Plan
  - Impacts of "Transfer Some" Treatment Option
  - Impacts of "Transfer All" Treatment Option
  - Potential for "Combined Wastewater Treatment and Reuse Treatment" Reuse Option

- **Workshop #3: Stakeholder and Regulatory Requirements (1-Day)**
  - Overview of Stakeholder Discussions
  - Issue Identification – Including CMOM, GASB 34, Asset Management Overview
  - Reuse Impacts/Considerations
  - Impact of reduced discharge from Roger Road WWTP on the Santa Cruz River riparian habitats
  - Regulatory Review/Establish January 2007 ADEQ Compliance Reports
  - Review of Future Regulatory Requirements (Nutrient Control, Pharmaceuticals, Air Permits, etc.)
  - Study and Schedule Implementation

- **Workshop #4: First Brainstorming Workshop & Background Data Review (1 Day)**
  - Results of Background Data Review
  - Results of Facility Tour Visits
  - Results of Condition Evaluation of Roger Road WWTP and Ina Road WPCF
  - Develop Risk Matrix
  - Develop Alternative Evaluation Matrix
  - Brainstorm Study Alternatives
  - Finalize Flow and Loading Projections

- **Workshop #5: Ina Road WPCF Facility (1/2 Day)**
  - Ina Road WPCF Operation Practices
  - Ina Road WPCF Nutrient Removal Operation Considerations
  - Alternative Considerations
  - Impact on Existing Facilities

- **Workshop #6: Roger Road WWTP Facility (1/2 Day)**
  - Roger Road WWTP Operation Practices
  - Roger Road WWTP Nutrient Removal Operation Considerations
  - Alternative Considerations
  - Impact on Existing Facilities

- **Workshop #7: Biosolids Workshop (1/2 Day)**
  - Biosolids Regulatory Requirements/Operation Considerations
  - Biosolids State-of-the-Art Technologies/Operation Considerations
  - Biosolids Alternatives (Current/Future)
  - Biosolids and Existing Facilities

- **Workshop #8: Plant Interconnect/Conveyance System (1/2 Day)**
  - Plant Interconnect/Conveyance System Conceptual Layouts
  - Plant Interconnect Operation Considerations
  - Plant Interconnect Existing System Interface
  - Basin Model from Facility Plan
  - Use of Plant Interconnect to Share Peaks in Existing or Transfer Some Options

- **Workshop #9: Second Brainstorming Workshop & Facility Oriented Workshop (1 Day)**
  - Results of Workshops
  - Operation Practices at Other Nutrient Control Locations
  - Nutrient Control Operation Considerations
  - Conveyance System Operation Considerations
  - Impact of reduced discharge from Roger Road WWTP on the Santa Cruz River riparian habitats
  - Regulatory Compliance Plan
  - Reclaimed Water Quality
  - Effluent Water Quality Design Standards
  - Project Design Criteria

- **Workshop #10: Technologies Workshop (1-Day)**
  - Regulatory Requirements/Operation Considerations
  - State-of-the-Art Technologies/Operation Considerations (A presentation by the Consultant on relevant ammonia and nitrogen removal technologies)
  - Discussion of the inter-relationship of the Roger Road and Ina Road facilities in meeting treatment objectives (if applicable)
  - Brainstorming of applicable treatment technologies and strategies
  - Select Top Process Options to Carry Forward

- **Workshop #11: Evaluation of Treatment Plant Alternatives (1-Day)**
  - Conceptual Project Layouts
  - Treatment Facility
  - Facility Modifications and Additions
  - Impact of reduced discharge from Roger Road WWTP on the Santa Cruz River riparian habitats
  - Biosolids Treatment/Disposal/Reuse
  - Bio-Gas Generation
  - Alternate Power Supply Options
  - Power Generation Facilities
  - Laboratory Analysis

- **Workshop #12: Conveyance System Alternatives/Recommended Flow Management Plan (1-Day)**
  - Identification of Conveyance/Flow Management Alternatives
  - Conceptual/Operation Needs to Meet Flow Requirements
  - Outlying Area Evaluation/Identify Sub regional Plant Needs, if any
  - Outlying Area Guidelines
  - Developer Agreement Topics

- **Workshop #13: Recommended Outlying Area Plan (1-Day)**
  - Location/Configuration of Sub-regional Plant
  - Operations Intent
  - Preliminary Decision/Operation Needs

- **Workshop #14: First Draft of Report Study (1-Day)**
  - Presentation of Draft Report (Chapters 2 through 9)
  - Overall Treatment Strategy

- **Workshop #15: CIP Phasing and Cost Schedules (1-Day)**
  - Overall Strategy
  - Project Delivery –Alternative Delivery Methods
  - Funding Alternatives/Rate Impacts

- **Workshop #16: Presentation of Implementation Plan/Final Report (1-Day)**
  - Plan Elements
  - Agreement of Final Plan
  - Final Implementation Schedule
  - Project Delivery –Alternative Delivery Methods (Program Management Options)
  - Funding Considerations
  - Rate Impacts

Workshop #1 Meeting Notes
Study Initiation and Kick-Off

1. The Study Initiation and Kick-Off Workshop for Pima County Metropolitan Wastewater Treatment System Capacity Management, Nutrient Removal, Solids Handling/Treatment and CIP Development Study was held on April 19, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
Controller
Jeff Nichols
County Administrator's Office Water Policy
Kathy Chavez
PCWMD Staff
David Bartos
Tom Berry
Bob Decker
James Doyle
Laura Fairbanks
Frank Gall
David Garrett
Jeff Graunke
Tim Harmon
Michael Kostrzewski
David Longobardi
Frank Luiz
Jing Luo
Peter Magaddino
Tim McGarry
Byron McMillan
John Numden
Glen Peterson
Jeff Prevatt
Prakash Rao
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager

PCWMD Staff (con't)
Mandley Rust
Jack Van Riper
John Warner
Ken Weber
Eric Wieduwilt
Legal
Harlan Agnew
Chuck Wesselhoff

TUCSON WATER
Director
David Modeer
TW Staff
Jeff Biggs
Karen Dotson
Melodee Loyer
Ralph Marra
Dennis Rule
Mark Seamans
Tim Thomure

TOWN OF MARANA
Brad DeSpain

GREELEY AND HANSEN PROJECT TEAM
Orrie Albertson
Jerry Bish
Gordon Culp
Carl Koch
Eric Petersen
Joe Popeck
Andrew Richardson
Harold Smith
Joe Sullivan

2. The major topics of the workshop were:

- Workshop #1: Study Initiation and Kick-Off
  - ► Study Schedule Review and Workshop Schedule Review
  - ► Study Approach and Scope of Services Review
  - ► Study Expectations
  - ► Preliminary Project Implementation Schedule, Delivery Options/Funding Options
  - ► Identify and Review of Initial Study Alternatives
  - ► Opinion of Probable Cost Level
  - ► Background Information Available
  - ► Study Report Outline Review
  - ► Develop Evaluation Criteria
  - ► Identify Stakeholders

A handout was provided to each attendee which included all slides used during the presentation and a detailed summary of the future workshops.

Throughout the workshop, a list of notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk opened the workshop stating that this project is a regional master plan to define and establish the future wastewater management system for the County. At the start there is no option that has preference. Each option under study will be given equal weight until proven otherwise.

The approach of the study is to involve stakeholders, including all in attendance. Decisions will be made based on multi-disciplined evaluations and stakeholders input. The study will develop the right plan for the County by identifying best applicable technologies and an overall cost-effective program.

Where we go with reclaimed water is an important consideration in the overall wastewater management program for the County. Dave Modeer, Director of Tucson Water, and his staff were in attendance to cooperate in developing the right reclaimed water plan for the County.

Ron Riska was recognized as the Project Manager for PCWMD.

4. Andy Richardson defined his role as facilitator to move the group through the agenda and to encourage participation from the expertise available in the room. The purpose of this workshop and future workshops is to make decisions and to work toward informed consent, if consensus is unachievable. The emphasis is on participation and that the project is a group project.

Agenda, ground rules and objectives of the first workshop were presented and covered pages 1 through 4 of the handout.

5. Andy Richardson covered the study schedule and the future workshops descriptions. It was noted that the dates for implementation of nutrient removal at Roger Road WWTP and Ina Road WPCF (2014 and 2015, respectively) are important. The group was informed that more detail on future workshops were provided in the back of the handout. The schedule and future workshops were covered on pages 5 and 6 of the handout.

6. Joe Popeck began the review of the scope of the study by citing the goals of the study elements. The emphasis was on optimization of flow management, wastewater treatment, biosolids handling/treatment, and water reuse throughout the County. For the regional plants, three basic starting points are to be considered:

   - Maintain existing plan
   - Transfer Some Flow from Roger Road WWTP to Ina Road WPCF (treat 20 mgd ± at Roger Road WWTP)
   - Transfer All Flow from Roger Road WWTP to Ina Road WPCF

   In development of options, treatment of wastewater outside the metropolitan area will be addressed, including issues in those areas like connecting septic tanks to the collection system, treating wastewater down gradient from Ina Road WPCF, growth projections, permit limitations, and ultimate use of effluent. Long-term biosolids disposal options, conveyance system capacity and ADEQ requirements are integral to the study results along with the financing needs to support the effort.

   The decision making process of the study requires input and consideration of the stakeholders on the various elements. For scheduling short-term projects underway or those identified during the study, PCWMD management will decide on their priority. The scope of the study was covered on pages 7 through 16 of the handout.

7. Andy Richardson opened the floor of the workshop meeting to the group at large to offer study expectation and obstacles. Expectations range from developing points of synergy between Tucson Water and PCWMD to meet community needs, to creating a single comprehensive plan for PCWMD that is followed into the future. Obstacles range from affordability, legislative issues, staffing concerns, land acquisition, developing a realistic schedule for future facilities, political and environmental issues and more. Expectations and obstacles will be reviewed by the project team and PCWMD to incorporate into the study actions and results where appropriate.

   The plan needs to have a reasonable expectation for successful implementation, but meet current regulatory requirements and be flexible to meet future regulations. In addition, future considerations of Roger Road WWTP must bring it into the 21st century. Additional comments and concerns were captured on Pages 1 and 2 of the attached meeting "flip chart" notes.

8. Joe Popeck provided an overview of the project schedule which included time for design, ADEQ review and approval schedule, and construction of new facilities to meet future needs. It was noted that the current schedule for the plant interconnect is faster than that presented on the schedule, and there is a need to address this issue early. Funding was highlighted as an ongoing activity.

9. Harold Smith addressed the funding aspects of the project. Funding sources: public debt, state-revolving loans, grants, rates and charges were covered. Intergenerational equity was explained as a means to spread costs equitably to the users over a long period of time. The importance for communicating rate impacts to ratepayers and politicians is vital to producing an adequate funding stream for the required projects. The funding plan will need to recognize current bonding commitments and bonding needs of other agencies. Funding issues were covered on pages 17 through 21 of the handout.

10. Eric Petersen addressed the various delivery methods allowable under Arizona law. Issues of control with the design-bid-build process versus the construction-manager-at-risk (CMAR) versus design-build were presented to the group. The most control by the owner is provided in the traditional design-bid-build approach. With CMAR the designer and the contractor are hired separately by the owner and the project delivery is a collaborative process. With design-build delivery the submission by the competing teams is a proposal which encourages innovation to reduce costs. This latter approach gives the owner the least control over the final project. Further presentation provided the potentials benefits and drawbacks of the various delivery methods.

    By Arizona law the County could proceed with design and construction under a request for qualifications/request for proposal (RFQ/RFP) process. This process allows the county to shortlist competent and capable firms based on selective criteria. An honorarium is typically offered to the shortlisted firms to prepare proposals to meet design intent and project constraints.

    For every delivery method there are risks retained by the owner and risks transferred. From the beginning of the project through startup there are risks. On a project there are permitting, design, construction and operations and maintenance risks.

    Contractors are responsible for what is known not what is unknown. With rehabilitation projects the owner can lower costs for a project, but cannot shift risk to the contractor. This is an “as-is” risk which carries a higher risk premium for the contractor because of the potential unknowns. Higher risks result in higher bid costs.

    The plan will need to determine which projects lend themselves to alternative delivery and which projects can be bundled. The delivery methods and risks issues were covered in pages 21 through 26 of the handout.

11. Joe Popeck presented the study options and key study elements. The existing plan, transfer some and transfer all options will be looked at in the context of the new more restrictive effluent standards at Roger Road WWTP and Ina Road WPCF. Addition of “scalping” plants in the Roger Road WWTP and Ina Road WPCF sewer basins, a treatment plant north of Ina Road WPCF, and the possibility of reuse needs greater than 20 mgd near Roger Road WWTP should be evaluated. Space, constructability, operability and costs are important issues to be considered in the overall planning. The study options and key elements were covered on pages 27 through 31 in the handout.

12. Jerry Bish stated that each study option has conveyance issues that needed to be addressed. The existing plan has the transfer of some flow from the Roger Road WWTP sewer basin to the Ina Road WPCF sewer basin. There is some capacity to transfer wastewater through existing flow

management structures. This capacity appears to be limited. A plant interconnect can be sized to transfer significant flows between the water basins. Is there a cost advantage to use upstream flow management structures with the plant interconnect, or the transfer flow entirely through a plant interconnect sized for the appropriate flow? Will the Randolph Park WRF operate continuously and at what flow? The most cost effective conveyance approach in combination with treatment plant sizing will be determined through the study. With the review of the conveyance system a redundancy of where flows can be conveyed needs to be considered. Furthermore, environmental restoration projects need to be addressed when considering discharge options. The conveyance issues were covered in pages 31 through 34 in the handout.

13. Andy Richardson asked the group about the risks related to Roger Road WWTP and Ina Road WPCF. In general it was pointed out that the cost to build new is less costly than to rehabilitate facilities when considerations for keeping facilities in service during construction and the costs of selective demolition are factored into the project. In addition, the impacts of taking an element out of service for an extended period for rehabilitation must be considered. More comments related to the use of proven technologies, not leading (bleeding) edge technologies without a proven track record. Currently, there is a mixture of technologies utilized at the various County owned and operated facilities which complicates the utilization of operators from one plant to another.

    Jeff Prevatt offered that the laboratory space is quite limited and dispersed throughout the Ina Road WPCF. This results in inefficiencies in function and performance that may be relieved with temporary facilities until a permanent location is identified

14. Orrie Albertson introduced the specific needs required to select the appropriate wastewater treatment technology to meet the goals of the future permit requirements. Flow, characteristic strengths, future growth requirements, system reliability, process stability and many other factors will be included in the process evaluation. Changes in basic data such as gpcd will need significant documentation and consensus from numerous stakeholders to change.

    When asked about the biotowers at Roger Road WWTP, the preliminary evaluation suggests that they will not survive the final cut of alternatives that will meet the stringent new standards required by the State of Arizona.

    Disinfection of the effluent from the facilities will become an issue. Ultraviolet or ozone treatment may need to be considered to meet residual toxicity limits.

    Whatever process selected should not be designed to the very edge of its capacity or limits, but be robust to do the job. The process evaluations were covered on pages 35 through 39 of the handout.

15. Carl Koch reviewed the current facilities for processing biosolids and what may be required to achieve a class A biosolids designation. Current operations produces a Class B biosolids output which is land applied. Class A requires advance processing of biosolids to lower pathogens and odor potentials. There are various markets for the higher biosolids classification, but is it large enough to absorb the volumes produced from Pima County facilities? Does the higher

classification warrant the higher costs of treatment? With any future biosolids program the existing storage facility and future storage requirements need to be considered.

As with any biosolids program it is prudent to have multiple outlets for sludge disposal in the event that one is temporarily restricted. Mine reclamation would be a possible alternative disposal option. It was noted that California has a very high standard for biosolids which exceed the Class A requirement. Achieving the California standard comes at higher costs, but may be without a higher product value to offset the additional cost of treatment. The Camby process should be given consideration during the study. The biosolids issues were covered on pages 40 through 45 of the handout.

16. Jerry Bish presented the issues with the areas that lie outside the metropolitan service areas of Roger Road WWTP and Ina Road WPCF. These areas are projected to see explosive growth over the next 25 years and are served by small wastewater treatment facilities scattered to the south, west and northwest. There are some plans to consolidate some facilities that are currently in service, but there are also plans to build additional facilities as growth expands in these outlying areas. This may present an opportunity to consolidate some facilities into a sub-regional facility to the south of the metropolitan area. There may also be an opportunity to consolidate facilities and construct a sub-regional facility in the northwest. Conveyance capacity in existing sewer systems and the costs of transferring flows are key to developing a cost effective approach to treat wastewater in the outlying areas. Consolidation may be effective for sub-areas with proximity, but may not be suitable for all areas. The outlying areas issues were covered in pages 45 through 47 of the handout.

17. Gordon Culp covered the development of evaluation criteria for the study that incorporates all facets of a multi-discipline study. Factors in the evaluation include costs for capital and operations and maintenance, but must integrate non-cost aspects, such as public acceptance and system reliability, which may not carry a cost value. In the end a matrix for cost, and a matrix for cost and other factors will be utilized in the decision making process. It was further recognized that not all evaluation criteria may carry the same weight in an evaluation matrix. It was agreed that the weighting of evaluation criteria would be deferred until a later date rather than tackle that issue with the workshop group. The evaluation criteria were covered in pages 48 through 51 of the handout.

18. Joe Popeck addressed the importance of the level of costs for various elements in the plan. Initially, detailed cost estimates are unnecessary in making capital cost comparisons between alternatives. Representative values that are consistent among the alternatives are necessary to make judgments of costs for the various options. O&M costs will be developed for various elements of a system and will consist of estimates of power usage, chemical consumption, and allowances for O&M of equipment and structures. Capital costs will include equipment, structures and identified significant special costs. Common elements such as roads, sitework, landscaping which are common to all alternatives will have limited cost development. A cost sensitivity analysis will be evaluated for various elements of the costs for each option. Level of costs estimates were covered in pages 52 and 53 of the handout

19. Harold Smith followed the costs development with a presentation on how those costs are utilized in a financial analysis. Costs are not only use in a comparative analysis of option but are included in the funding options analysis. Cost model inputs result in cost outputs that address affordability, rate structure, debt service and cost risk profiles. The cost model can be easily updated to adapt to changing financial conditions and be capable of showing current dollar values. The funding analysis will look at the rates and bonding capacity of other communities comparable to Pima County. Financial analysis was covered in pages 54 through 56 of the handout.

20. Jerry Bish presented the available background information on which to build the master plan documentation. The 2006 Facility Plan Update and the Tucson Water -Water Plan 2000-2050 provide background information for existing facilities, population forecasts and proposed future facilities. Regulatory permits provide the current requirements for operating facilities and a request to achieve higher standards in the near future. Additional information needs to be collected in various areas of treatment, conveyance and finance in order to assess the current situation. Further onsite evaluation of the existing wastewater treatment facilities will be conducted to capture the current assessment of conditions at each site. Background information was covered in pages 56 through 59 of the handout.

21. Andy Richardson presented a list of stakeholders for consideration of the group. Additional stakeholders were offered by the group which included: Chamber of Commerce, TREO, SAHBA, Tucson Electric Power Company and other utilities, Neighborhood associations, Southwest Gas Corp., Bureau of Reclamation, AVRA Water Valley Co-op (Bob Decker, President), US Forest Service, PAG, Pima County Flood Control, Indian Nations, City of Tucson and Town of Sahuarita.

22. Andy Richardson previewed the next workshop scheduled for May 31, 2006. Workshop # 2 will address water reuse and how that impacts the various options under consideration. The workshop outline was presented on page 60 of the handout.

23. Mike Gritzuk provided closing remarks for the workshop. The workshop was intended to introduce the department and various stakeholders to the overall goals and intent of the study. The study is to determine the right plan for the future of PCWMD using a multi-discipline approach. For the study to be successful we need to cooperate and work together. Communications within the department and with public officials and others is key; and each is to share the information with others in their departments. Working together with Tucson Water, a reclaimed water plan will be developed that will best serve the community. With the results of the study, PCWMD will move forward together.

Agenda

Time	Topic	Presenter	Pg
8:00 am	Opening Session • Welcoming Remarks • Overview of Agenda • Adoption of Groundrules: Role of Facilitator • Confirmation of Agenda • Workshop Objectives	 Mike Gritzuk Andy Richardson	1
8:30 am	Study and Workshop Schedule Review	Andy Richardson	4
8:45 am	Scope of Services and Study Approach - Overview • Study Report Outline	Joe Popeck	6
9:15 am	Study Expectations/Obstacles (Develop List)	Andy Richardson	16
9:45 am	Project Implementation Schedule (Based on Study Results) Funding Options Delivery Options/Contractor's Risk	Joe Popeck Harold Smith Eric Petersen	17 17 21
10:15 am	Break		
10:30 am	Overview Study Options and Key Elements • "Existing Plan" • "Transfer Some" • "Transfer All" • Others • Agreement on Study Options/Key Elements	Joe Popeck/ Jerry Bish	26
11:30 am	Roger Road WWTP/Ina Road WPCF Evaluations	Andy Richardson	34
Noon	Lunch		
1:00 pm	BNR Alternatives under Consideration	Orrie Albertson	35
1:40 pm	Solids Handling/Treatment	Carl Koch	39
2:00 pm	Outlying Area Scenarios	Jerry Bish	45
2:15 pm	Break		
2:30 pm	Evaluation Criteria • Develop • Agreement on Evaluation Criteria	Gordon Culp	48
3:15 pm	Level of Cost Estimates	Joe Popeck/Harold Smith	52
3:45 pm	Background Information and Detail of Information for Decision Making	Jerry Bish	56
4:00 pm	Identify List of Stakeholders	Andy Richardson	59
4:10 pm	Preview of Next Workshop	Andy Richardson	60
4:20 pm	Summary Wrap-Up Comment by Group Remarks by Mike Gritzuk	Andy Richardson All Mike Gritzuk	60
4:30 pm	Adjourn		

Flip Chart Notes – April 19, 2006

Schedule

- Plant interconnect needs to be in place to meet the needs of Tucson Water's reclamation facilities
- Timeline – consider time for ADEQ to respond to "plan"
- Plant interconnect – need now
- How will land acquisition be taken into consideration?
- Need to plan now for land acquisition for a new Metro and outlying area treatment plants

Scope

- Will we identify short-term projects to meet need? Yes
- What is our list of assumptions? Will develop as we move forward
- Explanation of assumptions are key – need to be supportable
- Area downstream of Ina – how addressed?

Expectations

- Come up with a plan that can be implemented and meet proposed and future regulatory requirements
- This is "the" plan for 25-years – the year 2030
- The plan should include how it will be "sold" to the community
- Puts Roger Road into the 21st century
- Keep annual O&M to minimum
- Pan will address water reuse water quality requirements – water use and needs of reclaimed water system will be included
- Identify points of synergy and water reuse – where Tucson Water and Pima County can work together to meet "entire" community needs
- Need to have flexibility on short term; be able to adjust the unknowns of water side – identify leading indicators and monitor those indicators as plan is implemented
- Support policy decisions that have to be made
- Create a name for the "plan" that the public can identify with
- Optimal technology ***cost effective*** plan for long-term wastewater management in Pima County as well as affordable

Obstacles

- What impact will the 25-year plan have on staffing? Needs to be addressed in plan
- Include stakeholders – so they accept solution – still identify more stakeholders
- Be willing to try and understand other people's view – not easy to do
- How do we make plan a "living" document?
- How do we integrate other entities plans – that are concurrent with our "plan"?
- Communication to those outside the workshops – on what's going on; keep people in Pima County up-to-date for "buy-in" – operators are key. People at workshops need to communicate to others that were not present in the workshops
- Listen to operators
- We need to make this happen
- Be aware of legislative issues

- Where the effluent goes, where the biosolids go is a major issue that needs to be addressed
- Opportunity – institutional structure of water and wastewater management needs to be taken into consideration
- How does entitlement affect water reuse?
- Keep open mind as we all work through study
- Look at how partnership can evolve – let go of the past
- Money – will be key to implement plan – or it will be outdated by the time it is done
- Disconnect between technological reality and political reality
- Look at Mother Nature / natural ways to treat wastewater
- Need to accept framework to show how plan was developed and how it should be updated
- Need to state assumptions and get "buy-in" on assumptions and monitor them as they change
- How do we get consensus? How do we get "buy-in"?
- Lot of "unknowns" – scope is broad
- Need realistic schedule on implementation
- Antiquated institutional arrangements need to be evaluated
- Politics has to be taken into consideration for projects to be implemented
- Inability to change will be a major issue
- Affordability
- Regulatory uncertainty, i.e., pharmaceuticals removals, etc.
- Municipal competition instead of cooperation

Funding Options

- When will funding start? Need to look at funding sources right now
- Community capacity on funding – other funding needs – look at both "water and wastewater bill" impact
- Look at current bonding levels and how it relates to future capacity
- Proactive in tax incentive for commercial and developer for locations of wastewater service
- Impact on costs based on construction funding and activity; will labor force be there to build CIP?
- Need to consider all construction activity in Pima County -- road, water, etc.

Delivery Options/Contractor's Risk

- Are there really time and cost savings? (Would like documented information.)
- How is the issue of control addressed?
- What are the relative "cost" impacts and "savings" on each method?
- Data needs to back up cost savings with different methods
- Value engineering – how should it be used to manage risks and costs?
- Program management – look at program management as a way to implement entire CIP – will this method manage risks and result in cost savings?

Study Options

- Make sure to include the concept of scalping water reclamation plants in options development and evaluation
- Another big plant between Ina Road and Roger Road?
- New option: look at North Regional WWTP to handle flow North of Ina Road WPCF sewer basin. Plant would be located around Tangerine Road
- Make sure we look at solids load if scalping plants are used

- Transfer some – build plant only to meet Tucson Water need at Tucson Water quality requirements and decommission Tucson Water AWT Plant
- Look at the issue of reclaimed water storage
- What is the volume needed that is optimal for Roger Road?
- Still deliver to Sweetwater Facility; look at age and conditions at Tucson Facility
- For outlying areas, look at direct aquifer recharge of reclaimed water
- Make sure aware of odor issues as we move forward
- Talk to Tucson Water on how costs may be shared on different reclaimed water options

Conveyance Options

- Address reliability and redundancy for options considered
- Environmental restoration projects impacts have to be taken into consideration in the evaluation of flow routing

Roger Road / Ina Road Evaluations

- Bid Build – Pima County may keep all the risk on rehabilitation?
- Cost more to rehabilitate – than new
- Cost to build new and cost of demolition need to be evaluated
- Catastrophic failure and risk of that happening
- Maintain to extend useful life
- What methods for assuming risk

BNR Alternatives

- How were target treatment limits picked? Need to justify
- Basic assumption on gpcd values; need to look at "buy-in"; have to work together on planning data; need to make sure Pima County and Tucson Water are together on water use values
- Look at robustness of lower limits and cost as it relates to treatment alternatives
- How comfortable are we with nitrogen limits under 6 and what is the cost?
- What about phosphorus?
- On BNR alternative evaluations, indicate why deleted from further evaluation and state the justification
- How does BCAT impact disinfection considerations?

Solids Handling / Treatment

- Need to interact with ongoing projects as they relate to this study; need to be aware that conditions will change as those projects are implemented
- How long will market exist for Class B and will there be a market for Class A?
- Look at additional storage space for biosolids; need storage space right now
- Use existing research on Class A as evaluations are made
- Look at developers on marketing Class A process
- Consider keeping two options open for final biosolids disposal for County as a back-up plan

Outlying Area Scenarios

- Be mindful of how certain areas will grow in future; pygmy owl vs. other areas
- What to do about Indian nation?
- Shift of growth from Ina WPCF service area to Marana area
- Future is 2030, plan for "build out"

- Look at the issue at how flow diversion can offer relief to Roger Road?
- Desert Museum WWTP does not exist
- Operational responsibility for Randolph Park WRF is with outlying areas
- How is effluent going to be used relative to outlying areas?
- Proactive guidelines for satellite plants – Pima County control, not developers
- Look at solids impacts

Evaluation Criteria

- Technology new – reliability
- Reuse of entire effluent – value of water
- Recharge potential
- To what extent are we using proven technology?
- How to measure risk – how to convert to $?
- User friendly – labor impacts
- Employee safety
- Odor generation potential
- Transition from new to old
- Flexibility to expand over time
- Archeological impacts
- Ease of conversion from existing to new – compatibility
- Alternative energy sources and impact on costs
- How do we work into evaluating the value of the reclaimed water?
- SCADA – support for technology and impact on O&M
- How to measure risk in $ - what other ways to measure risk?
- Look at space issues; need space for support facilities such as a new laboratory
- Willing to take risk not to look at new technology
- How to make it work vs. adaptation at other locations
- Have to make business case for use of existing facilities if it drives up O&M cost
- Look at all technologies that are out there; is there uniformity? In future would like ease of operation
- Need to consider impacts of being on the "bleeding edge" versus proven technology

Level of Cost Estimates (Types of Cost Estimates – Comparative Cost Estimates)

- O&M cost development as a percentage of capital – not comfortable with approach, would like some additional consideration; example: maintenance on certain types of technologies considered
- O&M cost relative to benchmarking as a check – need to compare
- Have Pima County O&M staff look at O&M cost numbers
- 80% of O&M costs with four areas: labor, energy, chemicals, supplies
- Complexity of process; take into consideration on development of O&M costs
- Need to be able to defend O&M numbers on comparative estimates

Level of Cost Estimates (Financial Analysis)

- Would like a sensitivity analysis on each of the options
- How do Pima County rates compare to other rates?
- May not be collecting revenues of areas we need to
- How much bonding should Pima County have compared to similar size utilities?
- 2006 dollars – year when construction will occur; dollars need to be included in plan

Background Data

- Tucson Water reclaimed water usage plan – plus other document relative to water reuse
- November 15, 2005 CMOM State Rule
- Permits for recharge
- Randolph Park, Ina and Roger reuse permits
- Stormwater permits, APP
- Need to look at developer agreements
- Need to review Pima County planning strategy documents
- Need previous biosolids study and agreements

Stakeholders

- ADWR
- Development community
- Indian nations
- Environmental community
- SAHBA
- Pima County Flood Control
- Chamber of Commerce
- TREO
- Tucson Electric Power Company (TEP)
- Neighborhood Associations
- Southwest Energy Solutions, Inc.
- Southwest Gas Corp
- Town of Sahuarita
- PAG 208 Program
- State Land
- Arva Valley Water Co-op
- Pinal County
- US Forest Service
- USGS
- Bureau of Reclamation
- City of Tucson, Habitat Conservation Planning

Regionalization Study of Metropolitan Treatment Facilities and CIP

Workshop #1 Kick-Off Meeting

April 19, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
Joe Popeck	Project Mgt/Overview
Howard Smith	Financial
Eric Petersen	Legal
Jerry Bish	Conveyance/Outlying Areas
Orrie Albertson	Treatment Alternatives
Carl Koch	Biosolids
Gordon Culp	Evaluation Criteria

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Study overview
- Treatment alternatives
- Biosolids
- Outlying areas
- Evaluation criteria
- Background information
- Closing

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in "parking lot"

8

Role of Facilitator

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

9

Workshop Objectives

- Familiarize group with scope of study , approach and schedule
- Familiarize group with workshop process for study execution
- Develop list of study expectations and identify obstacles
- Review project funding options, project delivery options and concept of contractor's risk
- Reach agreement on study options and key elements

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Workshop Objectives

- Gain consensus or informed consent on issues associated with Roger Road WWTP / Ina Road WPCF condition evaluations
- Review BNR and solids handling/treatment alternatives under consideration
- Reach agreement on study options evaluation criteria
- Gain understanding and agreement on level of cost estimates used
- Gain consensus or informed consent on level of detail of information used for final decision making
- Identify/verify study stakeholders

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Pima County Wastewater Management Department

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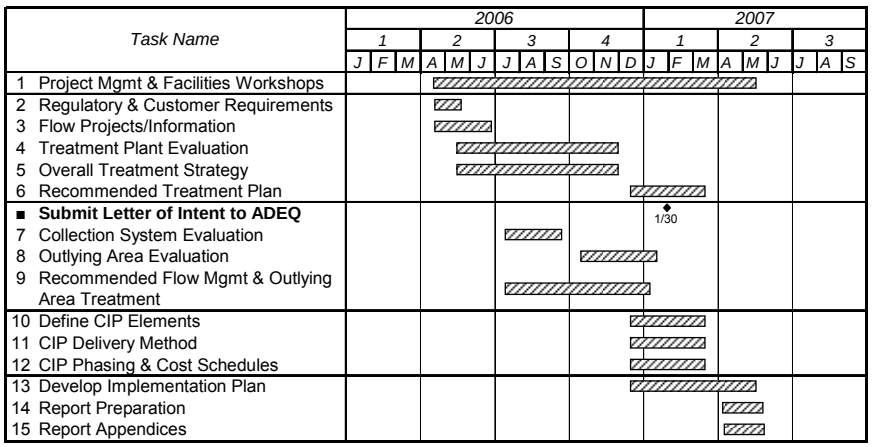
Study and Workshop Schedule Review

Andy Richardson

Study Schedule



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Workshop Descriptions

- *Workshop #1*: **Study Initiation and Kick-Off**
- *Workshop #2*: **Reuse Workshop**
- *Workshop #3*: **Stakeholder Regulatory Requirements**
- *Workshop #4*: **First Brainstorming Workshop and Background Data Review**

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Workshop Descriptions

- *Workshop #5*: **Ina Road WPCF Facility Oriented Workshop**
- *Workshop #6*: **Roger Road WWTP Facility Oriented Workshop**
- *Workshop #7*: **Biosolids Workshop**
- *Workshop #8*: **Plant Interconnect/ Conveyance System Workshop**

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Workshop Descriptions

- *Workshop #9*: **Second Brainstorming Workshop and Facility Oriented Workshop Results**
- *Workshop #10*: **Technologies Workshop**
- *Workshop #11*: **Evaluation of Treatment Plant Alternatives**
- *Workshop #12*: **Conveyance System Alternatives/Recommended Flow Management Plan**

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Workshop Descriptions

- *Workshop #13*: **Recommended Outlying Area Plan**
- *Workshop #14*: **First Draft of Report Study**
- *Workshop #15*: **CIP Phasing and Cost Schedules**
- *Workshop #16*: **Presentation of Implementation Plan/Final Report**

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Pima County Wastewater Management Department

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Scope of Study

Joe Popeck

Goals of the Study

- Determine strategy for:
  - Managing long-term flow/capacity
  - Treating additional loading of Metro basin wastewater
  - Rehabilitating existing facilities
  - Handling biosolids
  - Providing reclaimed water

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Goals of the Study *(continued)*

- Develop coordinated Capital Improvement Design and Construction Program:
  - Cost estimates
  - Schedules
  - Recommended delivery strategy
  - Funding strategy
  - Integration with PCWMD CIP

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Major Project Scope Elements

- Regionalization study of Metropolitan treatment facilities
- Wastewater treatment
  - Location of treatment
  - Nutrient removal
  - Reclaimed water/outlying treatment facilities
- Long-term biosolids disposal
- Conveyance system issues
- Implementation schedule
- Financial requirements
- Stakeholder involvement
- Study report outline

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Regionalization Study of Metropolitan Treatment Facilities

- Optimize flow management scheme across the county wastewater service areas
- Optimize treatment processes to meet future needs
- Optimize biosolids handling / utilization

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Regionalization Study of Metropolitan Treatment Facilities *(continued)*

- Optimize configuration for meeting regional reuse needs
- Optimize configuration of facilities for Roger Road WWTP, Ina Road WPCF and outlying facilities
- Cost effective allocation of resources
- Comprehensive financial plan to achieve results

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Regionalization Study of Metropolitan Treatment Facilities *(continued)*

- Which regionalization option for Roger Road WWTP and Ina Road WPCF is best?
  - Maintain existing plan (Facility Plan)
  - Transfer some flow from Roger Road WWTP to Ina Road WPCF
  - Transfer all flow from Roger Road WWTP to Ina Road WPCF

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Regionalization Study of Metropolitan Treatment Facilities *(continued)*

- What are benefits/concerns of each option?
- How does reclaimed water fit in?

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Wastewater Treatment

- What nutrient removal treatment alternative best suits Pima County's needs?
  - To meet 2014 / 2015 regulatory requirements
  - For consideration of potential future requirements
- How does nutrient removal treatment work with reclaimed water treatment?

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Wastewater Treatment *(continued)*

- Which wastewater flow treatment scenario best addresses outlying facilities?
  - Add capacity to conveyance system through Tucson and treat future flows at Roger Road WWTP and/or Ina Road WPCF?
  - Connect some or all outlying facilities to regional facilities?
  - Construct sub-regional WPCF/WRF to treat flows from outlying areas.

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Long-Term Biosolids Disposal

- How will the treatment, solids and conveyance issues be implemented?
  - What is the plan to transition from old to new?
  - How will elements of the program be phased in or phased out?

28

Conveyance System Issues

- Location of treatment
- Rehabilitation phasing
- Implementation phasing
- Conveyance system expansion vs. satellite plants

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Implementation Schedule

- Result in compliance with ADEQ discharge limits
- Temporary and permanent Improvement projects
- Operational considerations

30

Financial Requirements

- What are the financial impacts of the recommended plan?
  - What are the program elements/phasing?
  - What are the element costs?
  - Where is the money?
  - When does the money need to be available?
  - What is the supporting rate structure?

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Stakeholder Involvement

- Facilitated Workshops
  - PCWMD Staff/Review Team Leaders
  - Greeley and Hansen Team
  - Peer Group Members
  - ADEQ
  - Tucson Water
  - Selected Stakeholders

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Stakeholder Involvement *(continued)*

- **Public Meetings:**
  - PCWMD Management/PIO
  - Greeley and Hansen Management Team
  - Invited Selected Stakeholders
  - Elected Officials
  - ADEQ
  - Public

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Study Report Outline

- Chapter 1 – Introduction and Report Summary
- Chapter 2 – Regulatory and Customer Requirements
- Chapter 3 – Flow Projections and Capacity Needs
- Chapter 4 – Treatment Plant Evaluation
- Chapter 5 – Overall Treatment Strategy
- Chapter 6 – Recommended Treatment Plant Plan
- Chapter 7 – Conveyance System Evaluation
- Chapter 8 – Outlying Area Evaluation
- Chapter 9 – Recommended Flow Management and Outlying Area Treatment Plan
- Chapter 10 – CIP Elements
- Chapter 11 – CIP Delivery Method
- Chapter 12 – CIP Phasing and Cost Schedules
- Chapter 13 – Implementation Plan
- Report Appendices

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Study Report Outline *(continued)*

Chapter 2 – Regulatory and Customer Requirements

2.1 Introduction
2.2 System Capacity
  2.2.1 Conveyance System Capacity
  2.2.2 Treatment Capacity
2.3 Effluent Quality (River Discharge and Reclaimed Water Use)
  2.3.1 AZPDES and APP Permit Requirements
  2.3.2 Pathogen Removal
  2.3.3 Salinity
  2.3.4 Emerging Contaminants
  2.3.5 Future Customer Requirements
  2.3.6 Environmental Requirements
  2.3.7 Risk
2.4 Environmental Habitat Considerations for the Santa Cruz River
2.5 Residuals Quality
2.6 Air Quality
2.7 Redundancy, Flexibility, and Reliability
2.8 Roger Road WWTP Condition Assessment
2.9 Ina Road WPCF Condition Assessment
2.10 Conveyance System Assessment
2.11 Water Reuse Considerations
2.12 Summary

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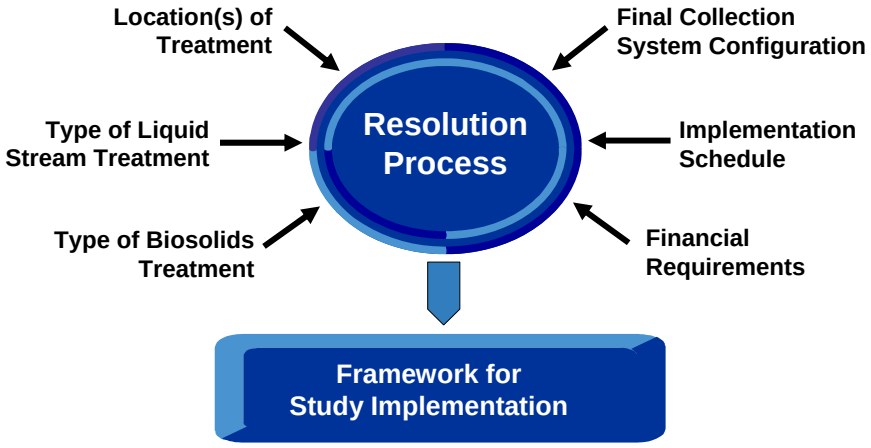
What We Have to Decide



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How to Answer the Questions?

- Identify major decisions / issues
- Gather and review pertinent information
- Collaborate with internal / external stakeholders
- Build consensus (workshops)
- Agree on decision

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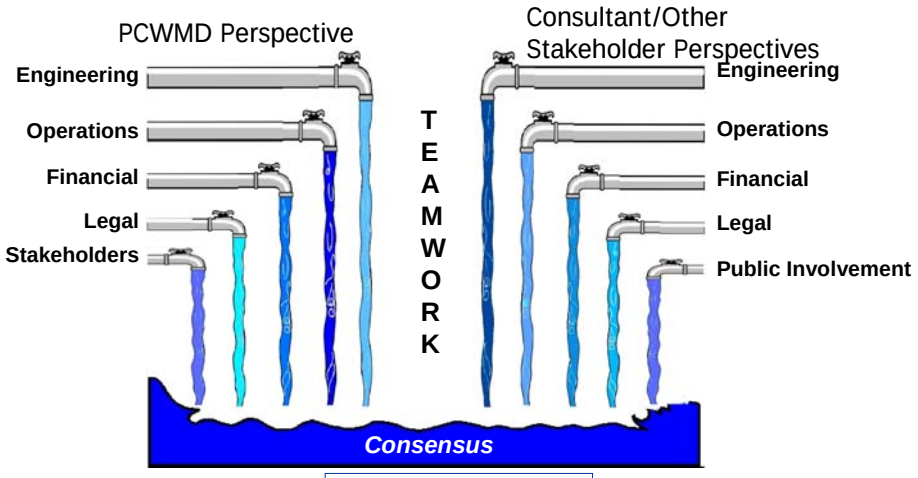
Study Interaction "Building Teamwork"



"Facilitation Makes It Work"

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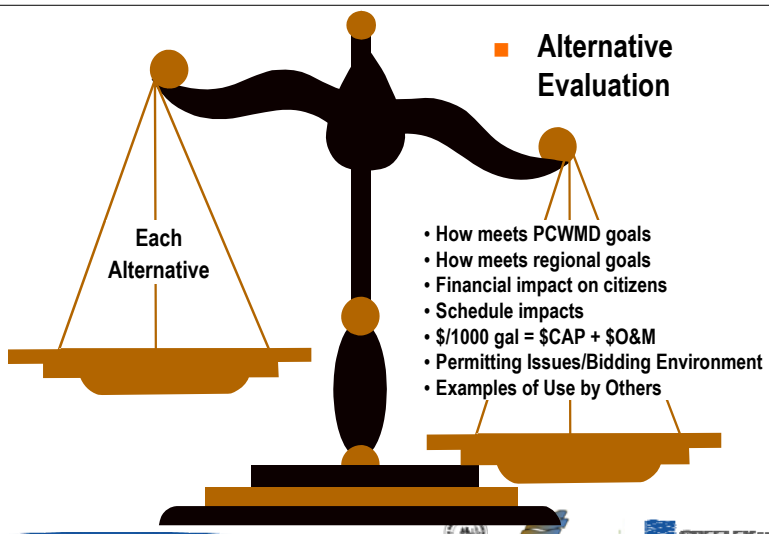
Evaluate Alternative and Subalternative



- Alternative Evaluation
  - How meets PCWMD goals
  - How meets regional goals
  - Financial impact on citizens
  - Schedule impacts
  - $/1000 gal = $CAP + $O&M
  - Permitting Issues/Bidding Environment
  - Examples of Use by Others

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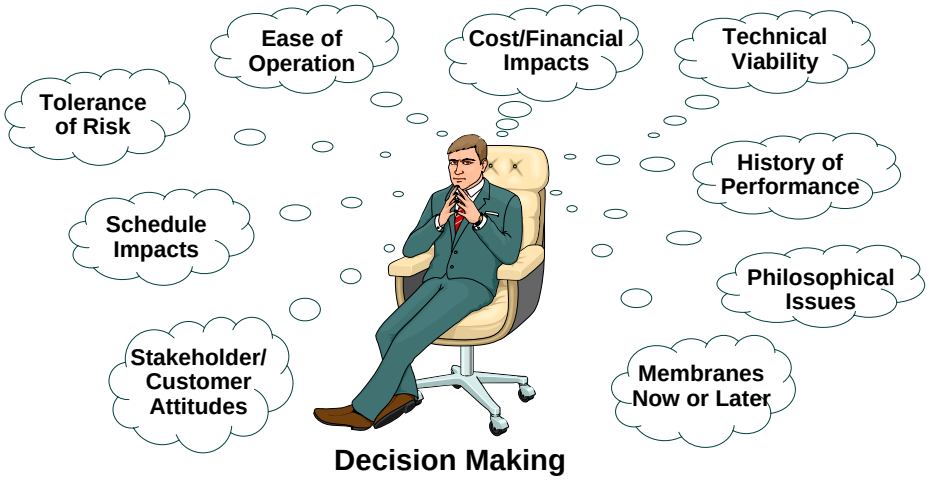
Major Decision Process



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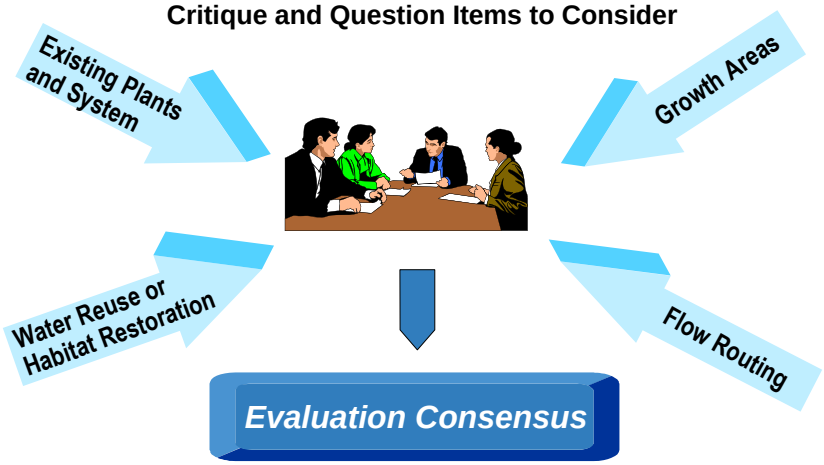
Location(s) of Treatment

Critique and Question Items to Consider



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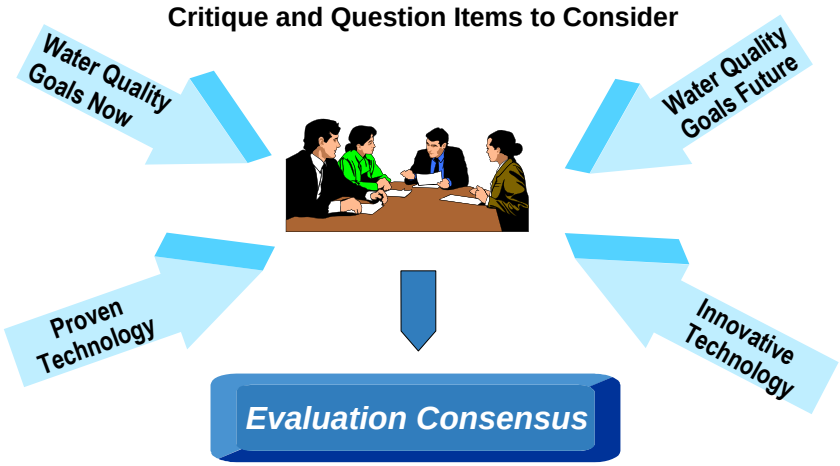
Type of Wastewater Treatment

Critique and Question Items to Consider



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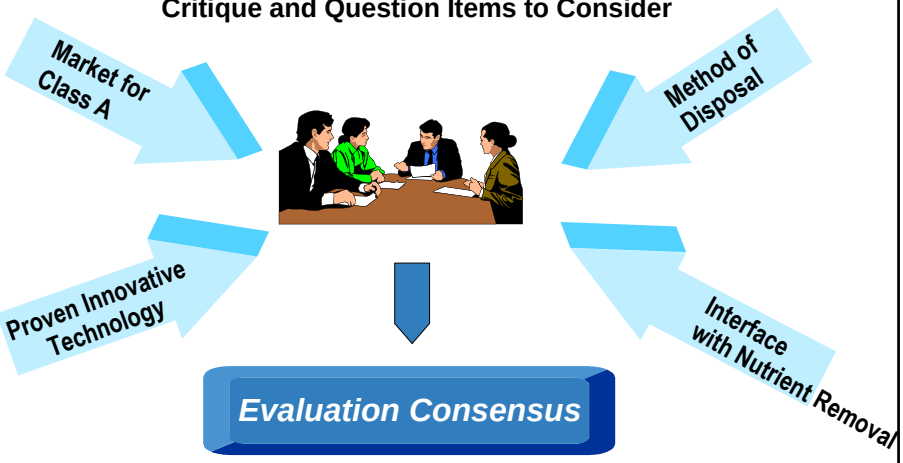
Type of Biosolids Treatment

Critique and Question Items to Consider



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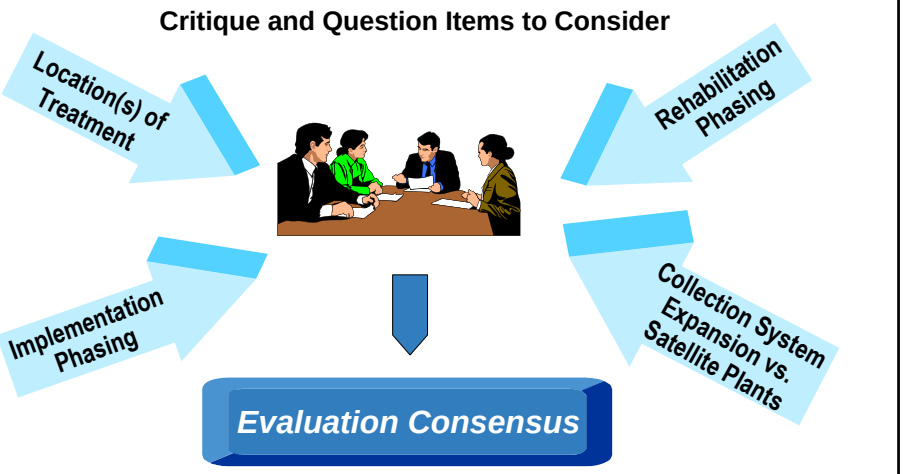
Type of Collection System Configuration

Critique and Question Items to Consider



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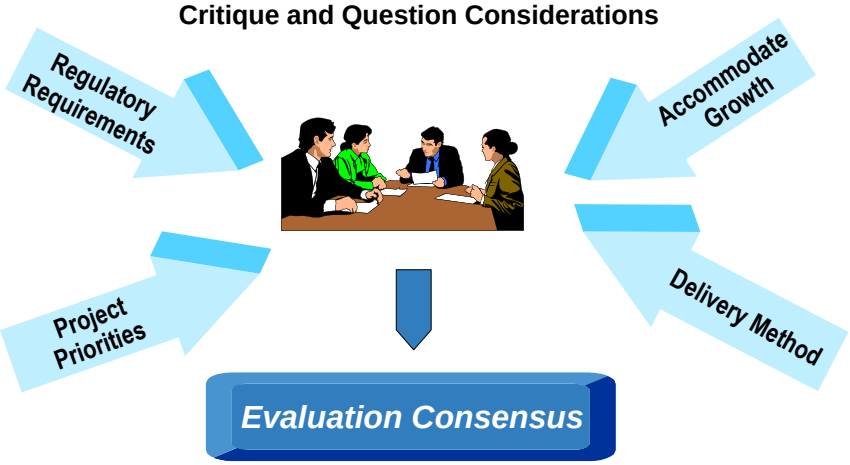
Implementation Schedule

Critique and Question Considerations



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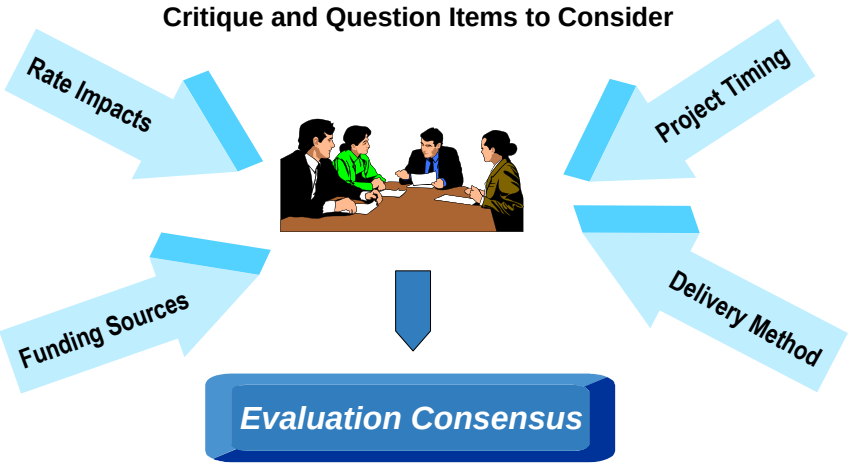
Financial Requirements

Critique and Question Items to Consider



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Interview Stakeholders

- Questions
  - What will success look like?
  - What are goals and needs?
  - What needs to happen for success?
  - What three difficult/important issues have to be worked through?
  - What issues can be addressed with confidence/no confidence?
  - What has worked well / what hasn't?
  - What topics need to be addressed in each of the workshops?

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Study Expectations/Obstacles

Andy Richardson

Project Implementation Schedule

Joe Popeck

Project Implementation Schedule

Item	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
		ADEQ Report Proposed Solution						Ina Road BNR	Roger Road BNR		
Metro Study											
Arrange Funding											
RR to IR Plant Interconnect											
Design											
Construct											
Convert Ina Road WPCF to BNR											
Design											
Construct											
Convert Roger Road WWTP to BNR											
Design											
Construct											

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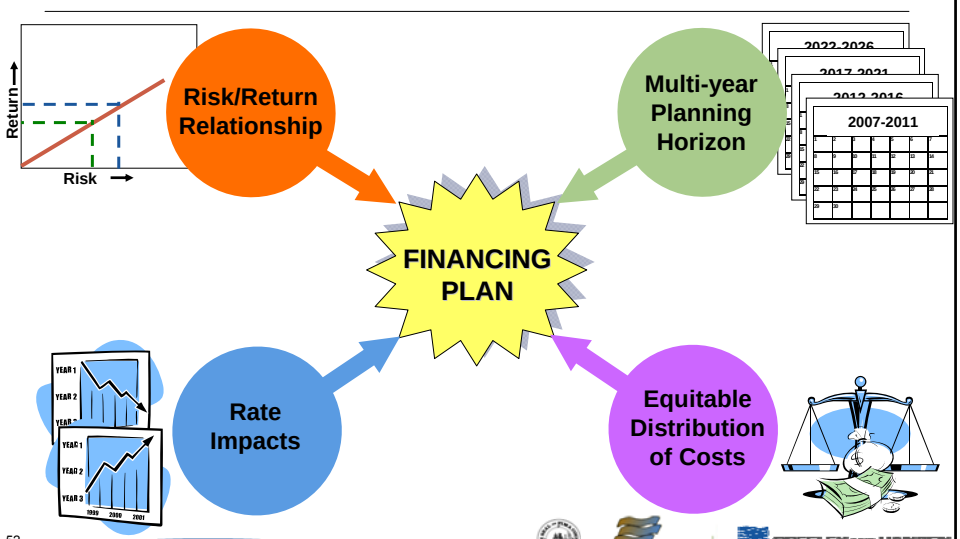
Funding Options

Harold Smith

Financial Planning Considerations



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Current Plan

- CIP program funding sources:
  - 1997 Bond Authorization –$105 million
  - 2004 Bond Authorization –$150 million
  - Future Bond Authorizations –2008 ($245 –$355 million), 2012, 2016, 2020
  - System Development Funds (connection fee/ user fee funds allocated to capital projects)
  - Supporting rates

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Project Funding Options

- Rates
- Connection fees
- Public debt funding
- State revolving funds (SRF)
- Federal/state grants
- Regional stakeholders
- Private funding

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Rates and Charges

- Existing
  - Wastewater rates
  - Connection fees
  - Reserve funds
- New
  - Environmental fee
  - Capital replacement fee
  - CMOM Fee

55

Public Debt Funding

- Short-term tax-exempt debt
- Revenue bonds
- Water lease revenue financing
- Zero coupon bonds and capital appreciation bonds
- Interest rate swaps and other derivatives

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SRFs and Federal/State Grants

- AZWIFA Clean Water Revolving Funds
- EPA Loans and Grants

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Regional Stakeholders

- Neighboring Communities
- Developers
- Options for Participation
  - Up-front contribution of capital
  - Charges for service
  - Contributed assets

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Private Funding

- Private equity
- Private debt
- Private activity bonds

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Assessing Funding Options

- Typical assessment criteria
  - Applicability and availability
  - Administrative and compliance requirements
  - Issuance costs
  - Effective interest rate
  - Interest rate risk
  - Rate impacts
  - Effect on balance sheet

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Assessing Funding Options

- Typical assessment criteria
  - Applicability and availability
  - Administrative and compliance requirements
  - Issuance costs
  - Effective interest rate
  - Interest rate risk
  - Rate impacts
  - Effect on balance sheet

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Delivery Options/ Contractor's Risk

Eric Petersen

Alternative Project Delivery Methods Under Arizona Law

- Section 41-2579: Project Delivery Methods for Design and Construction Services
  - Design-bid-build ("bid-build")
  - Construction-manager-at-risk
  - Design-build and design-build-operate (D/B and D/B/O)

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Construction-Manager-at-Risk Considerations

- Potential Benefits
  - Qualifications-based selection of construction manager
  - Owner control over design
  - Collaboration between designer and construction manager
  - Capping of price

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Construction-Manager-at-Risk Considerations *(continued)*

- **Potential Drawbacks**
  - No transfer of design liability
  - Two points of responsibility (designer and construction manager)
  - Separate responsibility for operations
  - Limited risk transfer

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Design-Build and Design-Build-Operate Considerations

- **Potential Benefits**
  - Single point of responsibility
  - Guaranteed performance
  - Cost savings
  - Time savings
  - Substantial risk transfer
  - Early stage price certainty

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D/B and D/B/O Considerations
(continued)

- **Potential Benefits**
  - Competition and innovation
  - Financial strength of proposers
  - Willingness of proposers to invest
  - Fewer disputes
  - Less monitoring cost
  - Proven in Arizona and nationally

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D/B and D/B/O Considerations
(continued)

- **Potential Drawbacks**
  - Less control over project details
  - Less familiarity
  - More complex selection
  - More involved negotiations
  - Possibility of smaller number of competitors

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Process in Arizona – RFQ

- Selection committee
- Request for qualifications (RFQ)
- Create short-list based on criteria published in RFQ
- Short-list may contain only 3 firms
- Negotiate with the most qualified firm on the RFQ short-list

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Process in Arizona – RFP

- RFP is distributed to every firm on the RFQ short-list
- RFP contains scoring method
- Submittals contain separate technical and price proposals (option of preliminary and final)
- Award based on highest score
- Honorarium

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Risk Considerations

- Risks retained under any delivery method
  - Changes in law
  - Force majeure
  - Unusual influent parameters
  - Pre-existing site and environmental conditions
  - Buried infrastructure conditions
  - General price inflation

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Risk Considerations *(continued)*

- Risk transfer (D/B and D/B/O)
  - Permitting risks
    - Terms and conditions
    - Delays
    - Non-issuance
    - Permitting cost overruns
    - Limitations

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Risk Considerations *(continued)*

- Risk transfer (D/B and D/B/O)
  - Design risks
    - Design liability
    - Design cost overruns
    - Technological obsolescence
    - Securing patents and licenses

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Risk Considerations *(continued)*

- Risk transfer (D/B and D/B/O)
  - Construction risks
    - Completion risk (delay and efficacy)
    - Construction cost overruns
    - Disputes between designer and builder
    - Labor relations

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Risk Considerations *(continued)*

- Risk transfer (D/B/O)
  - Operation and maintenance risks
    - O&M cost overruns
    - Regulatory compliance
    - Capital maintenance
    - Excess electricity consumption
    - Market conditions affecting sludge disposal
    - Labor relations

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Risk Considerations *(continued)*

- Existing facilities
  - "As-is" risk generally
    - Facility design
    - Facility condition
    - Facility information
    - Appropriate circumstances for transfer of "as-is" risk

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Risk Considerations *(continued)*

- Existing facilities
  - "As-is" risk – limitations
    - Assurances companies will require
    - Opportunity for renegotiation if assumptions prove false
    - Risk premium
    - Industry reluctance

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Pima County Wastewater Management Department

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Pima County Wastewater Management Department

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Overview Study Options and Key Elements

Joe Popeck – Jerry Bish

Study Options

- Existing Plan
- Transfer All
- Transfer Some

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Key Elements

- GPS-X Modeling of RR and IR
  - Select BNR process to be implemented
  - Model each plant to determine BNR Treatment Capacity after modification

80

Key Elements

- Existing Plant Space and Configuration
  - Is there enough space to accommodate BNR modifications?
  - Does the existing configuration lend itself to a sensible re-configuration for BNR?

81

Key Elements

- Constructability
  - Can existing treatment capacity (or sufficient capacity) be maintained during reconfiguration to BNR?
  - Construction Risk associated with modifications to facilities that are 30, 40 or 50 years old

82

Key Elements

- Viability/operability
  - Hydraulics
  - Size and depth of process tanks
  - Logical Flow Path
  - Operational Flexibility

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Key Elements

- Costs
  - For BNR Conversion
  - To upgrade aging unit processes
  - For upgrades to outdated utility services
  - For Code upgrades
  - For additional odor control
  - For pumping effluent

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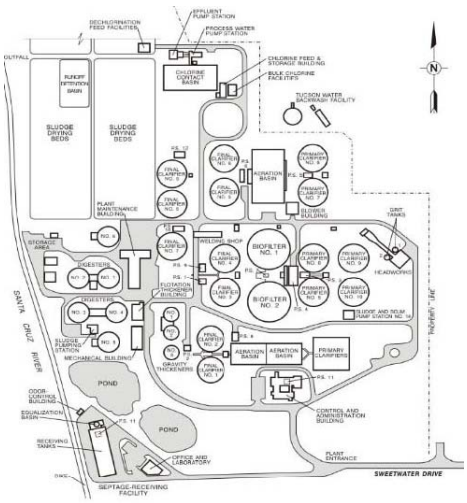
Roger Road WWTP Site Plan



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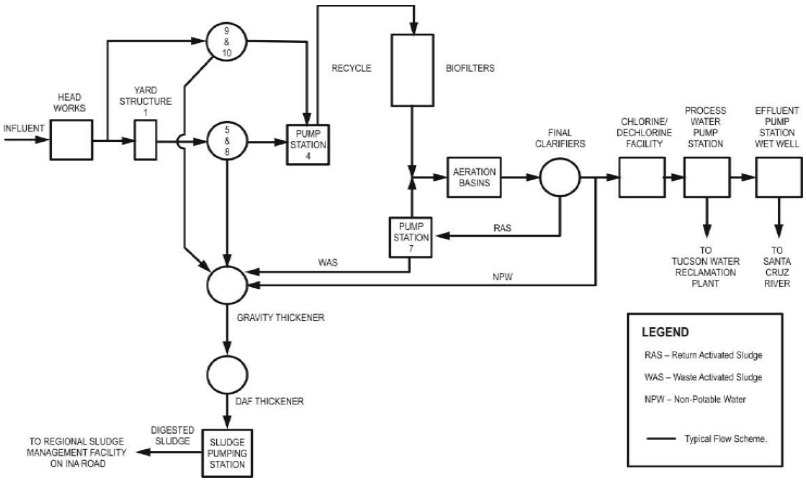
Roger Road WWTP Process Flow Diagram



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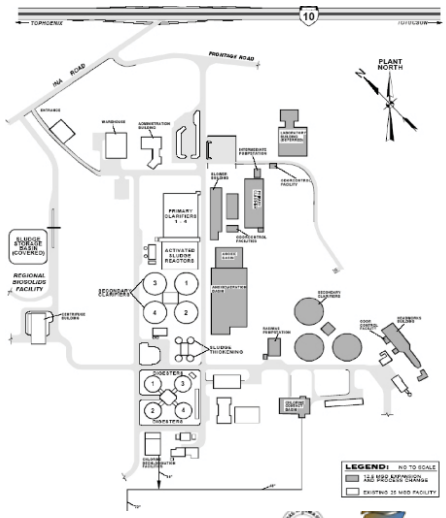
Ina Road WPCF Site Plan



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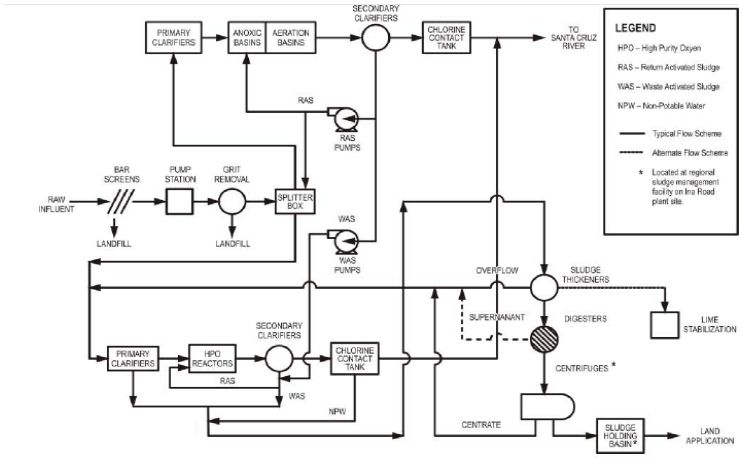
Ina Road WPCF Process Flow Diagram



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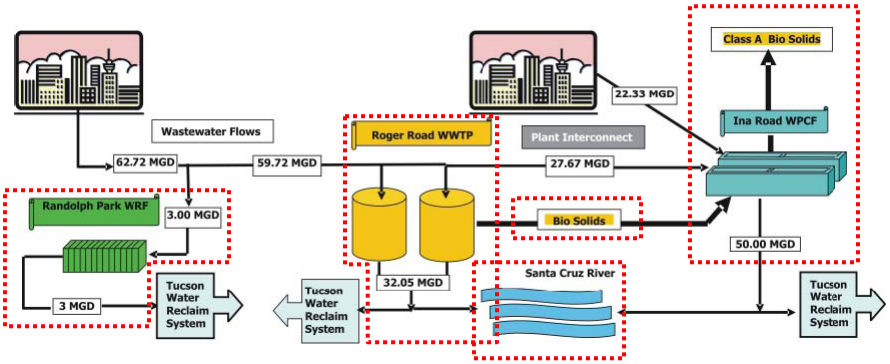
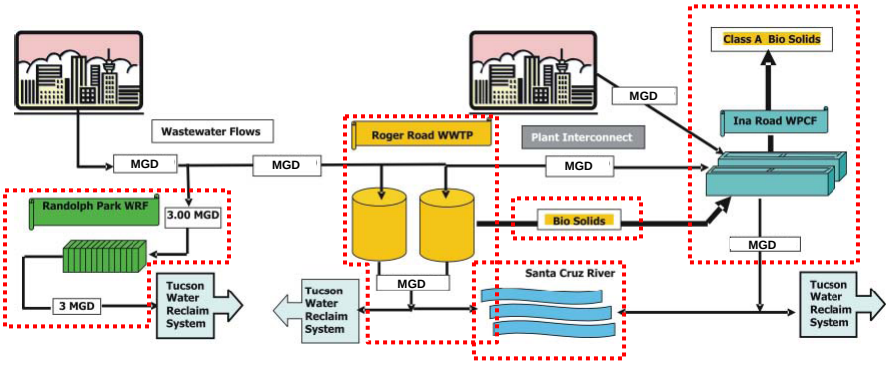
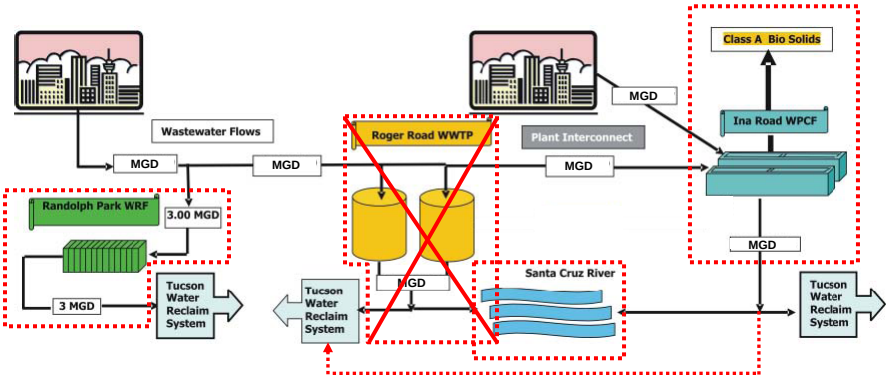
Existing Plan Schematic



Transfer Some Schematic



Transfer All Schematic



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Conveyance Issues/Options

- **Existing Plan:** Roger Road WWTP
  Ina Road WPCF
  Randolph Park WRF
- **Transfer Some:** Roger Road WWTP (downsized)
  Ina Road WPCF (expanded)
  Randolph Road WRF
- **Transfer All:** Ina Road WPCF
  (expanded significantly)
  Randolph Road WRF

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Conveyance Issues/Options

- Existing Plan:
  - Roger Road WWTP
  - Ina Road WPCF
  - Randolph Park WRF
- Transfer Some:
  - Roger Road WWTP (downsized)
  - Ina Road WPCF (expanded)
  - Randolph Road WRF
- Transfer All:
  - Ina Road WPCF (expanded significantly)
  - Randolph Road WRF

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Transfer Flow Issues

- What are environmental impacts?
  - Groundwater recharge
  - Santa Cruz River habitat
- How will reclaimed water needs be provided?
  - From where?
  - By whom?
- New conveyance system – size/route

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Flow Transfer

- Plant interconnect
- Flow management structures
  - Tucson Boulevard – 5.35 mgd
  - Craycroft Road – 2 mgd
  - Others?

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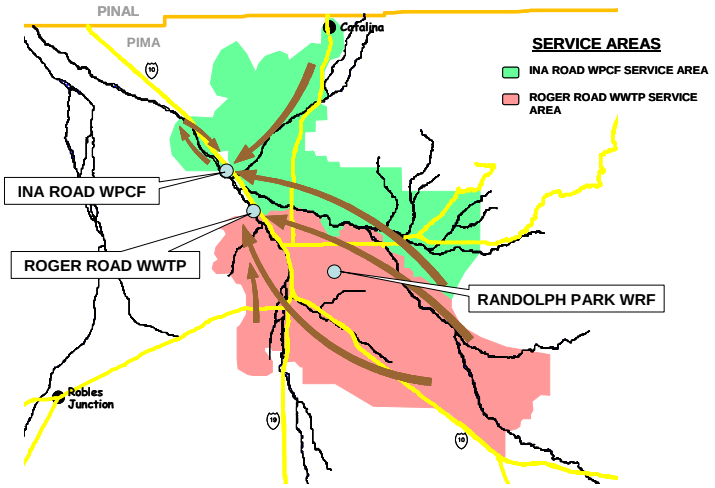
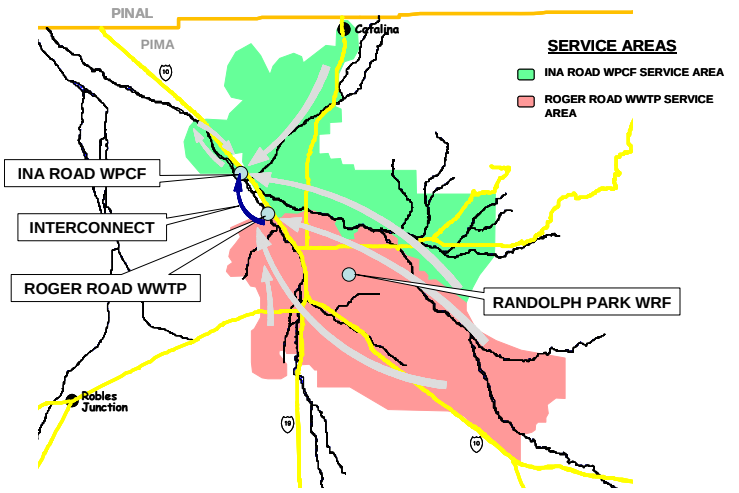
Roger Road WWTP/Ina Road WPCF Service Area



96

Transfer Some



97

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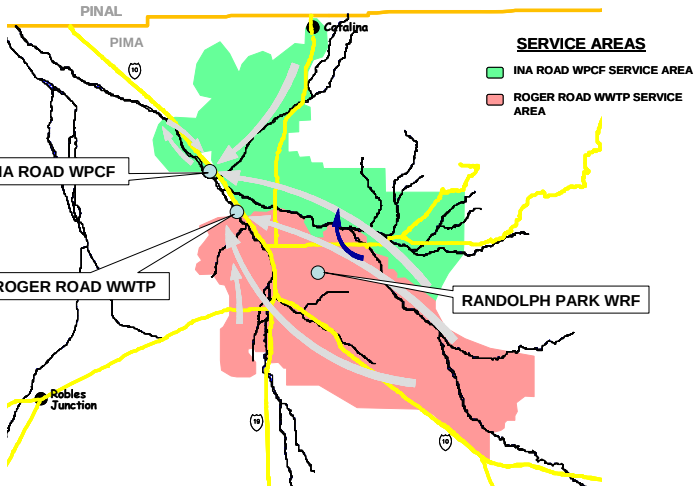

98

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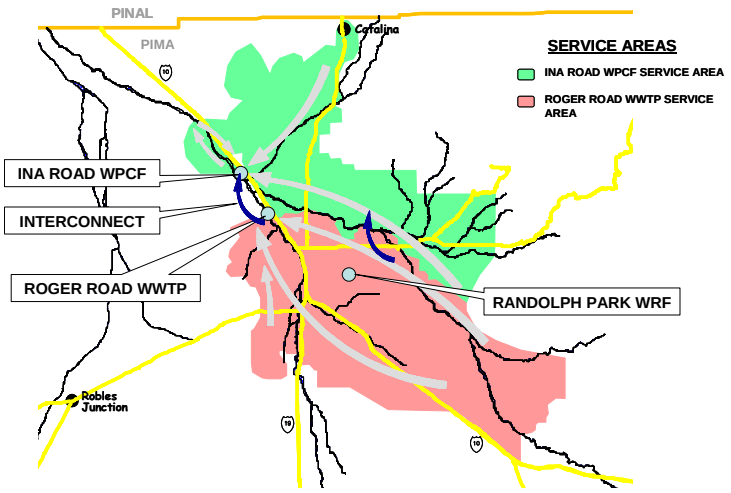
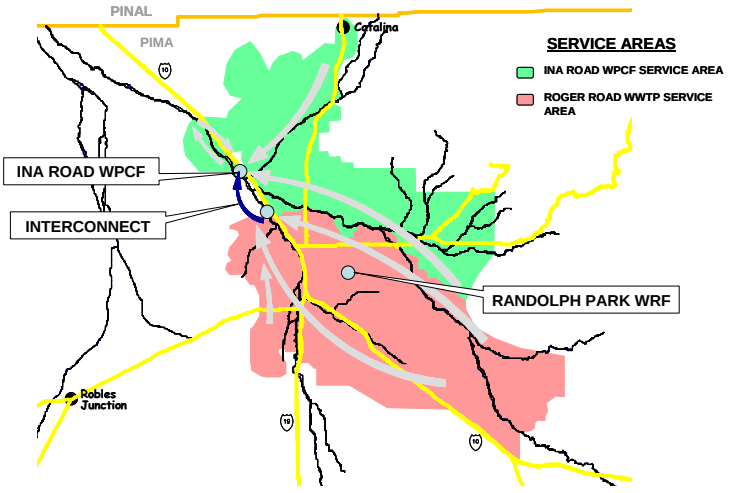


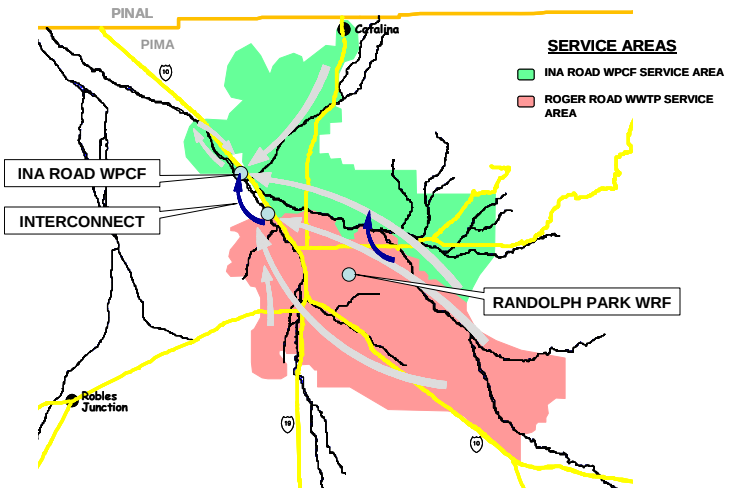
99

Transfer All



100

Transfer All



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Pima County Wastewater Management Department

GREELEY AND HANSEN

Roger Road WWTP/ Ina Road WPCF Evaluations

Andy Richardson

Roger Road WWTP/Ina Road WPCF Condition Evaluations

- Issues for discussion
  - Cost of risk transfer to contractor?
  - Cost premium for rehabilitation construction versus new?
  - When has a useful life been used?
  - How should we evaluate technology risk?

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Treatment Alternatives

Orrie Albertson

Process Evaluation

- Wastewater characteristics/analyses (3 yr.)
  - Ina Road WWTP
  - Rogers Road WWTP
- Allocation for future flows and loadings
- Flow and loading allocation to
  - Ina Road WWTP
  - Rogers Road WWTP

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Process Evaluation *(continued)*

- Reusable components of each Plant
- Alternative process evaluation
- Process selection criteria
- Permit and target effluent quality
  - Current
  - Future?

106

Wastewater Characteristics/ Analyses

- Analyze last 3 years of data
- Present data in tabular and graphical formats
  - Average annual
  - Maximum month
  - Average monthly ± 2 std dev
  - Chronological / annual trends
- Summarize recent data
- Define additional tasks, if needed

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Wastewater Characteristics/ Analyses *(continued)*

Summary of Current Data

Plant:_____ Period: _____to _____

Parameter	*Units*	*Annual Average*	*Maximum Month*	*Maximum Day*	*Peak Hour*
Flow	mgd				
COD	lb/d				
BODs	lb/d				
TSS	lb/d				
TKN	lb/d				
NH_4-N	lb/d				
TP	lb/d				
Tmin	°C				

Add future flow and loads for each plant.

108

Allocation for Future Flow and Loadings

- Definition of population growth
  - Allocations for industrial growth
  - Establish total design criteria
- Flow and loading allocations to plants
  - Key: early decision for process design
  - Influent quality is different for each plant
- Required for process evaluation and facility sizing

109

Reusable Components of Each Plant

- Inventory existing tankage
  - Condition
  - Volume, size, water surface elevation
  - Cost of refurbishing
  - Needed?
- Inventory existing equipment
  - Condition
  - Refurbish/replace
  - Needed?

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Alternative Process Evaluation

- Baseline Processes
  - TKN ≤ 45 to 50 mg/L
    Modified Luzack-Ettinger Flowsheet (MLE, MLR, AO)
  - TKN ≥ 50 mg/L
    Four-Stage Bardenpho Flowsheet (Phoredox, A202)

Note:

All activated sludge processes will incorporate 3 or 4 stage bioselectors or other well documented method(s) of controlling sludge bulking without chemicals.

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Alternative Process Evaluation
(continued)

- Processes to be considered:
  - MLE Flowsheet (Phoenix NdeN Process)
  - Four-Stage Bardenpho Flowsheet
  - IFAS Reactor (Kaldnes, etc.)
  - Step-Feed Flowsheet
  - MBR System
  - Trickling Filter / Activated Sludge / Denite Filters
  - Activated Sludge / NTF / Denite Filters

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Process Selection Criteria (Measurement Tools)

- Process performance reliability
- High mechanical reliability
- Process stability, ease of operation
- Low operating and maintenance cost
- Long-life of mechanical components
- Fit available space
- Acceptable capital cost

Quantifiable: Life cycle cost
Non-Quantifiable: Mutual agreement of value/need

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Permit and Target Effluent Quality

Parameter	*Units*	*Permit*	*Design Target*
BODs	mg/L		< 6
TSS	mg/L		< 10
NH_4-N	mg/L	2	< 1
TN	mg/L	8	< 6
pH	-		6.8 – 7.2

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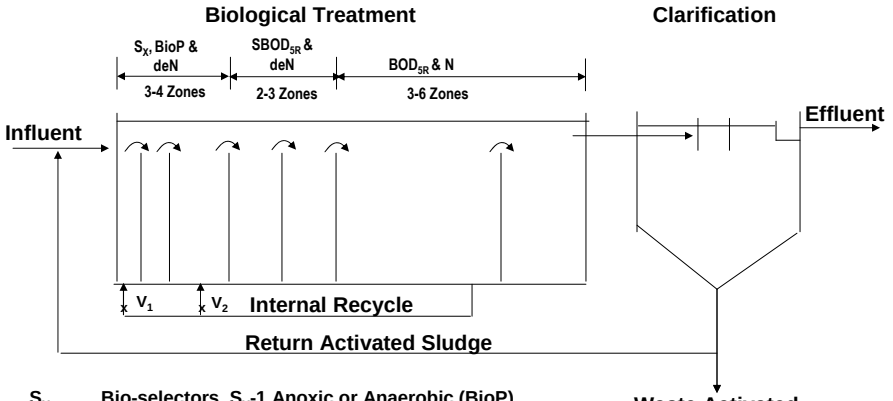
Semi-Aerobic Process for Bulking Control and Nutrient Removal

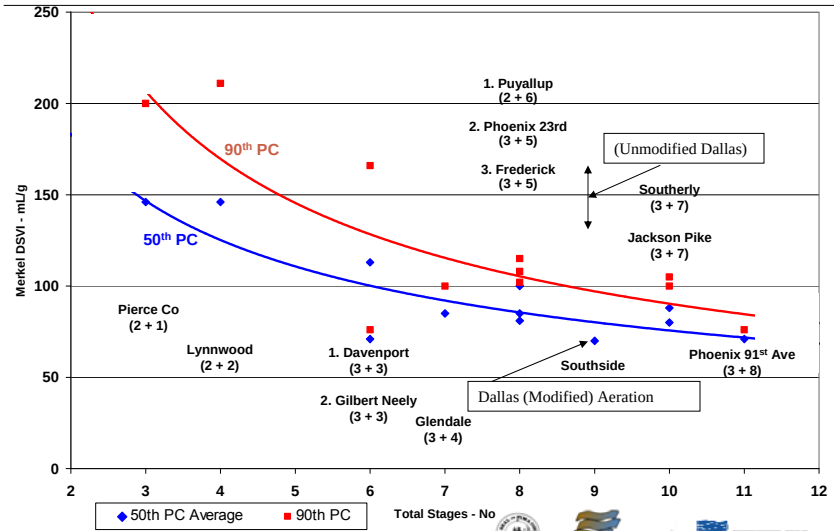


S_X	Bio-selectors, S_X-1 Anoxic or Anaerobic (BioP)
deN	Denitrification and $sBOD_5$ Removal/Oxidation
BioP	Biological Phosphorus Removal with V_1 closed
N	Nitrification and BOD_5 Oxidation

Mixing is Provided by Diffuser Aeration or Mixers

115

Effect of Number of Biological Stages (Bioselector + Anoxic and Oxic Stages)



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Biosolids

Carl Koch

Existing Conditions – Facilities

- Roger Road WWTP
  - GT corrosion problems
  - DAF function problems
  - Scum/grit/rag problems in digesters
  - Possible structural issues with digesters
  - Digester gas storage problems
  - Possible sludge pump issues

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Existing Conditions – Facilities

- Ina Road WPCF
  - Possible corrosion problems in thickening process
  - Hydrogen sulfide in compressor seal water
  - Digester mixers maintenance issues
  - Gas piping capacity issues
  - Limitations on centrifuge dewatering
  - Odor control issues

119

Existing Conditions – Class B

- Producing Class B product
- Land application of dewatered sludge
- Transport issues associated with % solids
- Future loss of application sites
- Potential public resistance to Class B product

120

Why Continue with Class B?

- Less Expensive
- Simpler to Operate
- Satisfies EPA Regulations
  - Acceptable Risk
- Consistent with Current Market Conditions

121

Why Consider Class A Process?

- Less Restrictive Management and Monitoring Requirements
- Lower Level of Pathogens
- Lower Odor Potential
- Perceived Superior Product
- More Utilization Options
- Public Pressure

122

Likely Class A Processes

- Staged/Thermophilic Digestion
- Alkaline Stabilization
- Composting
- Heat Drying

123

Types of Class A Products

- Liquid
- Cake
- Soil Amendment
- Compost
- Dried Pellet
- Aggregate

124

What Are the Markets?

- Fertilizer
  - Liquid/Cake
  - Compost
  - Alkaline Conditioned Product
  - Dried Pellet
- Construction
  - Vitrified aggregate
  - Artificial soil

125

What Are the Markets?

- Energy
  - Fuel Supplement
  - Oil Conversion
  - Digester Gas
- Manufacturing
  - Cement Kilns
  - Fertilizer Additive
  - Building Materials

126

What's New In Biosolids Dewatering

- More Efficient Centrifuges
- Enclosed Belt Press
- Disc Press
- Screw Press
- Robot Assisted Drying Beds
- Increased Pressure Belt Presses
- Heat assisted mechanical drying

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Biosolids Processing Issues

- Biosolids "Existing Plan"
  - Pump raw solids from Roger Road to Ina Road for processing
    - Eliminates solids handling/treatment at Roger Road
    - Increases recycle stream issues at Ina Road due to unbalance liquid flow/solids flow
  - Prepare for conversion to Class A

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Biosolids Processing Issues

- "Transfer Most" or "Transfer All" Options
  - Must consider biosolids processing with each alternative
    - Plan for recycle stream processing in alternatives
    - Plan for future disposal options/markets
    - Evaluate Class A conversion with market analysis and schedule
    - Centralized Sludge Processing can Increase Recycle Loads

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Biosolids Processing Issues

- Selecting process/location of stabilization must consider future regulations and market
- Recycle streams are significant and must be planned for in liquid treatment
- Dryness of product (volume) significantly impacts operation costs
  - Biosolids processing considerations must be integral in plant process evaluations and cost analyses!

130

Biosolids Process Evaluation and Selection

- Evaluate with overall treatment option
  - Existing Plan, Transfer Most, Transfer All
- Evaluate future market changes
- Determine appropriate processes consistent with future markets
- Evaluate processes on cost, operation, maintenance, conversion, reliability
- Include stakeholders in determination

131

Expectations

- Prioritization of Biosolids Upgrade Projects
- Approach to Achieve Class A
- Determination of Site Requirements
- Determination of Recycle Impacts

132

Outlying Area Scenarios

Jerry Bish

Outlying Facilities Issues

- What is the future growth/flows?
- How to address future flows?
- Could growth stress Metro conveyance system?
- Can facilities be consolidated?
  - Connect to regional facilities
  - Construct sub-regional WPCF/WRF

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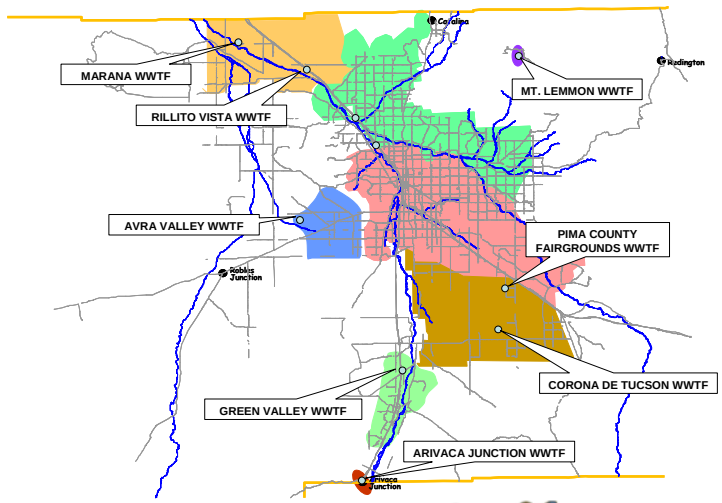
Outlying Facilities



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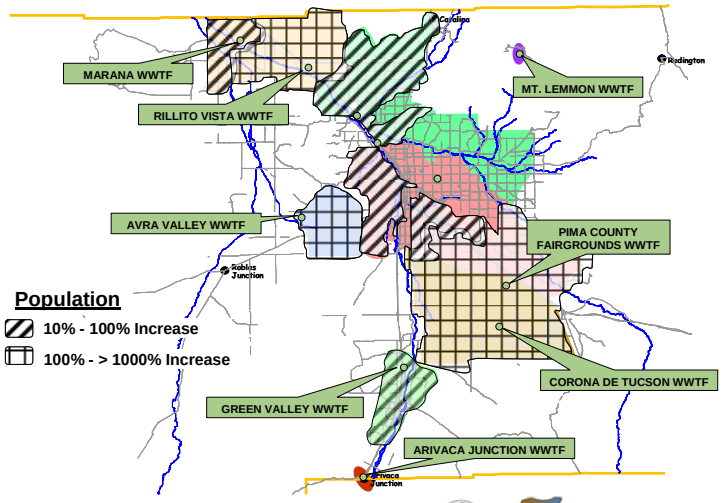
Projected Growth



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Outlying Treatment Facilities

- **Northwest Region**

Facility	*Capacity, mgd*	
	Current	*Future*
Marana WWTP	0.20	4.44
Rillito Vista WWTP	0.01	0.00
Totals	**0.21**	**4.44**

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Outlying Treatment Facilities

- **South/Southeast Regions**

Facility	*Capacity, mgd*	
	Current	*Future*
Avra Valley WWTP	1.600	2.950
Green Valley WWTP	4.100	6.100
Arivaca Junction WWTP	0.066	0.000
Southlands	0.000	13.700
Corona de Tucson WWTP	0.117	2.630
Fairgrounds WWTP	0.003	0.003
Totals	**5.890**	**25.380**

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Outlying Treatment Facilities

- **Other**

Facility	*Capacity, mgd*	
	Current	*Future*
Mt. Lemmon WWTP	**0.0125**	**0.0125**
Desert Museum WWTP	**??**	**??**
Sahuarita WWTP	**??**	**??**

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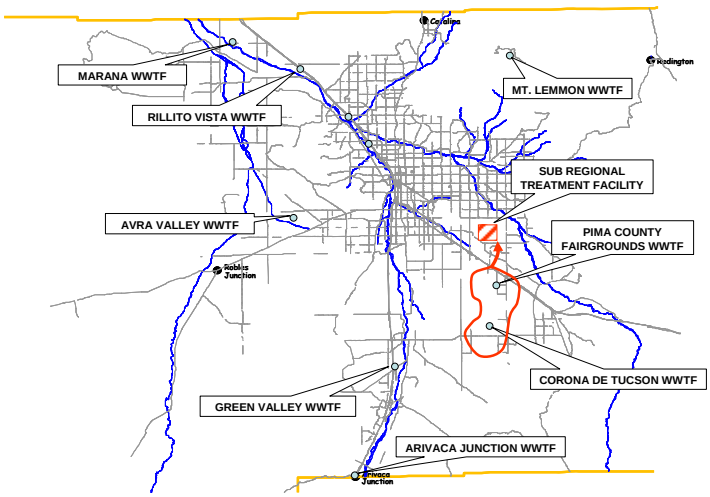
Sub-Regional Treatment Facility



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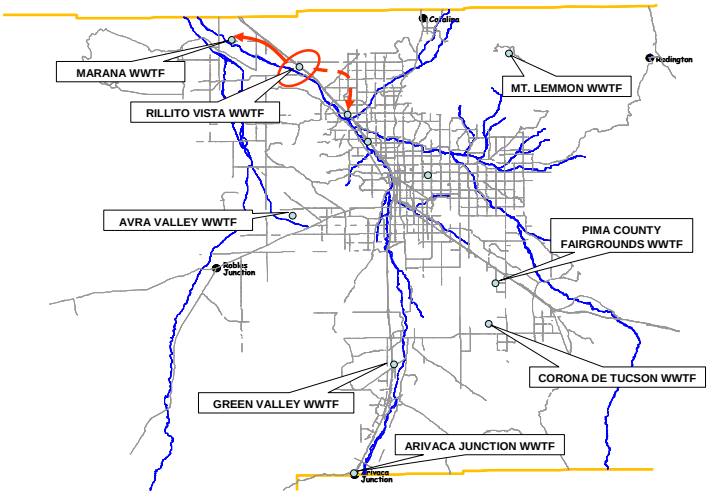
Consolidation of Northwest Facilities



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Pima County Wastewater Management Department

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Evaluation Criteria

Gordon Culp

Potential Evaluation Criteria

- Feasibility
- Cost
- Schedule
- Flexibility
- Environmental impacts
- Water reuse potential
- Public acceptability
- Cost sharing potential
- Effects on ability to finance
- System reliability

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Potential Evaluation Criteria

- Feasibility (treatment alternatives)
  - Can existing facilities be converted to BNR?
  - Will the conversion result in a facility that is readily and reliably operable as a BNR plant?
  - Are there any other aspects of the alternative that are fatal flaws?

144

Potential Evaluation Criteria

- Cost (treatment plant plus collection system)
  - Capital
  - O&M
  - Life cycle (includes consideration of probable life of rehabilitated vs new facilities)

145

Potential Evaluation Criteria

- Schedule, includes consideration of time requirements for
  - Permitting
  - Financing
  - Land or easement acquisition
  - Construction
  - New multi-party agreements
  - Addressing other legal issues

146

Potential Evaluation Criteria

- Flexibility, includes consideration of ability to cope with
  - Changing development pace and patterns
  - Changing discharge and reuse requirements
  - NdeN requirements
  - Changing biosolids demands and regulations
  - Future expansion
  - Advances in available technology

147

Potential Evaluation Criteria

- Environmental impacts, includes consideration of
  - Nature of land uses impacted
  - Odor
  - Noise
  - Construction activities
  - Riparian habitat
  - Groundwater quality/quantity
  - Surface water quality

148

Potential Evaluation Criteria

- **Water reuse potential, includes consideration of**
  - Location of reclaimed water
  - Location of potential demand for reclaimed water
  - Quantity of reclaimed water
  - Quality of reclaimed water

149

Potential Evaluation Criteria

- Public acceptability
- Cost sharing potential
- Effects on ability to obtain financing
- System reliability

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Criteria Weighting

Criteria	*Relative Weight*
Cost	
Schedule	
Flexibility	
Environmental impacts	
Water reuse potential	
Public acceptability	
Cost sharing potential	
Effects on ability to finance	
System reliability	

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Decision Matrix – Cost Comparison

System Element	*Existing Plan*	*Transfer Some*	*Transfer All*
Treatment-Capital Cost			
Conveyance-Capital Cost			
Treatment-Annual O&M			
Conveyance-Annual O&M			
Total, Present Worth Cost			

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Decision Matrix – Evaluation Criteria

Criteria	*Existing Plan*	*Transfer Some*	*Transfer All*
Cost			
Schedule			
Flexibility			
Environmental impacts			
Water reuse potential			
Public acceptability			
Cost sharing potential			
Effects on ability to finance			
System reliability			

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Level of Cost Estimates

Joe Popeck – Harold Smith

Types of Cost Estimates

- Comparative Cost Estimates
  - Used to compare alternatives
  - Do not include common elements (site work, roads, landscaping, etc.)
  - Present Worth of Capital and O&M Costs
- Conceptual Design Capital Cost Estimates
  - Used for Budgetary Planning of Recommended Alternative
  - Does include estimates for common elements

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Comparative Cost Estimates

- Capital
  - Unit costs per square foot or volume for process tankage and building structures
  - Vendor Cost Estimates for Major Equipment
  - Appropriate Contingency Costs for piping, mechanical, electrical, instrumentation, etc.

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Comparative Cost Estimates
(continued)

- O & M
  - 1% of Capital Cost for process tankage and structures
  - 3% of Capital Cost for major equipment
  - Power usage estimates for identified large motors
  - Current cost for power ($/kwh)
  - Chemical usage estimates
  - Current chemical costs

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Conceptual Design Capital Cost Estimates

- Capital
  - Limited Quantity Take-offs for Demolition and Removal with prices from Means
  - Unit costs per square foot or volume for process tankage and building structures, or:
  - Limited Quantity Take-offs with Material Prices from Means
  - Updated Vendor Cost Estimates for Major Equipment
  - Limited Quantity Take-offs with prices from Means for piping, mechanical, electrical, instrumentation, etc.

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Conceptual Design Capital Cost Estimates *(continued)*

- Capital
  - Limited Quantity Take-offs for common elements (site work, roads, landscaping, etc.) with prices from Means
  - Appropriate Contingency Costs for undefined elements
  - Appropriate Contingency Costs for PCWMD Administration, Design Services, Contractor's OH&P, etc.

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Purpose of Financial Analysis

- Purpose of financial analysis is two-fold:
  - Comparative analysis for decision making purposes
  - Analysis of funding options

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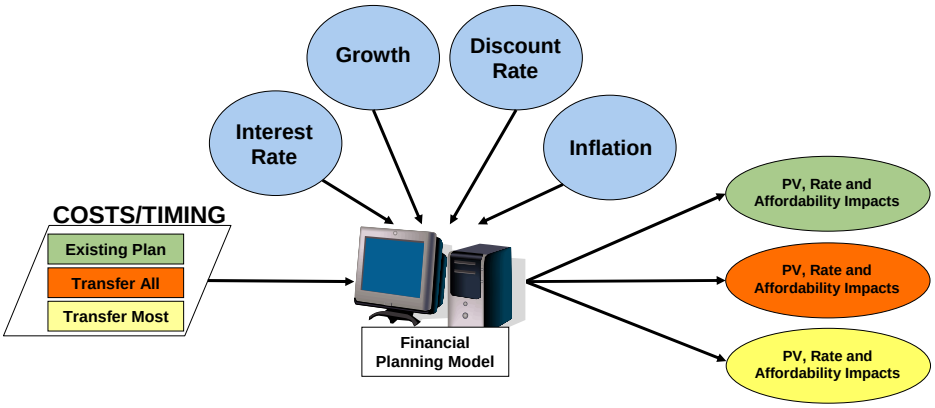
Comparative Analysis



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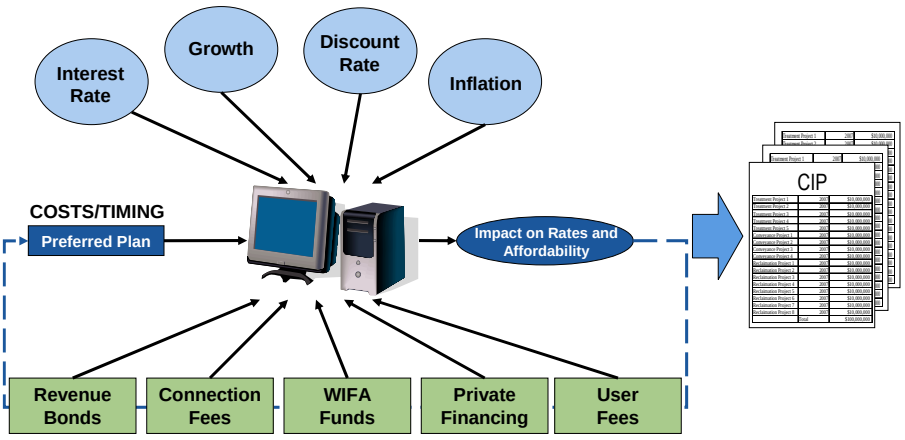
Funding Options Analysis



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Model Inputs

- Project costs
- Project timing
- O&M costs
- Inflation
- Interest rates
- Discount rate
- Growth (customers and flows)

163

Model Output

- Present value of each option
- Affordability impact analysis
- Customer type specific rate impacts
- Risk profiles
- Debt service coverage ratios
- Fund balances

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Risk Analysis

- Uses sophisticated risk analysis software
- Capable of analyzing the impact of multiple variables
- Applicable to both sides of the financial equation

Costs
– Construction costs
– O&M Costs
– Interest Rates

Revenues
– Volume Discharged
– Growth

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Key Attributes of the Financial Planning Model

- Long-term (25 years)
- Navigational menu
- Centralized input schedules
- Custom scenario builder
- User friendly
- Easily updated

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Background

Jerry Bish

Background Information

- 2006 Facility Plan Update
  - Population forecast (PAG)
  - Conveyance system capacity
  - Conveyance system condition
  - Treatment facility descriptions/capacities

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Background Information

- Tucson Water – Water Plan 2000-2050
  - Water resource challenges
  - Pressure to utilize reclaimed water
  - Encourages sewer connections
  - Construct new reclaimed supply sources
- Intergovernmental agreements

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Background Information

- Ina Road WPCF AZPDES Permit (3/11)
- Roger Road WWTP AZPDES Permit (1/11)
- Ina Road WPCF APP dated 2-27-02
- Roger Road WWTP APP dated 2-27-02
- Biosolids NPDES (Part 503)
- Air Quality Permit

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Background Information

- To be collected:
  - Treatment plant capacity models
  - Conveyance system capacity information
  - Performance history at Roger Road WWTP and Ina Road WPCF
  - Financial/budget information
  - Bond statements
  - Rate history

171

Background Information

- To be developed:
  - Condition assessment of Ina Road WPCF
  - Condition assessment of Roger Road WWTP
  - Condition assessment of outlying facilities

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Background Summary

- Population growth requires treatment and conveyance expansion
- Regulators require better wastewater treatment to achieve high quality effluent
- Existing capacity at Roger Road WWTP and Ina Road WPCF are limited
- Portions of conveyance system requires condition rehabilitation

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Background Summary

- Conveyance capacity generally good
- Growth stresses conveyance capacity in certain areas
- Biosolids treatment requires expansion, modification and upgrades

174

Background Summary

- Reclaimed water use will increase
- Future bond authorizations (2008, 2012, 2016, 2020)
- CIP >$1.4 billion over 25 years

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Pima County Wastewater Management Department

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List of Stakeholders

Andy Richardson

Stakeholders

- Pima County
- Pima County Wastewater Management Department
- Tucson Water
- Metro Water
- Oro Valley Water
- Marana
- South Tucson
- ADEQ

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Preview of Next Workshop

Andy Richardson

Workshop #2 Draft Agenda

- Reuse Workshop
  - Impacts of continuation of existing reuse plan
  - Impacts of "transfer some" treatment option
  - Impacts of "transfer all" treatment option
  - Potential for "combined wastewater treatment and reuse treatment" reuse option

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Closing

Andy Richardson – Mike Gritzuk

Workshop Objectives

- Familiarize group with scope of study, approach and schedule
- Familiarize group with workshop process for study execution
- Develop list of study expectations and identify obstacles
- Review project funding options, project delivery options and concept of contractor's risk
- Reach agreement on study options and key elements

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Workshop Objectives

- Gain consensus or informed consent on issues associated with Roger Road WWTP / Ina Road WPCF condition evaluations
- Review BNR and solids handling/treatment alternatives under consideration
- Reach agreement on study options evaluation criteria
- Gain understanding and agreement on level of cost estimates used
- Gain consensus or informed consent on level of detail of information used for final decision making
- Identify/verify study stakeholders

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Pima County Wastewater Management Department

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Workshop #2 Meeting Notes
Reuse and Flow Transfer

1. The Reuse and Flow Transfer Workshop for Pima County Regional Optimization Master Plan was held on May 31, 2006. The workshop agenda is attached. Attendance included:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Jackson Jenkins
PCWMD Staff
David Bartos
Bob Decker
James Doyle
Laura Fairbanks
Frank Gall
David Garrett
Frank Luiz
Jing Luo
Byron McMillan
Glen Peterson
Jeff Prevatt
Prakash Rao
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager
Mandley Rust
John Sherlock
Jack Van Riper
John Warner
Ken Weber
Legal
Harlan Agnew
Chuck Wesselhoff

TUCSON WATER
Director
David Modeer
TW Staff
Jeff Biggs
Karen Dotson
Sandy Elder

TW Staff, cont.
Richard Herran
Melodee Loyer
Ralph Marra
Mark Seamans
Tim Thomure
Dean Trammel
Tom Victory
Alan Forrest, CH2M Hill
Ken Thompson, CH2M Hill

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT
Frank Postillion

METRO WATER DISTRICT
Charlie Maish

ORO VALLEY WATER
Davis Ruiz
Phillip Saletta

PIMA ASSOCIATION OF GOVERNMENTS
C. Zucker

TOWN OF MARANA
Brad DeSpain

BUREAU OF RECLAMATION
Eric Holler

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Mark Cross
Gordon Culp
Andrew Richardson

2. Major topics of the workshop were:

- Workshop #2: Reuse and Flow Transfer
  - ► Overview of Reclaimed Water Operations
  - ► Impacts of Wastewater Treatment Options on Reuse
  - ► Planning Input Review – Quantity, Quality, Location
  - ► Underground Storage and Recharge /Recovery Considerations
  - ► Intergovernmental Agreement Impacts and Considerations
  - ► Identify wastewater treatment and reuse alternatives for technical and economic review

Two sets of handouts were provided to each attendee which included presentation slides used during the workshop. One set, entitled Reclaimed Water System, is a summary of current operations and near future planning of the Tucson Water reclaimed water system. The second set, entitled Workshop #2 Reuse/Flow Transfer, summarizes planning inputs, issues and considerations that are to be included in the master plan development.

Throughout the workshop, a list of notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, opened the workshop with a few remarks followed by Dave Modeer, Director of Tucson Water, with additional opening remarks. .The Directors stated the purpose of the meeting was to explore, identify and understand the reuse needs of Tucson Water and Pima County. The project is a technical evaluation of wastewater treatment and associated effluent reuse to provide a cost effective and practical way to deliver needed services to the community. This workshop is to review and discuss effluent reuse issues that will best serve the citizens of the community without regard to the current institutional arrangements that may act as barriers. Effluent reuse is becoming a very important part of the regional sustainability and will become more important to our future. The future will require that the County achieve maximum reuse of the wastewater effluent. Therefore the two organizations must work cooperatively on the technical issues to develop cost effective solutions to advanced wastewater treatment and future effluent reuse needs.

Effluent reuse is becoming increasingly important to the future of the community and needs to be dealt with cost effectively. The workshop is to clarify and enhance the understanding of how reclaimed water may be impacted by the three wastewater options under consideration in the master plan development – Existing Plan, Transfer Some, and Transfer All.

4. Andy Richardson defined his role as facilitator to move the group through the agenda and to encourage participation from the expertise available in the room. The purpose of this workshop is to clarify the inputs on effluent reuse. The emphasis is on participation by the assembled.

Agenda, ground rules and objectives of the first workshop were presented and covered on pages 1 through 4 of the Workshop #2 Reuse/Flow Transfer handout. Although the workshop proceeded in a different sequence than outlined on the agenda, each of the agenda topics was covered during the workshop.

5. Sandy Elder provided the introduction to the Tucson Water overview of effluent reuse. The reuse system is dependent upon the wastewater system operations including the quantity, quality of the raw effluent and where it is located.

6. Karen Dotson provided a summary of the Tucson Water organization, current reclaimed water users, effluent allocation agreements, quality of distributed reclaimed water (Class A). Reclaimed water users include 34 parks, schools, golf courses and 500 single family homes. Golf courses utilize 62% of the reclaimed water. The University of Arizona is the largest industrial user of reclaimed water.

7. Tim Thomure stated why reclaimed water is important to the community. It affects the potable water supply and affects the peak water summer demand in the community. Reclaimed water quality is suitable for a number of uses and relieves potable water demand. Population projections using the Pima Association of Governments (PAG) data for planning suggests that after 2025 additional renewable water sources will be needed.

   Effluent entitlements by entity were review based on 68.200 Acre Feet (AF)/year. Entities with effluent entitlement include the Water Providers, Pima County and the Federal government through the Southern Arizona Water Rights Settlement Act (SAWRSA). Tucson Water and Pima County will also participate in future conservation projects through the Conservation Effluent Pool (CEP) agreement.

   Locations of the effluent for reuse include the Sweetwater Facilities adjacent the Roger Road WWTP, recharge/recovery areas in the Santa Cruz River below Roger Road WWTP and Ina Road WPCF, and the Randolph Park WRF.

   New demands for reclaimed water are increasing. In the near future Oro Valley is adding 2,000 AF/year to their needs. The County needs are projected to increase from 11,000 to 12,000 AF/year to 20,000 AF/year by 2020. These estimates do not include the effluent needs of Metro Water, who has rights to some quantity of effluent.

   Constructed recharge and recovery basins can get credit for recovery of up to 100% of the effluent for use. Managed recharge can at best get credit for recovery up to 50% of the effluent for use in the community.

   To maximize effluent water utilization in the community, direct use and recharge/recover will need to be in the right place. Before addressing the options of the master plan, Tucson Water was considering the development of a reclaimed water supply at Ina Road WPCF, development of a "wet" water recovery system in the lower Santa Cruz River (below the Ina Road discharge) and expanding the Roger Road Sweetwater facility through re-permitting of the recharge and recovery basins from 6,500 AF/year to 9,000 AF/year.

   The future vision of Sweetwater recharge and recovery basins over the years is to increase that facility from 9,000AF/year to 12,000 AF/year then to 16,000 AF/year and ultimately to 20,000AF/year. Sweetwater is the hub of the Tucson Water operations and would costs $10's of millions to duplicate.

It is believed that there is sufficient demand for reclaimed water that underground storage is needed in the future even though Class A+ water is provided at the plant outfall. Direct recharge in wells is not permitted and Class A+ water does not meet the standard for aquifer recharge.

8. Tom Victory presented information on the reclaimed water distribution system. The average demand in the system is 11 million gallons per day (mgd). Peak demands are 2.3 times the average. Storage in the conveyance system is 15 million gallons plus storage at the golf courses in the lakes.

   The system experiences both seasonal and daily demands. The peak seasonal demands are in June and July. The low demand is in the winter. Daily demands peak at night when wastewater flows at the plant are low, making system storage necessary.

   It was noted that there are several "pinch" points in the existing distribution system that limit the capacity of the pipelines to deliver flow. If a source is developed at Ina Road WPCF, then there would be relief on the distribution system to the north of Roger Road WWTP and enable the system to be more flexible in meeting the customer demands. If all treatment is provided at Ina Road WPCF, there will need to be additional reclaimed water distribution piping to the south as the 24-inch line between Ina Road WPCF and Roger Road WWTP has a capacity of only 10 mgd.

   Effluent from the Sweetwater pressure filter treatment plant is blended with the recovered water from the recharge basin to achieve the Class A reclaimed water rating. The water blending is approximately a 50/50 split to achieve water quality. There is no regulatory requirement for a minimum volume of discharge to the Santa Cruz River at Roger Road WWTP, but the County needs to maintain a minimum discharge of 5 mgd to provide water for power plant cooling and sampling of the effluent.

   The Tucson Water criteria for success of the planning effort are:
   - Provide continuous service to existing customers
   - Water quality is maintained or improved
   - Supply must meet growing demand
   - Meet peak demands in most cost effective way, use aquifer for low cost storage
   - Preserve wetlands, they are perceived as an amenity
   - Retain existing infrastructure for reuse at Roger Road, a $200 million investment
   - Hold the cost down for the customers

   The reclaimed water system in Items 5, 6, 7, and 8 were covered in the handout entitled Reclaimed Water System.

9. John Warner indicated that the wastewater conveyance system would like to be customer of the reclaimed water system. Conveyance has instituted a sewer flushing program and would like access to reclaimed water throughout the conveyance service areas to reduce the usage of potable water for this activity. It was noted that often the cost to retrofit the system to make available reclaimed water can be expensive. Furthermore, the extent of the reclaimed water distribution system is somewhat limited as compared to the area covered by the conveyance system.

10. Mike Gritzuk stated that based on the forgoing workshop review of the current reclaimed water system and future needs; there are a number of alternatives that could be developed. (Assumes the treatment plants produce a Class A+ reclaimed water quality at the end of pipe.) Those alternatives are:

    - Base case – Roger Road WWTP remains in operation at 32 mgd with the Sweetwater Recharge/Recovery Facilities.
    - Roger Road WWTP size is reduced to match the Tucson Water demand for reclaimed water. (Scalping facility or with some discharge to the Santa Cruz River?)
    - All reclaimed water is produced at Ina Road WPCF. Roger Road WWTP is eliminated and Sweetwater Facilities are eliminated. Tucson Water or the County builds Sweetwater like facilities at or near Ina Road WPCF.
    - Ina Road WPCF produces reclaimed water and the Sweetwater Recharge and Recovery Facilities remain in operation next to Roger Road WWTP.
    - Randolph Road WRP remains at existing 3 mgd capacity
    - Randolph Park WRF expands to a greater capacity than 3 mgd. (This does not appear viable because of the limited service area connected with the plant.)
    - Abandon Randolph Park WRF.
    - Satellite wastewater treatment (scalping?) plants in the outlying areas are upgraded to reclaimed water quality and are used by Tucson Water to augment the reclaimed water system.
    - Santa Cruz River recovery is increased by constructed versus managed recharge systems.
    - Connect all outlying facilities to either Roger Road WWTP or Ina Road WPCF.
    - Provide an independent Southlands treatment facility with reclaimed water provisions.
    - Expand Roger Road WWTP to provide more flow to Tucson Water at a better elevation.
    - Provide potable quality reclaimed water and inject it directly into the aquifer

    If all the treatment is provided at one large Ina Road WPCF, the plant may produce a minimum flow adequate to meet reclaimed water demands without the need of underground storage.

    Determine what are the ultimate uses of effluent water? The plan should not box out any future options.

    The advantages and disadvantages for each of the above alternatives will need to be developed after the workshop.

11. The plan should take into account where water can be stored long-term. Storage will require land for recharge unless recharge wells are utilized. Avra Valley at the Pima Mine area has land available for recharge.

12. Laura Fairbanks reminded the group that odors must be considered with all alternatives. Long travel times of the wastewater in the sewers before the wastewater enters a treatment facility increase the potential for odor releases and complaints in the community.

13. There may be merit in locating "scalping" plants adjacent to the reclaimed water distribution system. Several locations were offered and include: Park and I-10, Rillito at Tucson Boulevard,

Harrison at Pantano, Tangerine at I-10, Thornydale at Tangerine, and a location adjacent the CAP canal. Brad DeSpain indicated that the Tangerine and I-10 would make a great water campus site.

14. Gordon Culp reviewed the wastewater treatment options and the areas of impact on the reclaimed water system. The options include:

- Maintain existing plan
- Transfer Some Flow from Roger Road WWTP to Ina Road WPCF (treat 20 mgd ± at Roger Road WWTP)
- Transfer All Flow from Roger Road WWTP to Ina Road WPCF

The Transfer Some and Transfer All options may require pumping plant effluent back to the Roger Road or Sweetwater facilities or both.

The treatment options were covered on pages 16 through 19 in the Workshop #2 Reuse/Flow Transfer handout.

15. Jerry Bish reviewed the reclaimed water planning inputs. Quantities of effluent, diurnal and seasonal variation of reclaimed water demand, probable water quality, and current storage and recovery requirements were presented. The inputs were identical or similar to those presented by Tucson Water in Items 5 through 8 above. In addition, the effluent quantities at the outlying facilities were presented to complete the picture of the available effluent for reclaimed water use.

The planning inputs were covered on pages 5 through 11 of the Workshop #2 Reuse/Flow Transfer handout.

16. Mark Cross reviewed the underground water storage in the aquifer and subsequent recovery considerations to meet seasonal storage and recovery needs. Underground storage is cost-effective and allows the current blending practice to meet Class A reclaimed water requirements. Potential for future use of injection wells for effluent was presented. It was stated that effluent at 2 NTU will cause clogging over time and would require periodic well maintenance and potential redrilling (especially for vadose zone injection wells) to keep viable. Further, the injection wells will require chlorination to prevent growths in the well. Zero discharge from Roger Road WWTP will change groundwater levels and groundwater movement in the local area. Conceptually from a hydrogeologic perspective, the underground storage facilities could be placed at Ina Road WPCF if land is available and other concerns and issues were met satisfactorily.

The underground storage and recovery considerations were covered on pages 20 through 25 of the Workshop #2 Reuse/Flow Transfer handout.

17. Tim Thomure indicated that if all reclaimed water operations are at Ina Road WPCF, the pipeline to the south will need to be increased in capacity. Current capacity is 20 mgd. The flow capacity would be greater than 28 mgd.

18. Jerry Bish reviewed the intergovernmental agreements that have an impact on reclaimed water issues. Between Tucson Water and Pima County, there are five basic agreements that govern

effluent. The intergovernmental agreements were covered on pages 11 through 14 of the Workshop #2 Reuse/Flow Transfer handout.

19. Byron McMillan reminded the group that the ADEQ permit requirements have set the timeline for the future option to be executed. A letter to ADEQ describing the direction of Pima County's wastewater compliance is required by January of 2007 with facilities in place and operating by 2014 or 2015.

20. Changes to reclaimed water regulations will need to be factored into the future. The regulations have gotten progressively more restrictive in the past 22 years of operation.

21. A number of issues and concerns were offered in the closing remarks by the attendees. Comments ranged from the riparian habitat issues in the Santa Cruz River being difficult to address, to having a discussion with Marana on water reuse, to looking at the upper reaches of the local rivers for water reuse opportunities, to purchasing land for new facilities, to keep wet water in Pima County and more. Additional comments are provided in the attached "flip chart" notes.

22. Dave Modeer and Mike Gritzuk offered closing remarks. The master plan will involve substantial costs to the community. Dealing with public and politicians on costs will be difficult. The benefits for the costs will need to be clearly addressed in the master plan. In the meantime Tucson Water will need rate increases to meet its operational needs. Although Tucson Water and Pima County are different organizations, reclaimed water is a water resource issue for both organizations and the organizations need to work together and focus on the best technical and economical solution. The two organizations are serving the same people in the community and we need the right holistic approach.

    The regulatory timeline has given Pima County until January 2007 to identify and submit the optimal solution for their review. For Tucson Water and Pima County, water reuse will be difficult to narrow to one specific option. More discussions will be required between the two organizations in the next several weeks to focus on the optimal reuse option with regard to the wastewater options under consideration.

23. Andy Richardson previewed the next workshop scheduled for June 5, 2006. Workshop # 4 will brainstorm various wastewater treatment alternatives for Roger Road WWTP and Ina Road WPCF and address issues and consideration of each.

Agenda
Workshop #2 – Reuse/Flow Transfer Workshop*
May 31, 2006

Time	Topic	Presenter	Pg
7:30 am	*Continental Breakfast – Rio Nuevo Upstairs Conference Room, 52 W. Congress*		
8:00 am	Opening Session		
	• Welcoming Remarks	Mike Gritzuk	1
	• Overview of Agenda	Andy Richardson	2
	• Adoption of Groundrules: Role of Facilitator		
	• Confirmation of Agenda		
	• Workshop Objectives–Pima County/Tucson Water	Mike Gritzuk/Dave Modeer	4
8:30 am	Reclaimed Water Operations Overview	Tucson Water	4
9:30 am	Clarifying Planning Inputs	Jerry Bish	5
	• Volumes/Flow		
	• Reclaimed Water Quality		
	• Reclaimed Water Demand (Annual, Peak, Summer, Winter)		
	• Balanced (storage) Underground Recharge/Recovery Facilities		
	• Plant Effluent at Outlying Areas		
10:30 am	Break		
10:45 am	IGA Impacts/Considerations	Mike Gritzuk/Dave Modeer/Jerry Bish	11
11:05 am	Current/Future Reclaimed Water Treatment Operations	Jerry Bish	14
	• Sweetwater Facilities		
	• Randolph Park WRP		
11:20 am	Wastewater Treatment Options/Impacts	Gordon Culp	16
	• "Existing Plan"		
	• "Transfer Some"		
	• "Transfer All"		
11:40 pm	Underground Storage Recharge/Recovery Considerations	Mark Cross	20
Noon	Lunch		
1:00 pm	Summary of Reclaimed Water Issues	Andy Richardson	25
2:00 pm	Preview of Next Workshop	Andy Richardson	25
2:05 pm	Summary Wrap-Up	Andy Richardson	25
	Comment by Group	All	
	Closing Remarks	Mike Gritzuk	
2:30 pm	Adjourn		

* Workshop hosted by Tucson Water

Flip Chart Notes – May 31, 2006

Objectives

- Identify and understand current and future reuse needs
- Look at the current way the reuse systems operates
- Look at alternatives to improve future operations
- Identify technical and economical alternatives
- Provide for a sustainable, long term future of reclaimed water in Pima County
- Look at alternatives from point of view of the best interest to the community

Tucson Water Overview

- How much more reclaimed water will be needed, if level of treatment is higher than now?
- Consructed recharge has a 2 percent loss in recoverable water
- Major flow is going into Pinal County
- A higher level of treatment plus a place for it to be stored would make for more effluent use
- Recharge location is an issue to future use
- Sweetwater "prime" location for recharge – future 20,000 AF/yr - desired location by Tucson Water
- Move to a reclaimed water "quality" that could be directly recharged to keep water in Pima County
- Supply at Ina Road needs storage to manage seasonal demand
- Reclaimed water system has capacity issue in the north and central parts of the distribution system
- Need to consider location for new flow as it relates to constraints in reclaimed water distribution system
- Capacity: three types
  - Carrying capacity 5 fps/pressure loss in pipeline (conveyance/transmission)
  - Storage capacity for peak day demand
  - Booster capacity – moving flow from south to north
- Recharge and recovery at Sweetwater is a 6,500 AF/yr put and take
- Water quality controls location of recharge of effluent to the aquifer
- Roger Road WWTP needs to maintain a flow of 5 mgd out to river
- How merge both Tucson and Pima County success factors?
- Locate effluent where demands for reclaimed water is better; use of gravity can help
- Only 40 percent of customers pay for system, others pay a minimum fee for reclaimed water
- Future distribution system will be more looped, not branched
- Look at providing reclaimed water for sewer cleaning services? May not be economical
- Need to talk in terms of "wet" water
- 24-inch line is a pinch point for delivery to projected demand in north

Alternatives

- Base Roger Road, Sweetwater is location of all recharge
- If Roger Road remains, include filters at Tucson Water facility
- Down size Roger Road and treat to Tucson Water quality
- Roger Road is decommissioned, ***all*** reclaimed water at Ina Road; Tucson Water or Pima County builds facility at Ina Road
- Roger Road is decommissioned with flow to Sweetwater from Ina Road; Tucson Water or Pima County builds facility at Ina Road
- Roger Road growing, expand to meet needs
- Randolph maintained at 3 mgd
- Randolph Park expanded (in the future flow may drop may off to this facility)
- Randolph Park is decommissioned
- Satellite/scalping reclamation facilities upgraded to Tucson Water water quality
- Look at sub-regional WRPs to treat effluent to reclaim water quality (pipeline) – south and southeast – need to work out details
- Alternative – constructed recharge and recovery for Santa Cruz River to increase capacity of recharge – opportunity and constraints
- Membrane treatment to meet potable quality

Location of Facilities

- Place facilities where water can be stored, upgradient of Roger Road
- Place where there is flexibility regarding the reuse of water.
- Need locations where there is available land: Avra Valley and Pima Mine Road area; Southeast areas
- Locate reclaimed facilities next to reclaimed water systems
  - Park and I-10 (5 mgd flow available)
  - Tucson Boulevard at Rillito River
  - Southeast corner of Harrison and Pantano (60 acre site - HAMP area)
- Tangerine and I-10 east side (potential water campus site)
- Thornydale – on east side of Tangerine
- Need effluent for 100-year water supply

Inputs

- Bureau of Reclamation has water for sale

Groundwater

- Talk to County solid waste group relative to landfill site
- Transfer all – peak demand to be met by discharge from Ina Road
- Avra Valley recharge capability exists; bring into reclaimed water system by gravity flow from Roger Road
- No conveyance to Avra Valley at this time
- Pantano system with SAT could work
- Use Sweetwater for peak day storage

- Balance between how much storage for seasonal needs
- Can extend into Pinal County and get credits
- Tucson Water may be turning off wells; will have an impact on groundwater picture
- Bring flow back to CAP plant by way of Avra Valley – large plant in Marana discharge to CAP Canal

Summary Comments

- Approved sale of reclaimed water to Quail Creek
- Riparian habit below Roger Road WWTP needs to be addressed
- How do Tucson Water facilities and Pima County facilities line up?
- Timeline impacts on decisions regarding reclaimed water
- Talk to Marana about reclaimed water
- Projections to 2020; how to handle uncertainty beyond that year?
- Educate public on what we are doing – provide a united front between organizations
- Water standards will not back slide – look at standards in future
- Utilization of River for recharge
- What about land availability?
- Improvement of transport within right-of-way
- Understand SAWRSA
- First public meeting will be in 4 to 6 weeks
- How to generate funds for the new facilities.
- What are the future design changes by regulations?
- How to position reuse to benefit the community

Pima County Wastewater Regional Optimization Plan Study

Workshop #2
Reuse/Flow Transfer Workshop

May 31, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
Tucson Water	Reclaimed Water Overview
Jerry Bish	Clarifying Planning Inputs
Gordon Culp	Treatment Plant Options
Mark Cross	Recharge/Recovery Considerations

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop objectives
- Reclaimed water overview
- Clarifying planning inputs
- IGA impacts
- Current/future reclaimed water operations
- Wastewater treatment options
- Underground storage considerations
- Discussion
- Closing

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

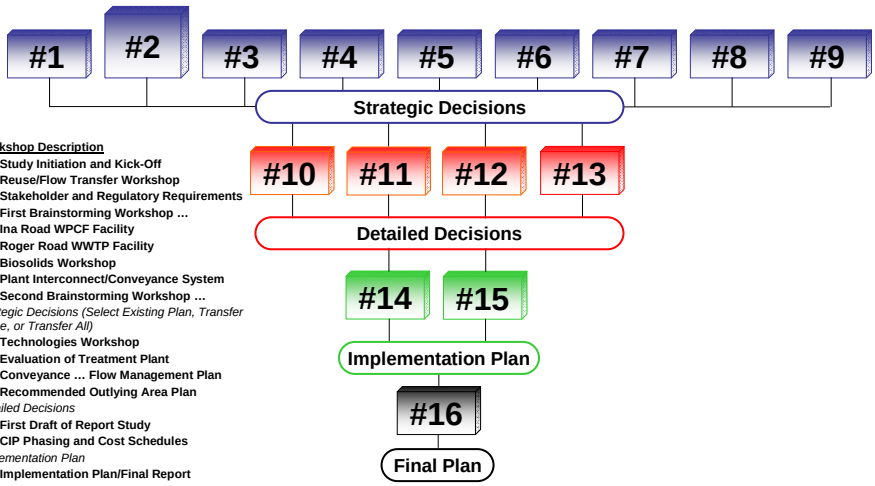
8

Role of Facilitator

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

9

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

10

Workshop Objectives

- Reach understanding of Tucson Water's current reclaimed water operations
- Clarify existing data to be used for planning
- Discuss/understand underground storage considerations
- Impacts of continuation of *Existing* reuse plan
- Impacts of "*Transfer Some*" treatment option
- Impacts of "*Transfer All*" treatment option

11

Pima County Wastewater Management Department

GREELEY AND HANSEN

Tucson Water Operations Overview

Tucson Water

Clarifying Planning Inputs

Jerry Bish

Reclaimed Water Uses

- Public/Private Turf Facilities
- Industrial Heavy Water Users
- Sweetwater Wetlands
- Sweetwater Recharge Facilities
- SCRMUSF
- LSCRMRP
- Conservation Projects (Sonoran Desert Conservation Plan)

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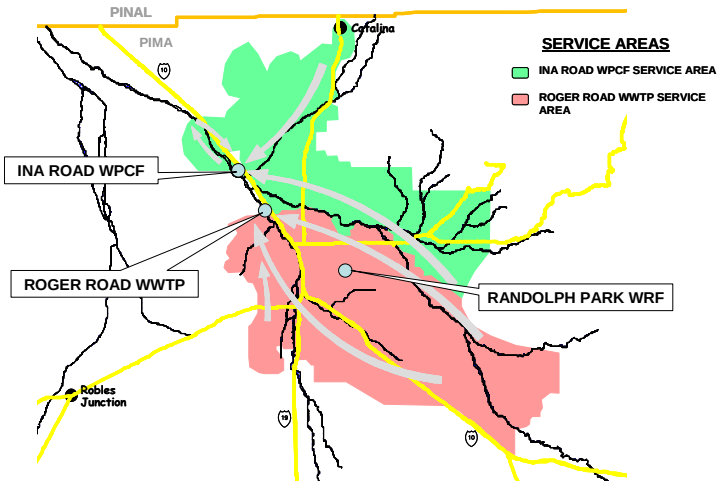
Metro Wastewater Treatment Plants



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Roger Road WWTP

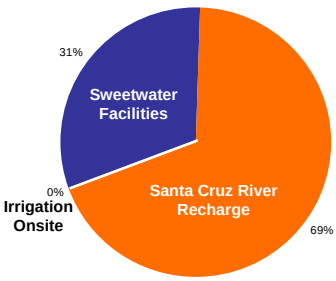
Roger Road WWTP Effluent

14 AF
Irrigation
Onsite

29,188 AF
Santa Cruz River
Recharge

13,124 AF
Tucson Water
Sweetwater Facilities/
Silverbell Golf Course

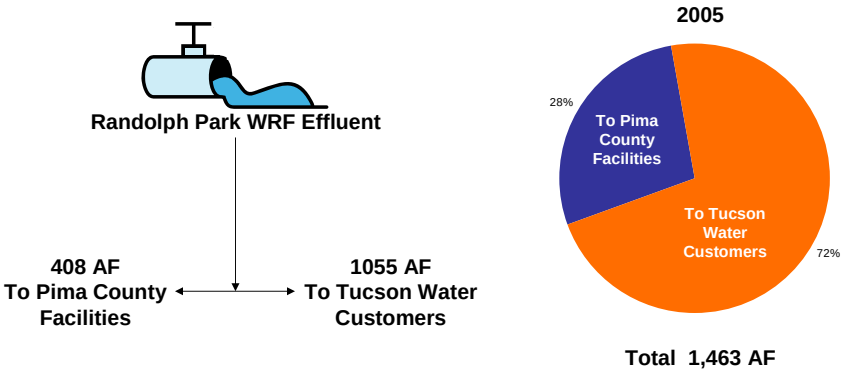
2005



Total 42,326 AF

16

Randolph Park WRF



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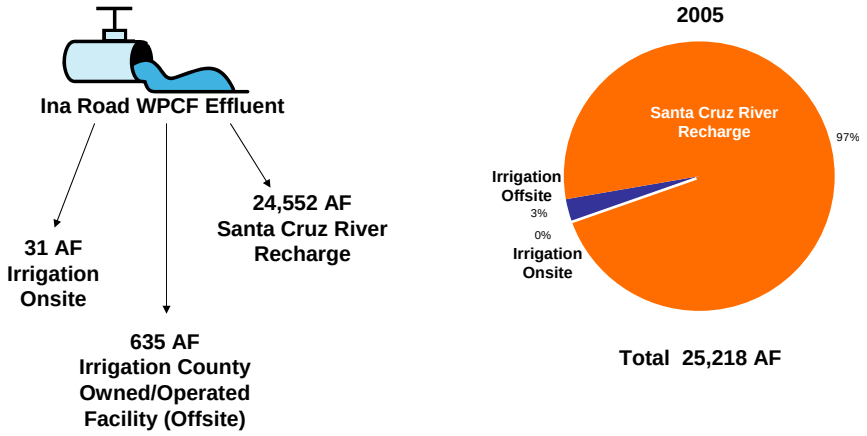
Ina Road WPCF



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Metropolitan Treatment Fac. Effluent (2005)

Treatment Facility	*Effluent Utilized (AF/YR)*
Ina Road WPCF	25,218
Roger Road WWTP	42,326
Randolph Park WRF	1,463
Total	69,007

19

Total Effluent (2005)

Total Effluent Utilized (AF/YR)	69,007
SAWRSA	28,200
Total less SAWRSA	40,807
Entities Share	
Water Providers (90%)	36,726
Pima County (10%)	4,081

20

Total Effluent with CEP (2005)

Total Effluent Utilized (AF/YR)	69,007
SAWRSA	28,200
CEP	10,000
Total less SAWRSA and CEP	30,807
Entities Share	
Water Providers (90%)	27,726
Pima County (10%)	3,081

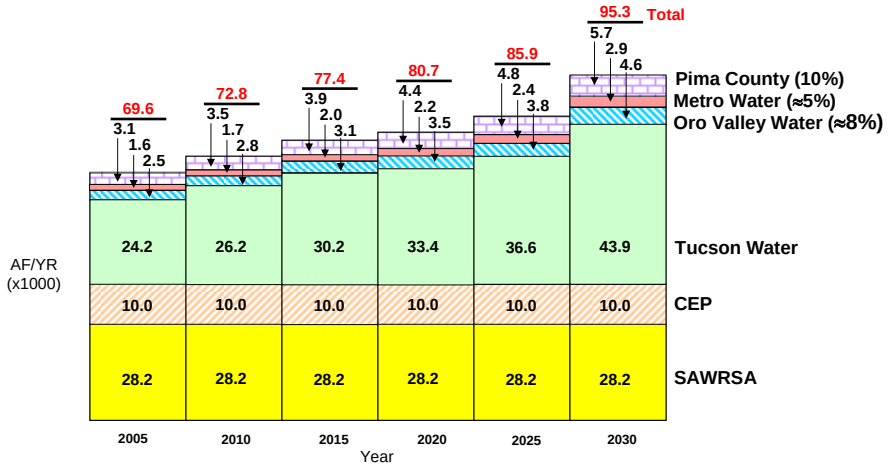
21

Joint Planning Group

- PCWMD and Tucson Water agree on:
  - Population projections
  - Effluent flows
- Utilizes PAG / TAZ data
- Forecasts to 2030
- Bases for planning

22

Metro Effluent



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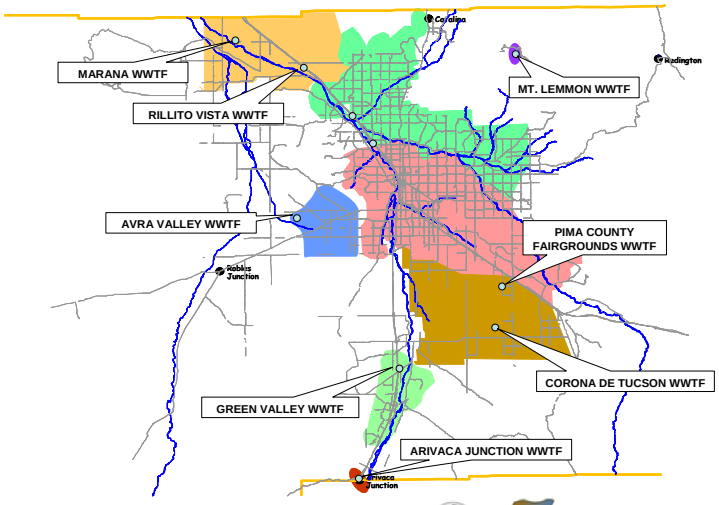
Outlying Facilities



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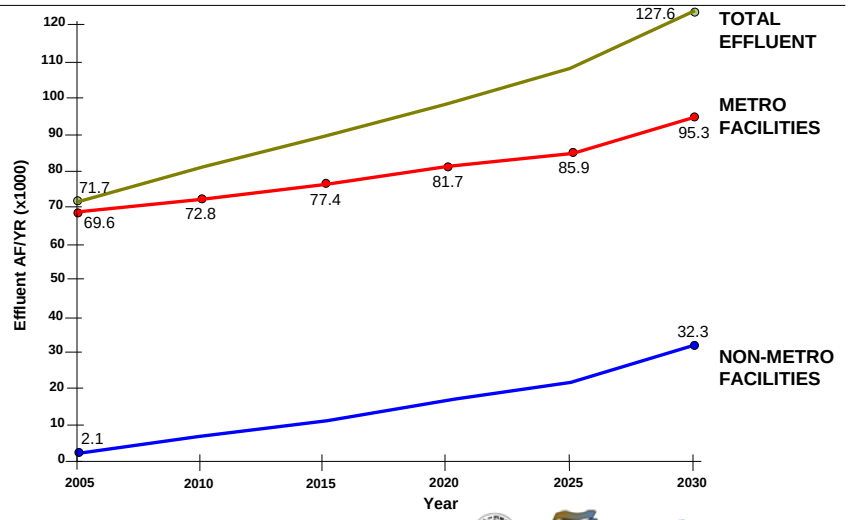
Outlying Facilities – Effluent Discharge

Facility	*Current (2005) AF*	*Future (2030) AF*
Arivaca Junction WWTP	85	0
Avra Valley WWTP	363	3,000
Green Valley WWTP	1,677	6,000
Mt. Lemmon WWTP	3	14
Marana WWTP	61	5,300
- Marana WWTP Usage	(30)	(30)
- Southlands	0	18,000
Total	2,121	≈32,300

25

Regional Effluent



26

A.A.C. Class A+ Reclaimed Water

- Total nitrogen concentration less than 10 mg/L
- NTU – less than 2
- Disinfection
  - No detect (E. coli) in 4 out of 7 samples per week
  - None to exceed 23/100 mL

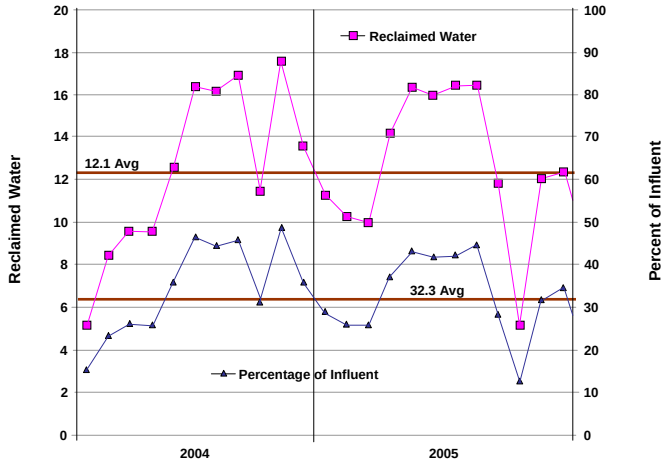
27

BADCT Requirements (WW Effluent)

- Total nitrogen concentration less than 10 mg/L
- Disinfection
  - No detect (E. coli) in 4 out of 7 samples per week
  - None to exceed 23/100 mL

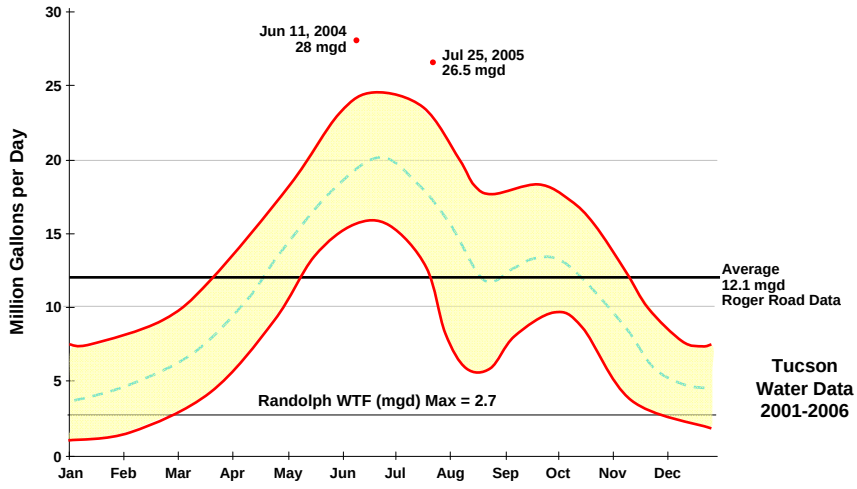
28

Roger Road WWTP to Sweetwater



29

Seasonal Reclaimed Water Demands



30

Balanced Underground Storage Recharge/Recovery

Production Capacity at Sweetwater Treatment	8 to 11 mgd
Production Capacity at Randolph Park WRF*	0 to 3 mgd
Total	8 to 14 mgd
Peak Demand	30 mgd
Recovery Wells	22 to 16 mgd

*Interruptible Operation

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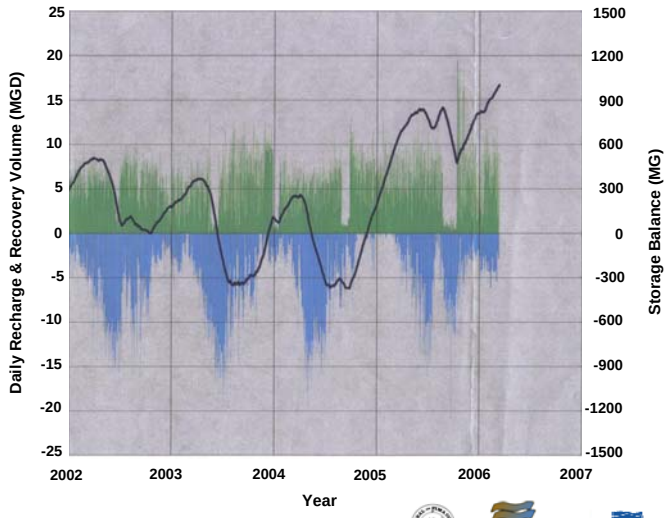
Daily Recharge, Recovery and Net Storage Balance, 2002 through 2006



Tucson Water Data

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Intergovernmental Agreement Impacts / Considerations

Jerry Bish

Effluent Agreements

- 1979 Intergovernmental Agreement
- SAWRSA (1982)
- Supplemental IGA (2000)
- Wheeling Agreement (2003)
- Managed Recharge (2003)

34

1979 IGA

- Transfers to Pima County City's wastewater treatment plants and conveyance system
- Grants City right to use 90% of effluent
- Grants County right to use 10% of effluent
- Grants City of Tucson land use at Ina Road WPCF for reclaimed water operations

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SAWRSA (1982)

- Southern Arizona Water Rights Settlement Act
  - To protect water resources in Upper Santa Cruz River basin
  - Secretary of Interior receives 28,200 AF/yr (plus evaporation losses)

36

Supplemental IGA (2000)

- Established conservation effluent pool (up to 10,000 AF/yr)
- Reopens Randolph Park WRF
- Restricts Pima County's uses of effluent water
- Established SAWRSA effluent water rights

37

Wheeling Agreement (2003)

- Governs reclaimed water transactions between Pima County and City of Tucson

38

Managed Recharge (2003)

- Governs recharge of effluent into Lower Santa Cruz Managed Recharge Project and associated credits
- Participants
  - Town of Marana
  - Cortaro-Marana Irrigation District
  - Avra Valley Irrigation and Drainage District
  - Flow Wells Irrigation District
  - Metro Water*
  - Oro Valley*
  - Pima County*
  - City of Tucson*

*with credits

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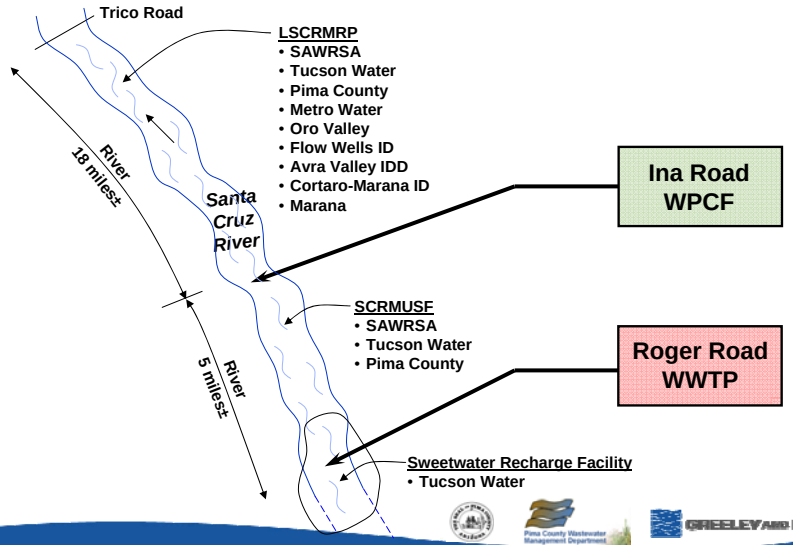
Effluent Rights

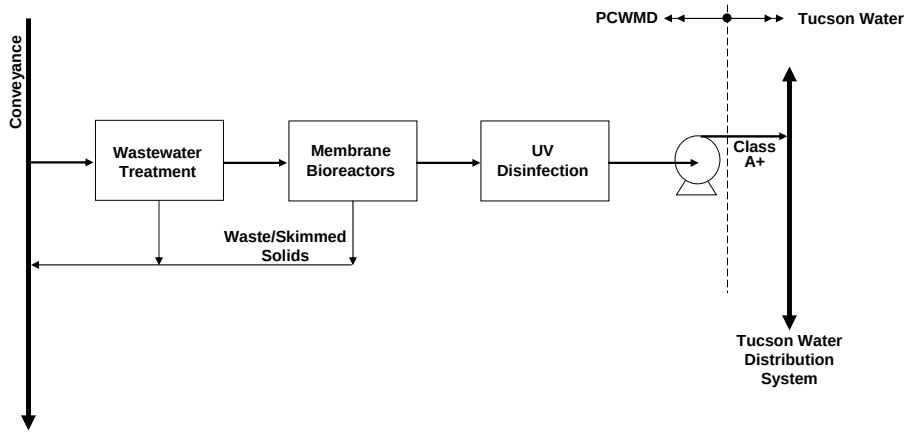


40

Current / Future Reclaimed Water Treatment Operations

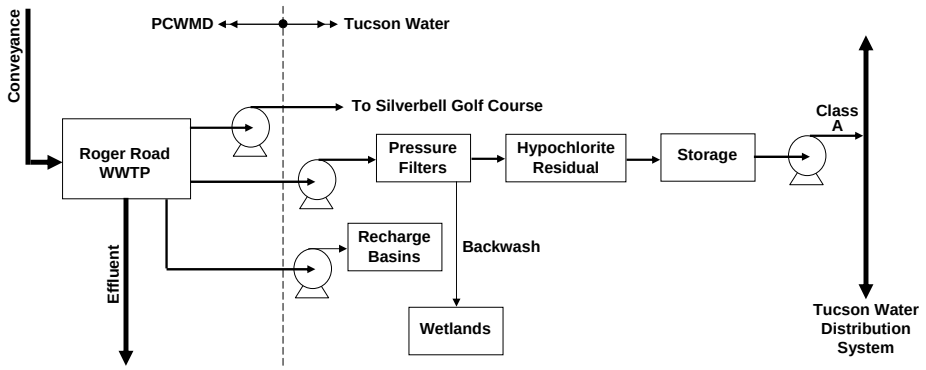
Jerry Bish

Randolph Park WRF



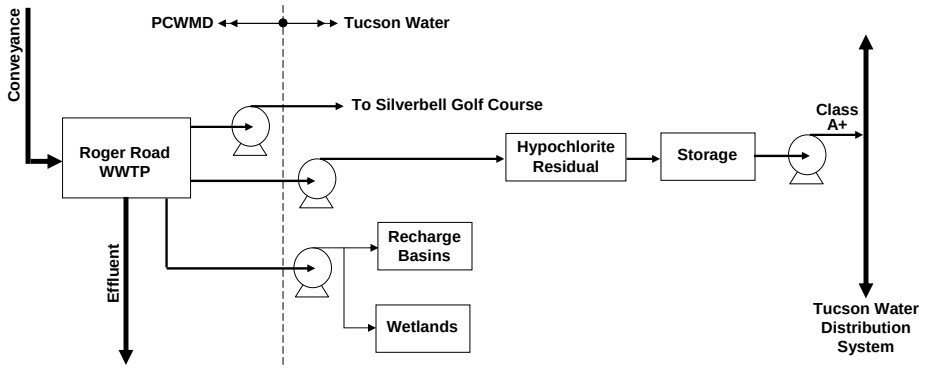
42

Sweetwater Facilities (Existing)



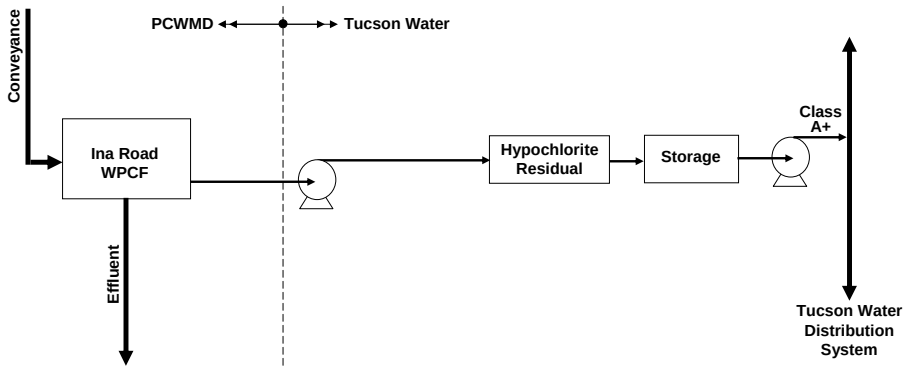
43

Sweetwater Facilities (Future)



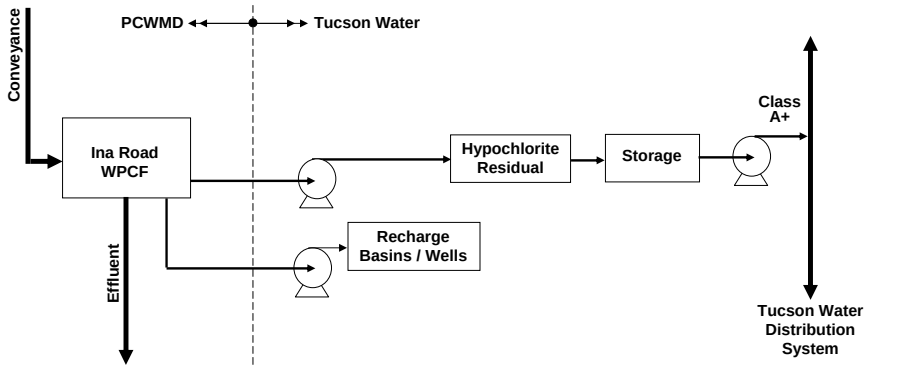
44

Ina Road Facilities (Future?) (1)



45

Ina Road Facilities (Future?) (2)



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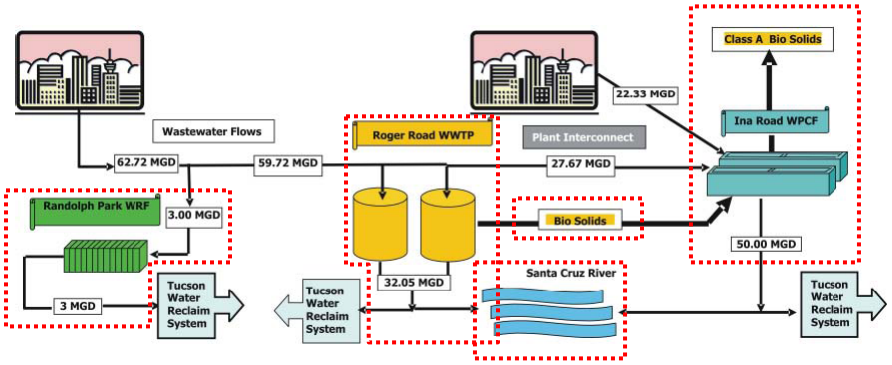
Wastewater Treatment Options / Impacts

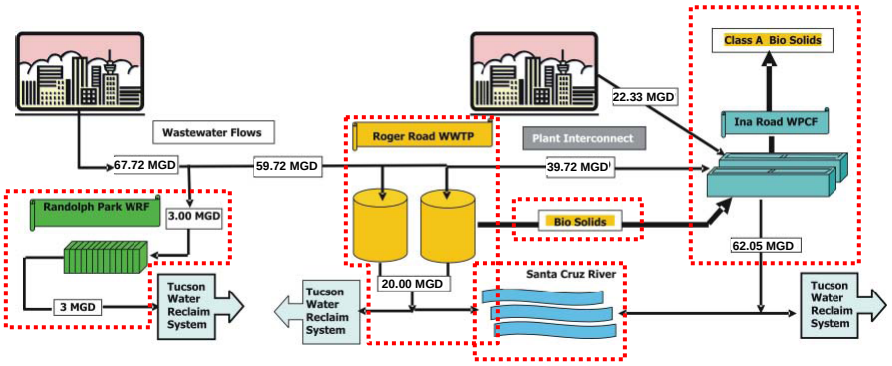
Gordon Culp

Existing Plan Schematic



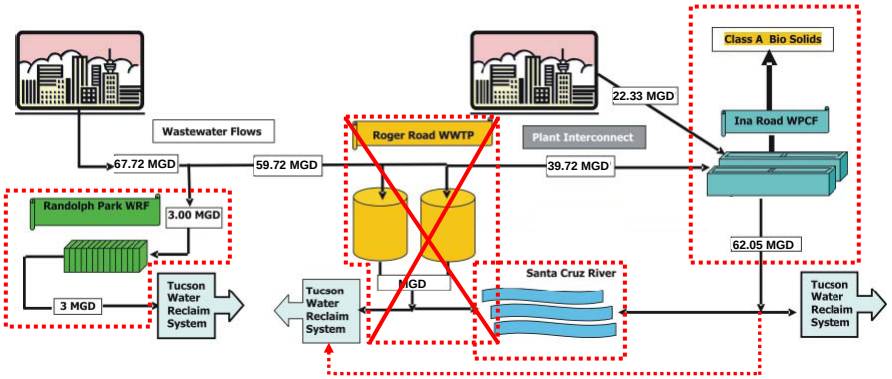
48

Transfer Some Schematic



49

Transfer All Schematic



50

Transfer Flow Issues

- What are environmental impacts?
  - Sweetwater Wetlands
  - Groundwater recharge
  - Santa Cruz River habitat
- How will reclaimed water needs be provided?
  - From where?
  - By whom?
- New conveyance system – size/route

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Conveyance Issues/Options

- Existing Plan:
  - Roger Road WWTP
  - Ina Road WPCF
  - Randolph Park WRF
- Transfer Some:
  - Roger Road WWTP (downsized)
  - Ina Road WPCF (expanded)
  - Randolph Road WRF
- Transfer All:
  - Ina Road WPCF (expanded significantly)
  - Randolph Road WRF

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Plant Interconnect Details

Roger Road sewer elevation	2250 feet
Ina Road sewer elevation	2192 feet
Available hydraulic head	58 feet
Length between plants	24,900 feet or 4.72 miles

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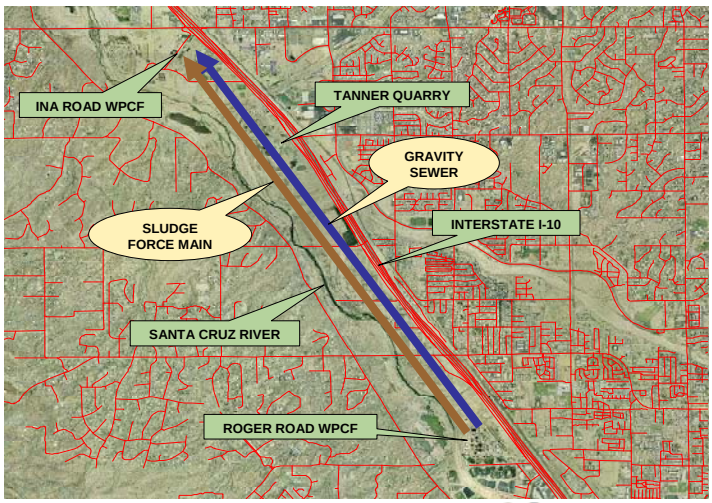
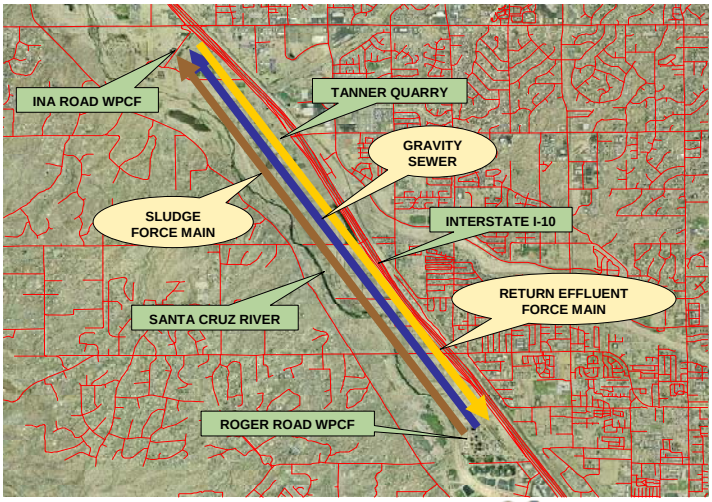
Existing/Transfer Some



54

Transfer Some



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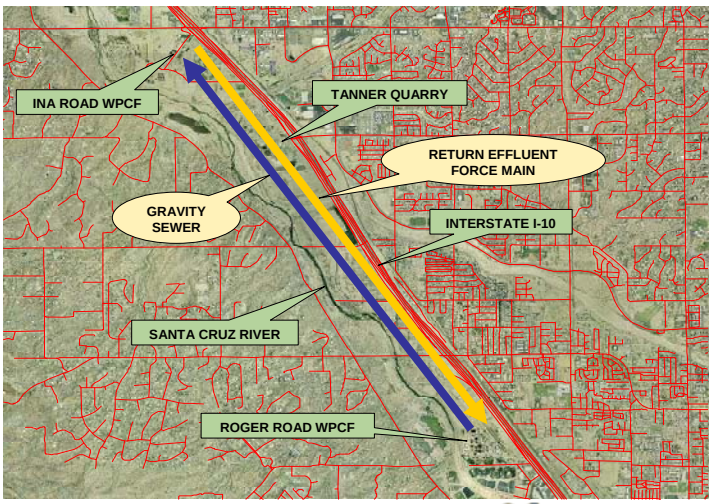

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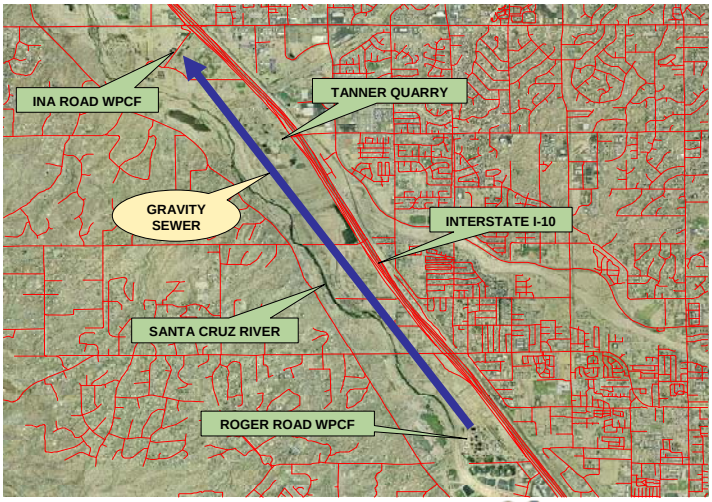

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Underground Storage Recharge / Recovery Considerations

Mark Cross

Underground Storage and Recovery

- Store water in aquifer for subsequent recovery
- Annual or longer-term storage – Santa Cruz River managed recharge
- Seasonal storage and recovery – Sweetwater Facility

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Benefits of Underground Storage and Recovery

- Soil Aquifer Treatment (SAT)
- Blending with groundwater
- Cost-effective storage
- Recover water when needed

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Recharge Methods for Underground Storage

- Infiltration in stream channel
- Infiltration in constructed basins
- Injection wells

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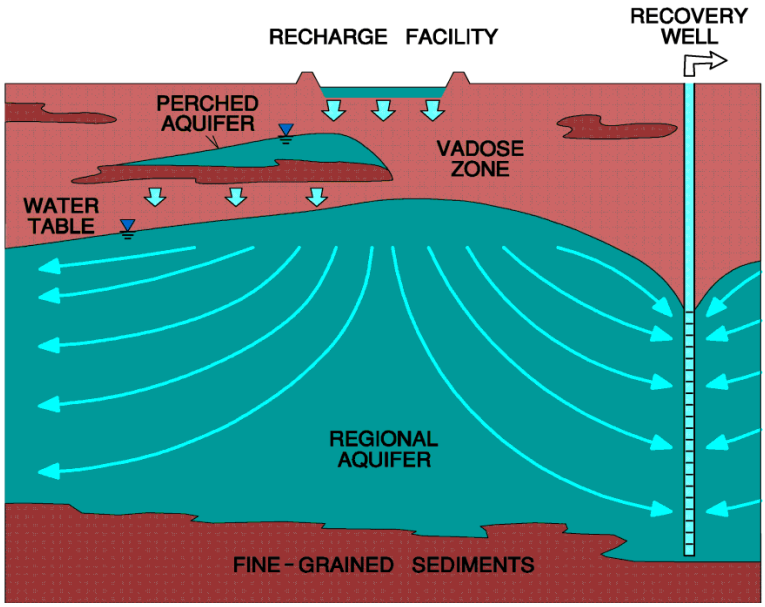

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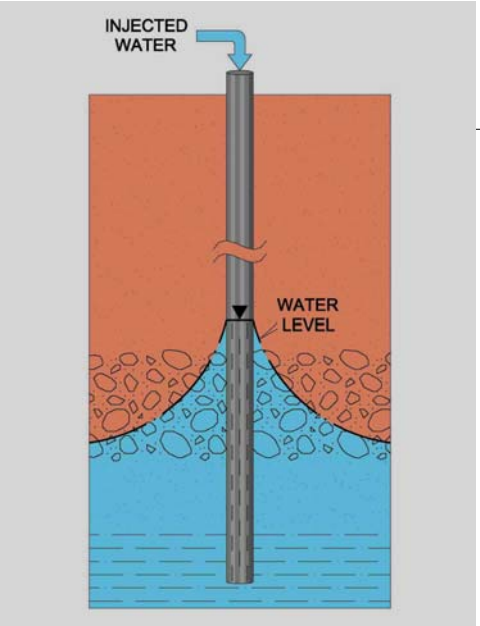

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Existing Storage and Recovery Operations

- Sustained recharge downstream from Roger Road WWTP
- Shallow groundwater levels along river and accrual of storage credits
- Seasonal storage and recovery at Sweetwater Facility

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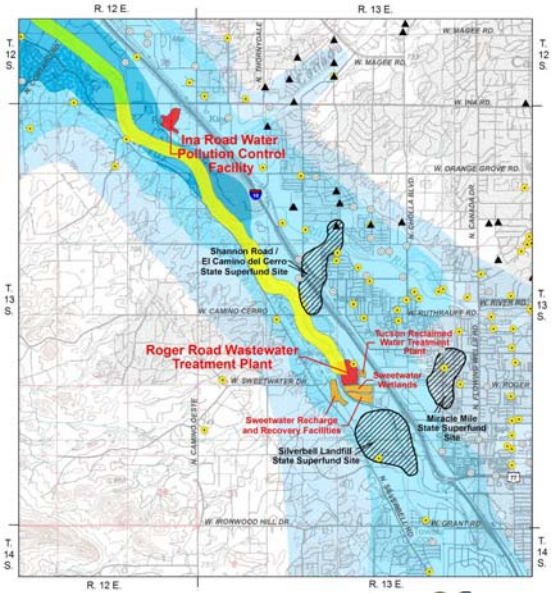
Depth to Groundwater Level



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Transfer Some Roger Road WWTP Capacity to Ina Road WPCF

- No discharge to river at WWTP outfall
- Effects on riparian habitat
- Changes in groundwater levels
- Changes in storage credits for managed recharge projects

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Changes in Groundwater Levels

- Decline in water levels
- Potential effects on productivity of shallow wells
- Changes in groundwater movement and contaminant migration
- Potential effects on remedial actions at State Superfund Sites

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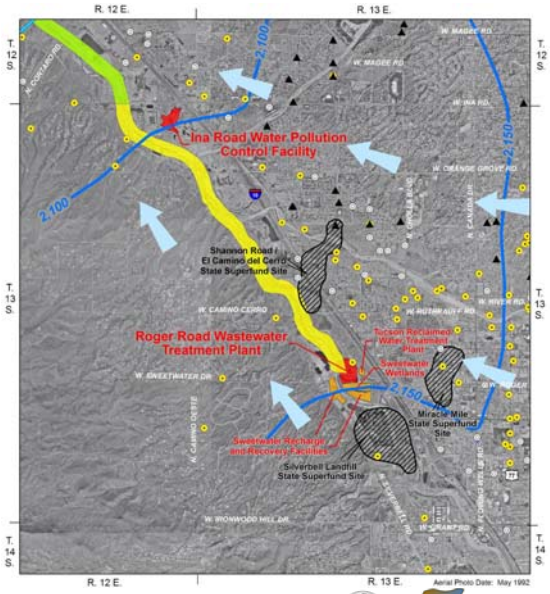
Groundwater Level Altitudes



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Transfer All Roger Road WWTP Capacity to Ina Road WPCF

- Implications of no discharge to river at Roger Road WWTP outfall
- Construct pipeline to Sweetwater Facility or construct new storage and recovery facility near Ina Road WPCF

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Sweetwater Recharge and Recovery Facility

- Meets critical need to maximize effluent reuse
- Proven facility; works well
- Favorable hydrogeologic conditions
- Established outdoor laboratory for collaborative research
- Isolation from potable supply system

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Conceptual Consideration of New Storage and Recovery Facilities

- Avoid need for pipeline to Sweetwater Facility
- Need suitable site of at least 40 to 50 acres
- Favorable hydrogeologic conditions
- Compatible with adjacent land and water uses

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Multiple Benefit Underground Storage Facilities

- Primary purpose is storage
- Recreational, educational, and (or) environmental benefits
- Some allowance by ADWR for less efficient water storage

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Summary of Considerations for Transfer of Capacity to Ina Road WPCF

- Changes in groundwater levels
- Changes in directions of groundwater movement
- Changes in credits from managed recharge projects
- Accommodation of seasonal storage and recovery needs

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Discussion / Summary

Andy Richardson

Pima County Wastewater Management Department

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Workshop #3A Meeting Notes
Stakeholder and Regulatory Requirements

1. The Stakeholder and Regulatory Requirements Workshop for Pima County Regional Optimization Master Plan was held on June 21, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
PCWMD Staff
Tom Berry
Ed Curley
James Doyle
Frank Gall
Byron McMillan
John Munden
Glen Peterson
Jeff Prevatt
Helen Rhudy
Ron Riska, Project Manager
Ken Weber

Legal
Harlan Agnew
Barbara McMurray
Chuck Wesselhoft

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Kevin Conway
Gordon Culp
Ramesh Narasimhan
Andrew Richardson

2. Major topics of the workshop were:

- Workshop #3A: Stakeholder and Regulatory Requirements Workshop
  - ► Identify Key AZPDES, APP, Reclaimed Water, and Air Quality issues that impact facility planning for each of the major facilities (Roger Road WWTP, Ina Road WPCF, Green Valley WWTP, Avra Valley WWTP and other Pima County wastewater facilities.)
  - ► Identify Other Key Permitting and Environmental Considerations/Issues.
  - ► Identify Fatal Flaws
  - ► Develop a Strategy and Agenda Items for Future Regulatory Agency and Stakeholder Meetings.

Handouts were provided to each attendee, which included presentation slides used during the workshop. Contents of these handouts are not included with these notes; however, comments on the handouts are recorded within the notes.

Throughout the workshop, notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, opened the workshop with welcoming remarks for all participants. Although some may think that regulatory issues may be dry subject, it is what drives the County to upgrade facilities and expend considerable capital in improvements. Therefore, we need to understand the implications of the regulatory issues. For the County to best understand the regulatory drivers, all participants in the Workshop are encouraged to participate.

4. Andy Richardson defined his role as facilitator, which is to move the group through the agenda, encourage participation from all in the room, and develop consensus for follow-up actions. Further, it was offered that with regulatory issues there may be three pathways to follow. First, identify the specific issues as defined by the regulations and proceed with compliance. Second, identify the specific regulatory issues that impact the County, evaluate whether the County agrees with the regulations (For example, evaluate if the regulation is supported by sound science or not?) and if not litigate against compliance. Third, review the regulations and determine if there is a middle ground that can be discussed and negotiated with the regulators those results in a benefit to the County, but achieves the results that the regulators seek. These approaches will be explored during the Workshop.
There is the question of what quality of water will be provided to Tucson Water. How will the reclaimed water system be accommodated in the future operation or do we do it now. John Munden reminded the group that there are the various effluent allocations that must be addressed as part of the reclaimed water issue.
Agenda, ground rules and objectives of the workshop were presented and covered on pages 1 through 4 of the handouts

5. Jerry Bish provided specifics on the variances in the AZPDES permits at Roger Road WWTP and Ina Road WPCF. The current variances are for ammonia toxicity and copper limitations. While the copper levels are above permits levels, the County is applying for a variance to the copper limits, because the background levels in the groundwater supply are high. Ammonia toxicity compliance will be met through nitrogen removal processes in the upgraded wastewater treatment

plants by 2014/2015. The January 2007 letter required by ADEQ is to describe compliance strategy and approach.
An overview of the treatment options under consideration in the plan – existing plan, transfer some and transfer all to Ina Road WPCF. If the transfer all option is selected then the compliance date for ADEQ will be January 30, 2015. Each of the options will include consideration of the reclaimed water alternatives developed in Workshop #2 on Water Reuse.
Permit variances and treatment options were covered on pages 4 through 9 of the handout.

6. Ramesh Narasimhan presented the key current permitting issues by facility. One major issue for the future facilities is BADCT compliance and its cost implications (filtration/UV or filtration /ozone or use of SAT). Other concerns are APP and Air Quality setback requirements, future WET testing issues, TMDL for dissolved oxygen (DO) in the Santa Cruz River (not impaired for DO), phosphorus limits, total dissolved solids in effluent from the use of CAP water for irrigation, emergency basins at the plants (none at Roger Road WWTP), testing for emerging contaminants, copper translator studies, total organic carbon and future reclaimed water regulations (Arizona has the highest standard in the nation).
Permit issues and concerns were covered on pages 9 through 25 of the handout. Matrices with permit detail and issues for each of Pima County wastewater facility are included at the back of the handout.

7. Harlan Agnew and others discussed Arizona NPDES primacy, recent litigation and implications. The 9th circuit court of appeals has upheld the decision to withdraw primacy from ADEQ. If EPA files another appeal to this decision, the decision could be stayed, meaning ADEQ retains primacy until a higher court decides. Harlan Agnew indicated that if primacy is returned to EPA, that the current permits issued by ADEQ would not be in effect and the last permits issued by EPA would govern. Permits will mostly likely be redone if EPA assumes permit responsibility. . Due to this uncertainty, both EPA and ADEQ will be invited to participate in the regulatory agency workshop.

8. A recent Supreme Court ruling raises the question if the Santa Cruz River is navigable water of the US and subject to the requirements of the NPDES permit process. If the Santa Cruz is not subject to the NPDES, it is possible that reuse would become the driver to determine wastewater treatment levels.

9. The Harding Lawson study addresses habitat impacts along the Santa Cruz River, The study indicates that major storms strip the vegetation from the river bed and channel. A briefing to

review this study findings will be scheduled by the County for the Project team and Tucson Water.
Another briefing will be provided on the Tres Rios Del Norte habitat and ecosystem restoration project. The Tres Rios del Norte Project may address the public's concerns over riparian habitat at the discharge of the treatment plants. PCWMD will include habitat issues in the public meeting process

10. Pima County approached ADEQ regarding use of Soil Aquifer Treatment (SAT) for compliance with new pathogen disinfection provisions under the APP Rules at two of their outlying facilities.. This request was preliminarily denied and ADEQ directed PCWMD to use filtration/UV technologies that meet the standards at the end of the pipe. The basis of this action was understood to be policy and guidance, not Rule. As a follow-up a request was made by Pima County legal for the disinfection guidance document to support that decision.

11. Jeff Prevatt opined that only two laboratories were certified in Arizona to perform whole effluent toxicity (WET) testing. Neither of these labs are in the Tucson area. Currently it takes 3 to 6 months to get lab results, which is too long for making any meaningful process changes.
There is a need to perform these tests in-house. It would take up to a year to get certified and approved to perform the tests. Pima County needs to investigate in-house WET testing.

12. Costs and benefits of filtration, UV, and ozonation for disinfection need to be considered along with treatment related effluent by-products produced by these processes. The County has three treatment plants on the verge of making a decision of UV versus ozone.

13. Potential use of higher levels of chlorination/de-chlorination to meet BADCT disinfection requirements should be considered (with and without filtration). Reduced analytical method interferences on chlorine residual detection are anticipated once N-deN treatment is implemented.

14. ADEQ has a policy that only one class of effluent can be discharged from a treatment plant. The policy language has not been seen. A copy will need to be obtained to determine if a dual class of effluent can be discharged from a facility.

15. Mike Bunch asked how security strategies will be handled in the master plan. The response was that fencing, security berms and other features will be identified on the footprint of the facilities, but specific details will not be provided because of the nature of keeping the security information private.

16. Avra Valley WWTP is a 4 mgd plant, not a 6.2 mgd facility. Spray irrigation at this facility does not does not percolate well, but runs off near Tucson Water's well fields and across other people's property. There is a need to develop a strategy for effluent disposal for outlying facilities.

17. Studies on emerging contaminants by David Walker have just gotten funding to test UV and ozone effectiveness in reducing contaminant levels. Results from these studies would be useful in addressing UV or ozone treatment technologies. Phoenix has determined that SAT removes contaminants to some degree.

18. With the group participation consensus was reached on the following key issues that need to be discussed with the regulatory agencies:

    - SAT and BADCT criteria (microbial treatment, disinfection)
    - Setback Requirements
    - AZPDES – copper, ammonia toxicity testing, chlorine analytical methodology, primacy, elimination of parameters where testing procedures or detection limits are uncertain (Jeff's list)
    - Regulation of wetlands
    - Air Quality permit modifications – HAP, MACT and BAT issues and emission caps
    - Different qualities of effluent from a single facility
    - Consistency with PAG 208 Plan

19. An archaeological survey will be required for new construction at Ina Road WPCF. Lack of this survey in the past has delayed projects up to one year. This survey should be launched now.

20. PCWMD agreed to meet with Phoenix Valley cities including SROG on BADCT and SAT for APP compliance. Mike Gritzuk will contact City of Phoenix to begin this process.

21. There is available property at I-10 and Ina Road adjacent the existing plant. This property would offer additional setback or buffer for new facilities. The County should look into purchase of this parcel.

22. Harlan Agnew will lead internal strategy discussions to set priorities on regulatory issues, develop a draft agenda for the upcoming Stakeholder meetings with Phoenix Valley cities and meet with the water quality groups of area mines.

23. Andy Richardson with assistance of the group developed a list of questions for discussion with Tucson Water in Workshop #3B. Questions are included in the attached flip chart notes.

24. Mike Gritzuk thanked the group for their participation in a lively and interesting workshop.

25. Andy Richardson previewed the next two workshops both are scheduled for July 12, 2006. Workshop #5 is on the Roger Road WWTP treatment system and Workshop #6 is on the Ina Road WPCF treatment system.

Agenda
Workshop #3A – Stakeholder and Regulatory Requirements
June 21, 2006

Time	*Topic*	*Presenter*	*Pg*
7:30 am	*Continental Breakfast – Rio Nuevo Upstairs Conference Room, 52 W. Congress*		
8:00 am	Opening Session		
	• Welcoming Remarks	Mike Gritzuk	1
	• Overview of Agenda	Andy Richardson	2
	• Purpose and Objectives		
8:15 am	Overview of Facilities	Jerry Bish	4
	• January 2007 ADEQ Permit Requirements		
	• Current and Ongoing Projects		
	• Potential Future Projects		
8:30 am	Summary of Permitting Criteria by Facility	Ramesh Narasimhan	9
	• Review Summary Permit Matrices		
	• Reclaimed Water Permits		
	• Aquifer Protection Permits		
	• AZPDES Permits		
	• Air Quality Permits		
	• Schedule Considerations		
	• Anticipated Near / Long Term Water Quality Issues		
	• Future Water Quality Considerations – Emerging Contaminants		
9:45 am	Break		
10:00 am	Key Water Quality Issues	Ramesh Narasimhan	18
	• BADCT Criteria		
	• Disinfection Processes		
	• Ammonia Toxicity		
	• Reclaimed Water Treatment Goals		
	• Recharge/Recovery Considerations		
	• Emerging Contaminants		
	• Cogeneration Process Technology Considerations		
	• Stakeholder Considerations – Potential Impacts on Habitat/Wildlife		
11:20 am	Other Permits/Considerations	Ramesh Narasimhan	23
	• Storm Water		
	• CMOM		
	• GASB 34		
	• Army COE 404		
	• Dam		
	• Forest Service		
	• Design Phase Permits/Approvals		
	• Construction Phase Permits/Approvals		
11:50 am	Summary / Wrap-Up	Andy Richardson	25
	• Comment by Group		
	• Closing Remarks	Mike Gritzuk	
12:00 pm	Lunch		

Flip Chart Notes – June 21, 2006

Overview

- PCWWM will be conducting metals translator studies to justify a higher limit for copper. This appears to be the preferred strategy for copper compliance as opposed to treatment.
- Based on verbal clarifications with ADEQ, Mike Gritzuk indicated that the term "initial engineering study" means a letter to ADEQ describing the compliance strategy and approach. This will not impact consultant's time lines for completion of the study.
- If only one plant at Ina Road is the selected option (Roger Road eliminated), the compliance schedule date becomes January 30, 2015
- The 9th circuit court if appeals has upheld the decision to withdraw primacy from ADEQ. If EPA files another appeal to this decision, the decision could be stayed meaning ADEQ retain primacy until a higher court reaches a decision. If primacy is returned to EPA, that the current permits issued by ADEQ, the last permits issued by EPA would govern.
- A Supreme Court decision may impact whether the Santa Cruz River is *Waters of the US* and thus affect its status as a regulated body.
- Project will need to determine what is the critical regulatory driver as far as effluent water quality standards (Reuse, surface discharge, APP?).
- Three areas of emphasis for communicating findings from the project with key stakeholders (Tucson Water) are workshops, Stakeholder interview process and the public involvement program
- For Marana, Oro Valley, and Metro Water; the workshops (these organizations have been invited) and public meetings will be used to communicate project findings.

Key Water Quality and Permitting Issues

- Obtain BADCT policy/guidance document for disinfection/microbial treatment criteria.
- Setback limits for both APPs and air quality permits are a consideration in the facility design parameters and costs (particularly at Ina Road WPCF).
- A suggestion was made to acquire "Starbucks' property" to meet setback criteria for the Ina Road WPCF.
- Several issues for WET test: Only two certified labs in State; timing of results and sampling is an issue – At this time Pima County does not control ammonia toxicity and implementation procedures.
- Consider "EPA nation-wide WET testing implementation" in Texas
- Although ammonia limit on Santa Cruz River does not currently exist, a 2 mg/.L is anticipated in ongoing triennial review.

- *Archeological survey - start now at Ina Road WPCF
- Assess possible air quality limits on DBPs and impacts
- Pima County is conducting a study on endocrine disruptors looking at different water sources
- What are the effects of ozone and UV on these containmants?
- *Reach out for research to WestCAS
- *Consider potential future TMDL for dissolved oxygen
- Low level chlorine detection a problem
- *Need to obtain list of "non-detected" parameters out of permit; follow up with Jeff Prevatt

Agenda Items for Regulatory Agency Meetings

- Filtration and UV light or SAT to meet BADCT??
- Phosphorus (timing and Tres Rios "lakes")
- ADEQ one reuse water class per plant by policy – need documentation
  - Can we have two water qualities?
    - Surface Discharge
    - Tucson Water Reuse
- TMDL for dissolved oxygen
- List of non-detected parameters to be removed from permit
- WET testing
- Setback limits for APP and air quality
- "Scalping" plants with biosolids issue

Key Issues

- Loss of habitat/riparian system – may not be an issue
- Need a briefing on Tres Rios del Norte study and Harding Lawson study
- Habitat assessments already conducted
- Order of upcoming meetings – 1) PCWMD Board, 2) Tres Rios del Norte meeting, 3) then public
- How will ADEQ regulate Tres Rios del Norte "lakes"?
- NDMA, Pima County would like to participate in the development of method and in regional studies

Questions for Tucson Water

- Tucson Water needs supply beyond 2020
- 1) What is their projection of when TDS from CAP water will be an issue? Also impact from TDS build-up from recharge?
- 2) When does the yellow become reclaimed water?
- 3) When will Tucson Water engage the public on this issue?
- 3) Participate in concurrent research efforts?
- 4) What is the schedule for chloramine conversion?

- 5) Participation in a state-wide meeting on SAT
- 6) Perchlorate levels in CAP water is being tracked by Tucson Water
- 7) TOC levels
- 8) Briefing for Tres Rios del Norte
- 9) Pipe to Avra Valley plans

Action Items

- Meet with SROG group (Mike Gritzuk, Greeley and Hansen project team and Pima County)
- Internal strategy development (Harlan Agnew, Ed Curley)
- Meet with mines on BADCT (Harlan Agnew)
- Meet ADEQ with priorities (Mike Gritzuk)
- Review WestCAS task groups (WET, triennial review/ammonia toxicity, nutrients) and have Pima County participate (Jeff Prevatt/Byron McMillan)
- Harlan Agnew to develop draft agenda for regulatory agencies

Avra Valley WWTF

- Use for spray irrigation a concern on groundwater quality; Tucson Water does not want it to impact wells
- Should Pima County, in outlying facilities, market reclaimed water?
- Craft strategy for effluent disposal for outlying facilities
- Expansion beyond 4 mgd will depend on growth

Pima County
Regional Optimization
Master Plan

Workshop #3A
Stakeholder and Regulatory Requirements

June 21, 2006

Workshop Presenters

- Mike Gritzuk — Welcome/Closing
- Andy Richardson — Facilitator
- Jerry Bish — Overview
- Ramesh Narasimhan — Permit/Regulation

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop Objectives
- Overview of Facilities
- Aquifer Protection Permits
- AZPDES Permits
- Reclaimed Water Permits
- Air Quality Permits
- Recharge / Recovery Permits
- Other Permits
- Closing

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

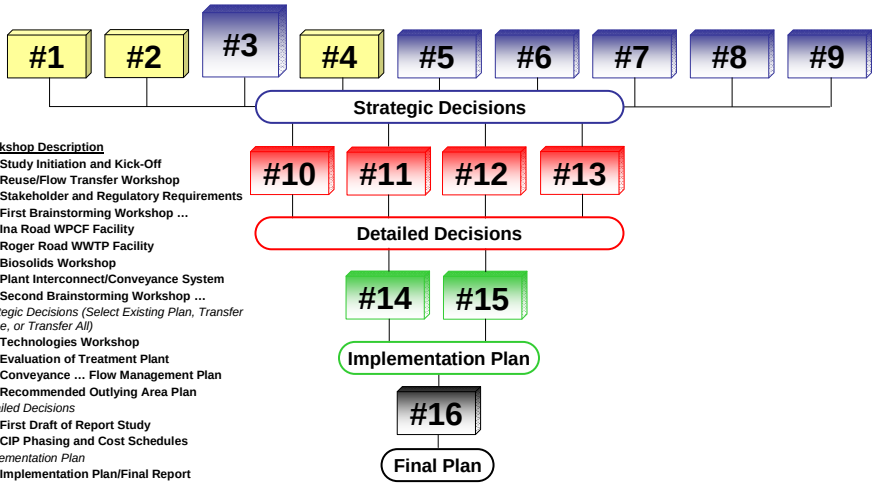
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Workshop Objectives

- January 2007 ADEQ letter compliance
- Review current permits
- Identify regulatory issues
- Reuse regulation impacts/considerations
- Regulatory impact of reduced discharge from Roger Road on Santa Cruz River
- Review future regulatory requirements

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Pima County Wastewater Management Department

GREELEY AND HANSEN

Overview of Facilities

Jerry Bish

AZPDES Permit – Roger Road WWTP

- Variances
  - Ammonia toxicity
    Variance until January 30, 2015
  - Copper limitations
    Variance until January 30, 2011

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AZPDES Permit – Roger Road WWTP

- Ammonia toxicity terms/conditions
  - By January 30, 2007
    - Complete engineering design review
      - Upgrade or replace
    - Document selected construction option
    - Submit documenting letter to ADEQ
  - By January 30, 2011
    - Award contract for construction
  - By January 30, 2015
    - Treatment of effluent to non-toxic ammonia levels

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AZPDES Permit – Roger Road WWTP

- Copper limitations
  - Interim limit daily maximum: 25 µg/L
  - By January 30, 2011
    - Comply with copper standard
      - Daily maximum: 16 µg/L
      - Monthly average: 12 µg/L

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AZPDES Permit – Ina Road WPCF

- Variances
  - Ammonia toxicity
    Variance until January 30, 2014
  - Copper limitations
    Variance until December 31, 2010

16

AZPDES Permit – Ina Road WPCF

- Ammonia toxicity terms/conditions
  - By February 1, 2007
    - Complete initial engineering study
    - Recommendation for upgrading Ina Road WPCF
    - Submit documenting letter to ADEQ
  - By December 31, 2010
    - Award contract for construction
  - By January 30, 2014
    - Treatment of effluent to non-toxic ammonia levels

17

AZPDES Permit – Ina Road WPCF

- Copper limitations
  - Interim limit daily maximum: 30 µg/L
  - By December 31, 2010
    - Comply with copper standard
      - Daily maximum: 16 µg/L
      - Monthly average: 12 µg/L

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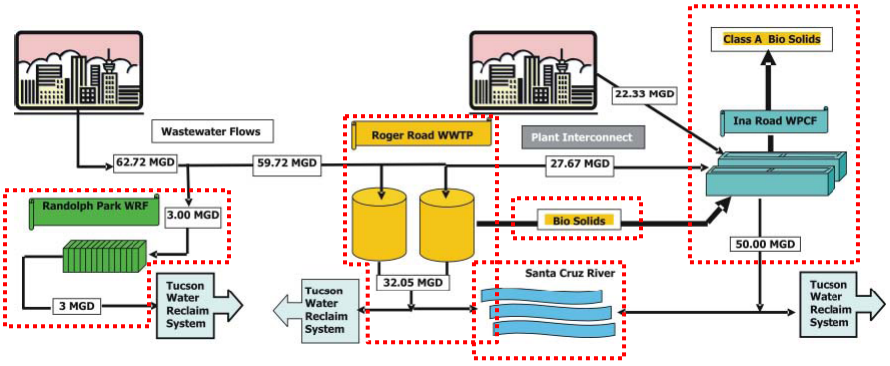
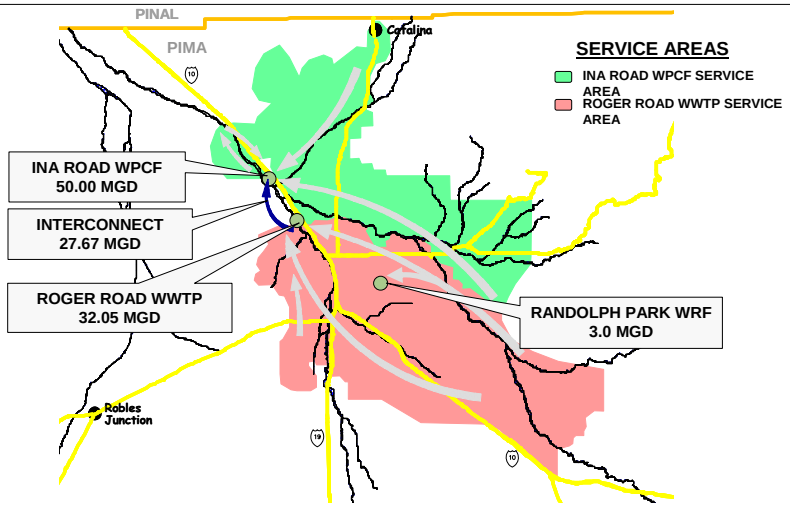
Existing Plan Schematic



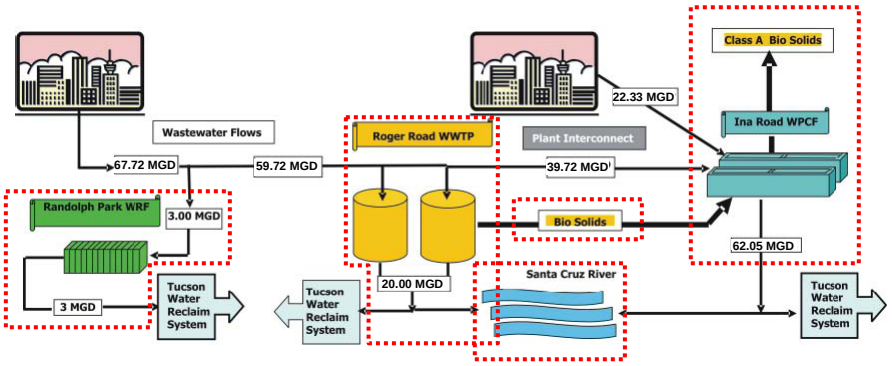
19

Existing Plan (2030)



20

Transfer Some Schematic



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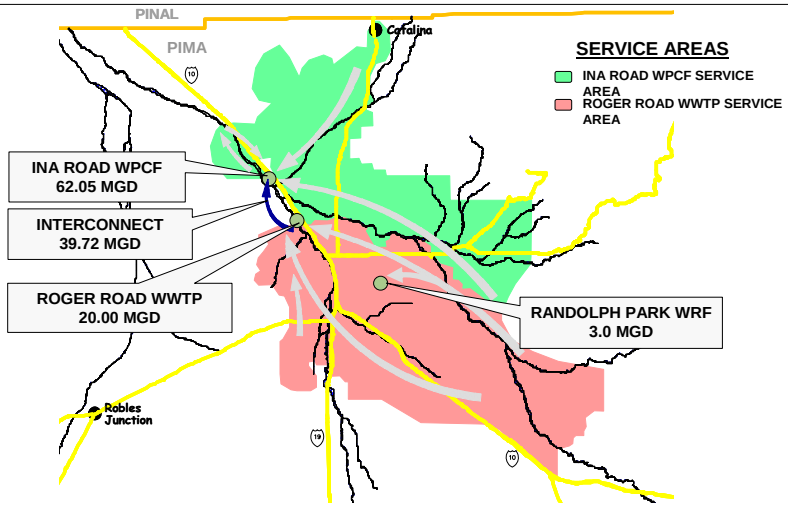
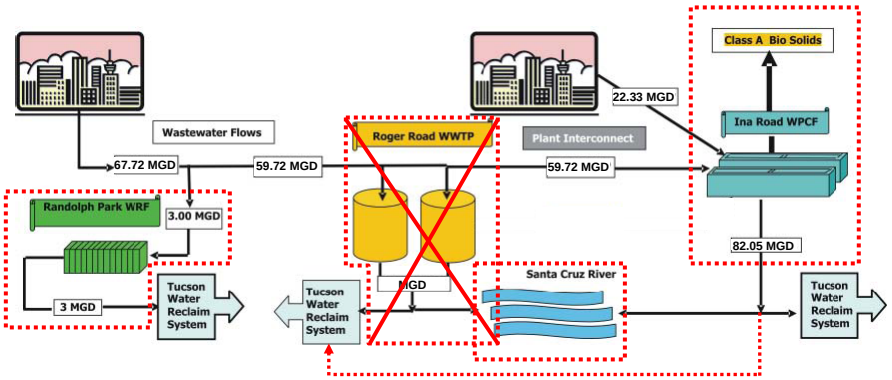
Transfer Some (2030)

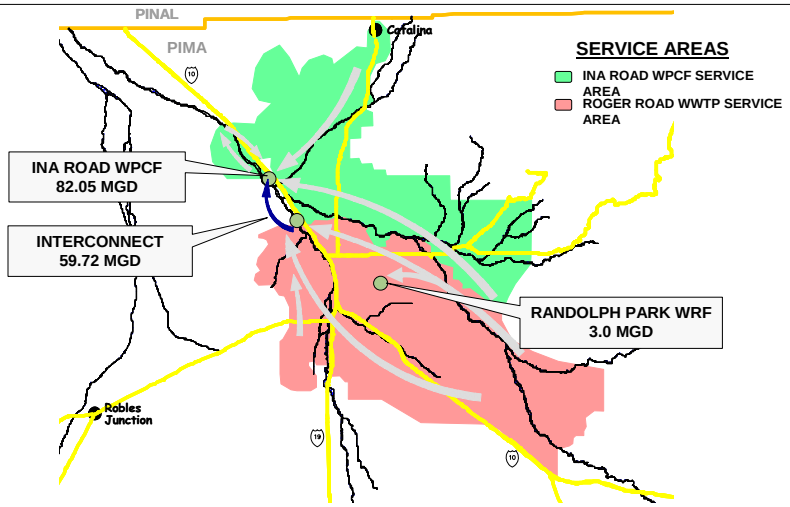


22

Transfer All Schematic



Transfer All (2030)



Current / Ongoing Projects

- Ina Road BNRAS
- Outlying facilities
  - Avra Valley WWTP
  - Corona de Tucson WWTP
  - Marana WWTP
  - Green Valley WWTF

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Potential Future Projects

- Existing Plan:
  - Roger Road WWTP (upgrade/downsize)
  - Ina Road WPCF (expand)
  - Randolph Park WRF
- Transfer Some:
  - Roger Road WWTP (upgrade/downsize significantly)
  - Ina Road WPCF (expand)
  - Randolph Park WRF
- Transfer All:
  - Ina Road WPCF (expand significantly)
  - Randolph Park WRF

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Summary of Permitting Criteria by Facility

Ramesh Narasimhan

Goals and Objectives

- Present and discuss current and future permitting issues
  - Integrate with current and planned improvements
- Outline timelines (establish deadlines) to meet permitting requirements
- Identify fatal flaws
- Identify needs of all stakeholders

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Goals and Objectives *(continued)*

- Identify key issues needed to develop an optimal permitting strategy
  - Develop agenda for workshop with agencies
- Assess consistency with the 208 plan prepared by Pima Association of Governments

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APP, AZPDES, Reclaimed Water, and Air Quality Permits

- Key issue development by facility
  - Matrices developed for each facility
    - Roger Road WWTP
    - Ina Road WPCF
    - Avra Valley WWTF
    - Green Valley WWTF

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ROGER ROAD WWTP

Aquifer Protection Permit – Effective 5/26/05

- Key Issues
  - POC location for well 12 replacement
  - Compliance with setback limits
  - Permit reopeners
  - BADCT: need to filter vs. SAT
  - Use of CAP water by Tucson Water
- Schedule Considerations
  - Replacement well
  - Permit modifications

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ROGER ROAD WWTP

Aquifer Protection Permit – Effective 5/26/05 *(continued)*

- Key Standards/Limits
  - POC location
  - Safety factors
  - Interim nitrate AQL
  - Near mid-term, and future contaminant considerations

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ROGER ROAD WWTP
AZPDES Permit – Effective 3/2/06 to 3/2/11

- Key Issues
  - Ammonia toxicity
  - Copper variance
  - Chlorine monitoring method and metal translator studies
  - Minimum flows
- Schedule Considerations
  - Compliance for ammonia, copper compliance
  - Chlorine method and metal translators studies

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ROGER ROAD WWTP
AZPDES Permit – Effective 3/2/06 to 3/2/11 *(continued)*

- Key Standards/Limits
  - Interim copper level
  - Current and future standards: Cr VI, Cu, Cl_2
  - Toxicity tests, results and follow-up actions

34

ROGER ROAD WWTP
Reclaimed Water Permit – Eff. 4/29/04 to 4/20/09

- Key Issues
  - Need to upgrade entire facility to higher class??
  - Usage/replacement of Tucson Water facility
- Schedule Considerations
  - Renewal
- Key Standards/Limits
  - Class B/B+ (Pima County uses)
  - Class A/A+ (Tucson Water uses)
  - Enhanced future standards not expected
  - Other future issues
    - Microbial fouling, UV efficiency, salinity, CAP water importation

35

ROGER ROAD WWTP
Air Quality Permit – 5-year term expires 2010

- Key Issues
  - Synthetic minor source for NO_x and CO
  - Minor source for other criteria pollutants
  - Permitted equipment includes 9 IC engines, WWTP, scrubbers
  - No issues with opacity testing, sulfur content
- Schedule Considerations
  - Permit reopeners
  - Emission modeling

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ROGER ROAD WWTP

Air Quality Permit – 5-year term expires 2010 *(continued)*

- Key Standards/Limits
  - Potential to emit
  - Plant expansion potential for triggering major source
  - H_2S limits at fence line

INA ROAD WPCF

Aquifer Protection Permit – Effective 2/26/02

- Key Issues
  - Archeological implications
  - Permit reopeners
  - BADCT: need to filter vs. SAT
  - Use of CAP water by Tucson Water
- Schedule Considerations
  - Pesticides and PCB monitoring
  - Permit modifications

INA ROAD WPCF

Aquifer Protection Permit – Effective 2/26/02 *(continued)*

- Key Standards/Limits
  - Point of compliance (POC) location
  - Near to mid-term contaminant considerations
    - Fecal coliforms or E. coli, TOC, THMs, HAAs, bromate, arsenic
  - Future contaminant considerations
    - Salinity, endocrine disruptors, pharmaceuticals, NDMA

39

INA ROAD WPCF

AZPDES Permit – Effective 1/2/06 to 1/2/10

- Key Issues
  - High ammonia levels
  - Chlorine and copper exceedances
- Schedule Considerations
  - Compliance for ammonia, copper toxicity, and chlorine
  - BNRAS upgrade

40

INA ROAD WPCF

AZPDES Permit – Effective 1/2/06 to 1/2/10 *(continued)*

- Key Standards/Limits
  - Current standards and ranges for Cr VI, Cu, Cl_2, cyanide, Pb, Ag, phthalate
  - Toxicity tests, results and follow-up actions
  - Future contaminant considerations

41

INA ROAD WPCF

Reclaimed Water Permit – Effective 1/6/04 to 1/6/09

- Key Issues
  - Need to upgrade to higher class??
  - Microbial fouling in distribution system
  - Reuse customers
- Schedule Considerations
  - Renewal

42

INA ROAD WPCF

Reclaimed Water Permit – Effective 1/6/04 to 1/6/09 *(continued)*

- Key Standards/Limits
  - Two treatment trains: Class B (25 MGD), Class B+ (12.5 MGD)
  - Enhanced future standards not expected
  - Benefits of upgrading Class
  - Future salinity issues

43

INA ROAD WPCF

Air Quality Permit – 5-year term expires 2010

- Key Issues
  - Major source for NO_x and CO
  - Minor source for other criteria pollutants
  - Permitted equipment include 7 large IC engines and plant processes
  - No issues with opacity testing, sulfur content, H_2S limits
- Schedule Considerations
  - Future expansions may trigger >25 tons/year HAP criteria
  - Emission modeling

44

INA ROAD WPCF

Air Quality Permit – 5-year term expires 2010 *(continued)*

- Key Standards/Limits
  - Potential to emit
  - H_2S fence line criteria
  - Costs and benefits of upgrading cogeneration vs. power from TEP

45

AVRA VALLEY WWTF

Aquifer Protection Permit – Effective 8/23/03

- Key Issues
  - Future disinfection considerations
  - Primarily a recharge facility
- Schedule Considerations
  - Emergency overflow basin use reporting
- Key Standards/Limits
  - Near to mid-term contaminant considerations
  - Future contaminant considerations

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AVRA VALLEY WWTF
AZPDES Permit – Effective 8/22/04 to 8/22/08

- Key Issues
  - Future disinfection technology
  - Dechlorination impacts
  - Emergency discharge to Black Wash
- Schedule Considerations
  - Trace substances monitoring status
- Key Standards/Limits
  - Current and future standards
  - Toxicity tests, results and follow-up actions

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AVRA VALLEY WWTF
Reclaimed Water Permit – Eff. 7/30/04 to 7/30/09

- Key Issues
  - Reclaimed water uses
  - 6.2 MGD expansion ongoing -- includes UV, filtration
- Schedule Considerations
  - Renewal
- Key Standards/Limits
  - Class A+ with expansion/upgrades
  - Enhanced future standards not expected
  - Other future issues (fouling, UV efficiency, salinity)

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GREEN VALLEY WWTF
Aquifer Protection Permit – Effective 7/1/03

- Key Issues
  - Permit reopeners
  - Operation is permitted as two separate facilities
- Schedule Considerations
  - No compliance schedule issues
- Key Standards/Limits
  - POC location
  - BNROD limits
  - Near to mid-term contaminant considerations
  - Future contaminant considerations

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GREEN VALLEY WWTF
AZPDES Permit – Effective 8/22/04 to 8/22/08

- Key Issues
  - Future disinfection
  - Emergency backup storage
- Schedule Considerations
  - Trace substances monitoring status
- Key Standards/Limits
  - Current and future standards
  - Toxicity tests, results and follow-up actions

50

GREEN VALLEY WWTF

Reclaimed Water Permit – Eff. 12/28/04 to 12/28/09

- Key Issues
  - No major issues
- Schedule Considerations
  - Renewal
- Key Standards/Limits
  - Class B (WWTF 2.1 MGD)
  - Class A+/B+ (BNROD 2.0 MGD; with/without filters)
  - Enhanced future standards not expected
  - Other future issues (microbial fouling, UV efficiency, salinity)

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GREEN VALLEY WWTF

Air Quality Permit – 5-year term expired 2005

(administratively continued)

- Key Issues
  - Synthetic minor source for NO_x and CO
  - Minor source for other criteria pollutants
  - Permitted equipment
  - No issues with opacity testing, sulfur content, H_2S limits
- Schedule Considerations
  - Emission modeling
- Key Standards/Limits
  - Potential to emit
  - H_2S fence line criteria

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Key Water Quality Issues

Ramesh Narasimhan

Key Issue: Coliforms and Microbial Treatment

- Non-detect compliance criteria for fecal coliform and E. coli anticipated under future APPs
- Plants may need filtration to meet new limits
  - Type of filtration
  - Impact of potential UV system efficiency

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Key Issue: Coliforms and Microbial Treatment *(continued)*

- Or consider SAT and alternate POC for compliance with more stringent microbial standards

55

Key Issue: Disinfection Process

- Use of chlorine periodically results in problems historically due to ineffective dechlorination (Roger Road WWTP and Ina Road WPCF)
- Monitoring <20 ppb chlorine poses analytical challenges due to interference
- Excess sodium bisulfite, used to dechlorinate, causes DO sag in river

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Disinfection Issues *(continued)*

- Consider use of ozone and/or UV for disinfection, with limited use of chlorine
  - UV and ozonated by-products a potential concern (e.g., bromate)
  - Ozone is complex process
  - Pretreatment critical to UV effectiveness
  - Additional pretreatment likely required for advanced disinfection

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Disinfection Issues *(continued)*

- THMs and HAAs not a current problem (likely because of low organic precursors and high ammonia levels)
  - Future standard will be 80 ppb
  - May be an issue if chlorination is used for effluent disinfection and CAP water is used in Tucson's water supply
- After NdeN is implemented
  - Reduced impacts from analytical interference anticipated
  - Better control of dechlorination process anticipated

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Key Issue: Ammonia Toxicity

- NdeN to reduce ammonia levels to <2 mg/L
- If chlorine is used as disinfectant
  - Residual ammonia after NdeN will be consumed to form chloramines
  - Free chlorine is available and is more powerful disinfectant
  - With UV/ozone, residual
- Current levels of residual ammonia may impact dechlorination effectiveness
  - Effectiveness of ORP feedback sensors for controlling chlorination/dechlorination

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Key Issue: Change in Habitat

- Reduced flow in effluent dependent receiving stream at Roger Road WWTP
  - Loss of riparian ecosystem
  - Need to consider public concerns
- Conduct habitat assessment studies
- Perform public and stakeholder outreach activities
  - Game and Fish, Fish and Wildlife, PAG, Defenders of Wildlife, local interest groups, etc.

60

Phosphorus

- Numeric targets currently proposed for lakes and reservoirs in Arizona
  - Driver is Chlorophyll-a concentration
  - Total phosphorus considered as additional evidence of nutrient related impairment
- Nutrient targets for impaired streams also currently imposed
- No such standards anticipated in near future for County's receiving stream
- Removal may be desirable if costs are minimal

61

Total Organic Carbon

- Potential issue for recharge/injection sites
  - Other states have more stringent standards (e.g., California)
  - Advanced treatment (GAC/enhanced coagulation) to be considered in future?

62

Emerging Contaminants
(Potential APP Issues)

- Endocrine disruptors/pharmaceuticals
  - UV or ozone treatment
  - Requirements for photo degradation and biodegradation of pharmaceuticals to be investigated
- NDMA
  - 20 ng/L action level in California
  - Assess presence
  - Applicable treatment – UV oxidation

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Emerging Contaminants
(Potential APP Issues) *(continued)*

- Perchlorate
  - List 1 UCMR – AZ action level of 14 ppb
  - Perform sampling
- Salinity (also potential reclaimed water issue)
  - Consider use of CAP water by Tucson
- Arsenic
  - 10 ug/L

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Reclaimed Water Issues

- Standards for reuse not expected to soon change
  - AZ among highest standards in the country
- Microbial fouling and release
- UV system efficiency
- Salinity buildup
- Chlorine residuals
- Turbidity
- Consider differences in treatment needs between PCWMD effluent and Tucson Water reclaimed water

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Recharge / Recovery Permits

- ADWR recharge/recovery permitting activities would be a joint effort between PCWMD and City of Tucson
- Need to meet City of Tucson's future needs
  - Flow requirements by site
  - Develop congruent timelines
  - Treatment and quality standards and impacts on potable supplies (TOC, etc.)

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Other Permits / Considerations

Ramesh Narasimhan

Other Permits

- Storm Water
  - Modify permit to reflect plant upgrades
    - General
    - Individual
- Army COE 404 (KERP)
- Dam
  - Update to reflect plant upgrades (Avra Valley, Green Valley)
- Forest service
  - Update to reflect plant upgrades (Mt. Lemmon)

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Other Permits *(continued)*

- Design phase permits and approvals
  - Coordinate through appropriate agency
  - Potential permits
    - Fire access
    - Fire Department Chemical Storage, Hazardous Material Management Plan
    - Building Permit (plan approval)
    - Right-of-Way Work Permit for sewer lines and reclaimed water lines
    - Recharge Well Permit
    - Well Drilling Permit
    - Dry Well Registration/Permit
    - AZPDES (general) Construction Storm Water NOI

AAC Setback Requirements

- 1,000 feet without noise, odor and aesthetic controls

AAC Setback Requirements

- With Controls
  - <50 db at fence
  - Enclosed odor producing components
  - Odor scrubbers on vents
  - Fencing – match surroundings

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Other Permits *(continued)*

- Construction phase permits and approvals
  - Earth Moving Permit
  - Approval to Construct (ATC)
  - Archeological Assessment
  - Environmental Assessment (federal funding)
  - Spill Prevention, Control, and Counter Measures Plan

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Other Permits *(continued)*

- Construction phase permits and approvals *(continued)*
  - AZ Protected Native Plants and Wood Removal Application (if needed)
  - Approval of Construction
    - Interim permit to operate
    - Final approval of construction
  - Risk Management/Process Safety Management Plan
  - RCRA Hazardous Waste Compliance (if needed, depending on process)

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Summary

Andy Richardson

Pima County Wastewater Management Department

GREELEY AND HANSEN

Workshop #3B Meeting Notes
Stakeholder and Regulatory Requirements

1. The Stakeholder and Regulatory Requirements Workshop for Pima County Regional Optimization Master Plan was held on June 21, 2006 after Workshop #3A. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
PCWMD Staff
Tom Berry
Ed Curley
James Doyle
Frank Gall
Byron McMillan
Jeff Prevatt
Helen Rhudy
Ron Riska, Project Manager
Ken Weber
Legal
Harlan Agnew
Barbara McMurray
Chuck Wesselhoft

TUCSON WATER
Tucson Water Staff
Jeff Biggs
Karen Dotson
John Kmiec
Melodee Loyer
Mark Seamans
Tim Thomure
Wally Wilson
Alan Forrest, CH2M Hill
Ken Thompson, CH2M Hill

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Kevin Conway
Gordon Culp
Ramesh Narasimhan
Andrew Richardson

2. Major topics of the workshop were:

- Workshop #3B: Stakeholder and Regulatory Requirements Workshop
  - ► Identify and understand Tucson Water's Reclaimed Water System operational and regulatory issues to develop mutually beneficial strategies.
  - ► Obtain information on Tucson Water's Recharge/Recovery operations and permits to identify key interface issues between the two agencies.
  - ► Provide Tucson Water with an overview of some of the key regulatory challenges that PCWMM is facing regarding AZPDES, APP, Reclaimed Water, and Air Quality issues that will impact facility planning for each of the major facilities (Ina Rd. WWTP, Roger Rd. WWTP).
  - ► Develop a strategy and agenda for future regulatory agency and stakeholder meetings.

Handouts were provided to each attendee, which included presentation slides used during the workshop. Contents of these handouts are not repeated in these notes; however comments on the handouts are recorded within the notes.

Throughout the workshop, notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, opened the workshop by recognizing presence and thanking Tucson Water for use of the meeting room. He indicated that the topics of the morning workshop were stimulating and hoped that the afternoon workshop would be as stimulating. Finally, he invited everyone to participate in the discussions on regulatory issues.

4. Andy Richardson defined his role as facilitator to move the group through the agenda and to encourage participation from all in the room. The purpose of this workshop is to identify key operational and permitting issues relating to the reclaimed water system and recharge/recovery facilities that impact PCWWM's facility planning and regulatory efforts. Other objectives include developing unified permitting strategies and answering questions relating to future water quality issues.
A brief summary of Workshop #3A was provided which indicated three areas for collaboration with Tucson Water – 1) treatablity studies, 2) stakeholder process, and 3) public involvement. Also, there were nine questions developed in Workshop #3A for discussion with Tucson Water. The questions and the subsequent answers by Tucson Water are provided in item 12 below. Tucson Water was invited to participate in meetings with the Phoenix Valley cities including SROG on regulatory issues. Lastly, issues of ADEQ primacy and the recent Supreme Court ruling on navigable waters (NPDES permits) for the Santa Cruz River were presented.
The agenda, ground rules and objectives of the workshop were presented and covered on pages 1 through 4 of the handout.

5. Jerry Bish provided specifics on the variances in the AZPDES permits at Roger Road WWTP and Ina Road WPCF. The current variances are for ammonia toxicity and copper limitations. While the copper levels are above permits levels, the County is applying for a variance to the copper limits, because the background levels in the groundwater supply are high. Ammonia toxicity compliance will be met through nitrogen removal processes in the upgraded wastewater treatment plants by 2014/2015. The January 2007 letter required by ADEQ is to describe compliance strategy and approach.

An overview of the treatment options under consideration in the plan – existing plan, transfer some and transfer all to Ina Road WPCF was presented. If the transfer all option is selected then the compliance date for ADEQ will be January 30, 2015. Each of the options will include consideration of the reclaimed water alternatives developed in Workshop #2 on Water Reuse. Tucson Water asked if they could have access to the 12.5 mgd BNRAS effluent at Ina Road WPCF before 2015. There was a statement made that the plant permit may preclude this because it is based on a blend between the HPO and BNRAS, but is worth an investigation Tucson Water willing to take some BNRAS to help with Roger Road downtime.
Permit variances and treatment options were covered on pages 4 through 9 of the handout.

6. Karen Dotson provided an overview of Tucson Water's reclaimed water system indicating that Tucson Water has one of the largest community reclaimed water systems in the United States. Tucson Water holds a general reuse permit from ADEQ and delivers reclaimed water to about 600 sites, including: 14 golf courses; 32 parks; 40 schools and more than 300 single family homes. The University of Arizona is currently the only non irrigation use.
Tucson Water's reclaimed water production facilities at Roger Road near I-10 are wrapped around and are conjoined with the Roger Road WWTP, and have been filtering and disinfecting treated wastewater for 19 years. The facilities produce Class A effluent but would like to produce all Class A+ (total nitrogen below 10mg/L) effluent in the future due to ADEQ concerns, public exposure, and additional operational requirements during spills and leaks. Class A water requires lining of ponds on golf courses, whereas A+ would not. Also, if there is a main break with Class A water is a larger deal with requirements for containment and regulatory reporting that would not be required for A+ water.
The reclaimed water facility consists of recharge basins, recovery wells and a filtration plant. These facilities produce low turbidity water to meet Class A standards. Generally a blend of the two sources is used in the reclaimed water system. The recharge/recovery process has been effective in reducing TOC levels.
Tucson water indicated that they would be willing to fight WET testing criteria.

7. Wally Wilson provided an overview of the various recharge and recovery permits used by Tucson water and summarized the capacities of their filtration and recharge/recovery facilities. The filtration facility handles 10 mgd and the recharge/recovery facilities are being re-rated to 13,000 AF/yr. Currently the recharge basins has a nitrogen (N) concentration of 16 mg/L in with 6 to 12 mg/L of N out of the recovery wells.
The underground water storage facility permits expire in 2008 and are renewable for 20 years.
If all the effluent is produced at Ina Road WPCF, a 36-inch main would be required between Ina Road WPCF and Sweetwater to meet the demands of the reuse system.

Constructed recharge would bring up a lot of permitting issues. Lots of demonstration would be required and there would be Corp of Engineers 404 permit process to deal with. Other options would be less complex to meet current needs.
Tucson Water owns about 100 acres at Roger Road.
Tucson Water provided a handout at the workshop that summarized the current Tucson Water Recharge and Recovery Permits.

8. Ramesh Narasimhan presented the key current permitting issues for Roger Road WWTP and Ina Road WPCF. One major issue for the future facilities is BADCT compliance and its cost implications (filtration/UV or filtration /ozone or use of SAT). Other concerns are, TMDL for dissolved oxygen (DO) in the Santa Cruz River (not impaired for DO), phosphorus limits, total dissolved solids in effluent from the use of CAP water for irrigation, testing for emerging contaminants, total organic carbon and future reclaimed water regulations.
Permit issues and concerns were covered on pages 10 through 19 of the handout. Matrices with permit detail and issues for each of Pima County wastewater facility are included at the back of the workshop handout.

9. Ken Thompson stated that many sources show that coliform goes to zero in about 10 feet of SAT. So, no defect for coliform in APP is not special. Will bring data to ADEQ meeting, if helpful.

10. Salinity of potable water will increase as CAP use increases. Community believes TDS is an important parameter.

10. With the group participation consensus was reached on the following key issues that need to be discussed jointly with the regulatory agencies:

    a. SAT and BADCT criteria (microbial treatment, disinfection)
    b. Regulation of wetlands
    c. Air Quality permit modifications – HAP, MACT and BAT issues and emission caps
    d. Different qualities of effluent from a single facility
    e. Consistency with PAG 208 Plan

    Mike Gritzuk will take the lead in contacting the Phoenix Valley cities including SROG, ADEQ.
    Harlan Agnew will develop the draft agenda for the meetings

11. Melodee Loyer indicated that the Reuse Subcommittee for this project had only focused on options that featured a single Class or Quality of water from a particular facility. The options

discussed at the meeting were new to Tucson Water and will be further reviewed by Tucson Water.

12. A group discussion followed regarding the substantial benefits to PCWMM of producing effluent with different levels of treatment. High quality effluent for Tucson Water Reuse and lesser qualities for surface discharges and other types of reuse. The Master Plan will consider levels of treatment necessary to meet criteria based on regulatory drivers and costs. High Quality treatment for surface water discharge appears unnecessary to PCWWM. Subcommittee will need to address options with a lesser quality water.

13. The following responses were provided by Tucson Water to PCWMM questions:

- 1) What is their projection of when TDS from CAP water will be an issue? Also impact from TDS build-up from recharge? *Response: "Clean Water" program is in place. Brine disposal will consist of evaporation plants. Tucson water owns 100 acres at Roger Road for an RO facility and ponds to control TDS.*
- 2) When does the yellow become reclaimed water? *Response: After 2014, maybe much later, depends on growth.*
- 3) When will Tucson Water engage the public on this issue? Response: *At year 2013, 450 mg/L TDS is estimated from recovery wells at which time public is engaged and blending/treatment will be used to keep at this level; 600 mg/L could be a cap.*
- 3) Participate in concurrent research efforts? *Response: Tucson Water agreed to participate in joint research efforts on pharmaceuticals/endocrine disruptors.*
- 4) What is the schedule for chloramine conversion? *Response: No conversion planned at this time and is not desirable. Will reevaluate if necessary in the future (to comply with DBP limits).*
- 5) Participation in a state-wide meeting on SAT? *Response: Tucson Water agreed to participate in this meeting.*
- 6) Perchlorate levels in CAP water is being tracked by Tucson Water. *Response: Tucson Water is monitoring for perchlorate; Do not see as an issue (will share data with PCWWM)*
- 7) TOC levels: *Response: 3 mg/L TOC in recharge; 1 mg/L out of recharge, will treat if level increases prior to injection.*
- 8) Briefing for Tres Rios del Norte: *Response: Tucson Water will attend the debriefing on this project*
- 9) Pipe to Avra Valley plans: *Response; Will wait until 2014 to have the conversation about this issue.*

Agenda
Workshop #3B – Stakeholder and Regulatory Requirements
June 21, 2006

Time	*Topic*	*Presenter*	*Pg*
1:00 pm	*Rio Nuevo Upstairs Conference Room, 52 W. Congress*		
1:30 pm	Opening Session		
	• Welcoming Remarks	Mike Gritzuk	1
	• Overview of Agenda	Andy Richardson	2
	• Summary of #3A Workshop		
	• Purpose and Objectives		
1:45 pm	Overview of Facilities Impacting Tucson Water	Jerry Bish	5
	• January 2007 ADEQ Permit Requirements		
	• Current and Ongoing Projects		
	• Potential Future Projects		
2:00 pm	Reclaimed Water Permits	Karen Dotson/Ramesh Narasimhan	10
	• Reclaimed Water Permits		
	• Aquifer Protection Permits		
	• AZPDES Permits		
	• Schedule Considerations		
	• Anticipated Near, Mid and Long Term Reclaimed Water Quality Issues		
	• Future Water Quality Considerations – Emerging Contaminants		
2:45 pm	Recharge / Recovery Permits	Wally Wilson	14
	• Key Permitting Issues		
	• Flow Criteria and Requirements		
	• Schedule for Permit Renewal / Modifications		
	• Stakeholder Considerations		
3:00 pm	Key Water Quality Issues	Ramesh Narasimhan	15
	• BADCT Criteria		
	• Disinfection Processes		
	• Reclaimed Water Treatment Goals		
	• Recharge/Recovery Considerations		
	• Emerging Contaminants		
	• Stakeholder Considerations – Potential Impacts on Habitat and Wildlife		
	• Anticipated Future Reclaimed Water Standards		
4:00 pm	Summary / Wrap-Up	Andy Richardson	19
	• Comment by Group		
	• Closing Remarks	Mike Gritzuk	
4:15 pm	Adjourn		

Pima County
Regional Optimization
Master Plan

Workshop #3B
Stakeholder and Regulatory Requirements

June 21, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
Jerry Bish	Overview
Ramesh Narasimhan	Permit/Regulations
Karen Dotson	Tucson Water Permits
Wally Wilson	Tucson Water Permits

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop Objectives
- Overview of Facilities Impacting Tucson Water
- Reclaimed Water Permits
- Recharge / Recovery Permits
- Overview of Key Issues from Other Permits
- Closing

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

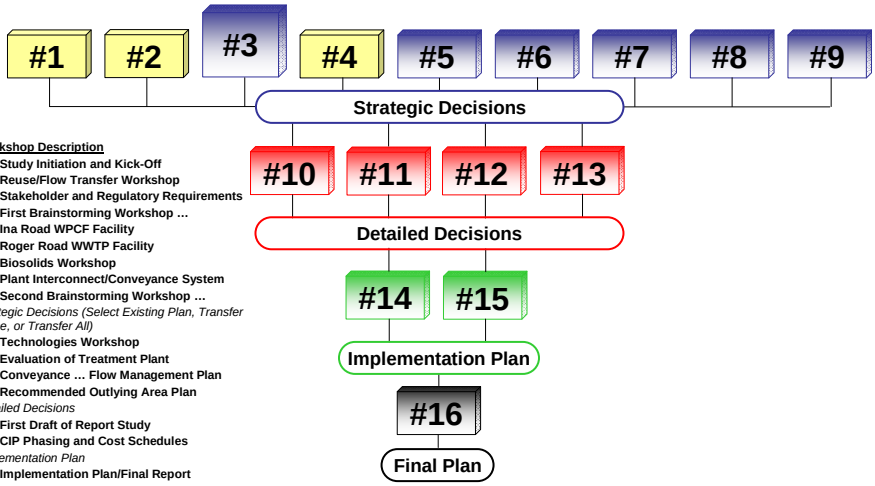
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Workshop #3A Summary

- Review outcomes of Workshop #3A impacting reclaimed water

11

Workshop Objectives

- January 2007 ADEQ Letter Compliance
- Review Current Permits
- Identify Regulatory Issues
- Reuse Regulation Impacts/Considerations
- Regulatory Impact of Reduced Discharge from Roger Road on Santa Cruz River
- Review Future Regulatory Requirements

12

Overview of Facilities Impacting Tucson Water

Jerry Bish

AZPDES Permit – Roger Road WWTP

- Variances
  - Ammonia toxicity
    Variance until January 30, 2015
  - Copper limitations
    Variance until January 30, 2011

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AZPDES Permit – Roger Road WWTP

- Ammonia toxicity terms/conditions
  - By January 30, 2007
    - Complete engineering design review
      - Upgrade or replace
    - Document selected construction option
    - Submit documenting letter to ADEQ
  - By January 30, 2011
    - Award contract for construction
  - By January 30, 2015
    - Treatment of effluent to non-toxic ammonia levels

15

AZPDES Permit – Roger Road WWTP

- Copper limitations
  - Interim limit daily maximum: 25 µg/L
  - By January 30, 2011
    - Comply with copper standard
      - Daily maximum: 16 µg/L
      - Monthly average: 12 µg/L

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AZPDES Permit – Ina Road WPCF

- Variances
  - Ammonia toxicity
    Variance until January 30, 2014
  - Copper limitations
    Variance until December 31, 2010

17

AZPDES Permit – Ina Road WPCF

- Ammonia toxicity terms/conditions
  - By February 1, 2007
    - Complete initial engineering study
    - Recommendation for upgrading Ina Road WPCF
    - Submit documenting letter to ADEQ
  - By December 31, 2010
    - Award contract for construction
  - By January 30, 2014
    - Treatment of effluent to non-toxic ammonia levels

18

AZPDES Permit – Ina Road WPCF

- Copper limitations
  - Interim limit daily maximum: 30 µg/L
  - By December 31, 2010
    - Comply with copper standard
      - Daily maximum: 16 µg/L
      - Monthly average: 12 µg/L

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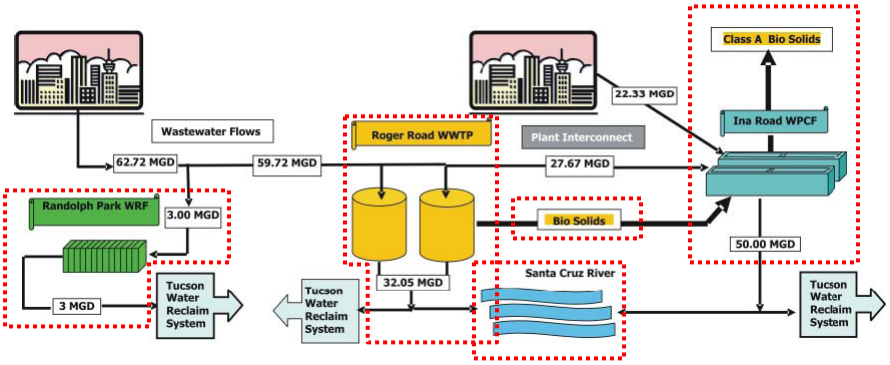
Existing Plan Schematic



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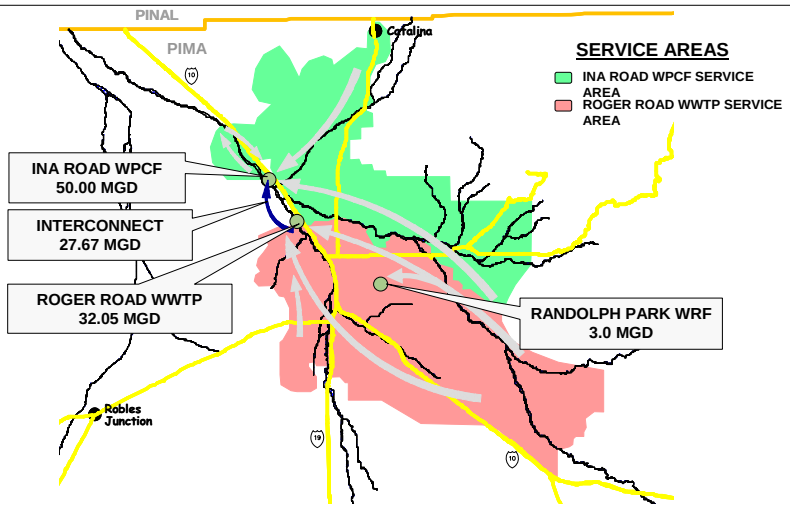
Existing Plan (2030)



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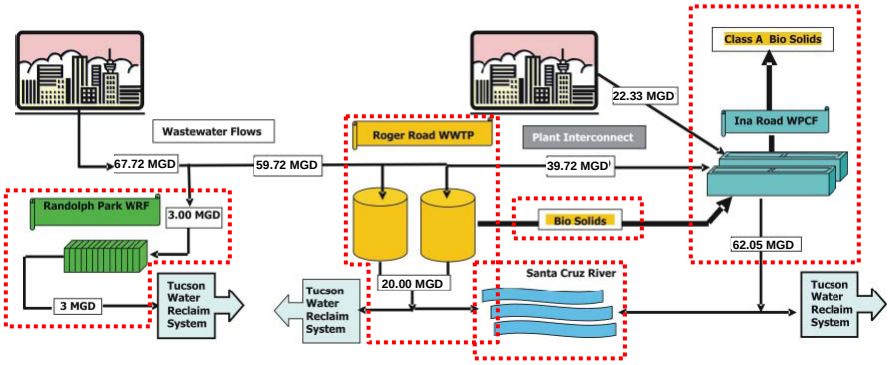
Transfer Some Schematic



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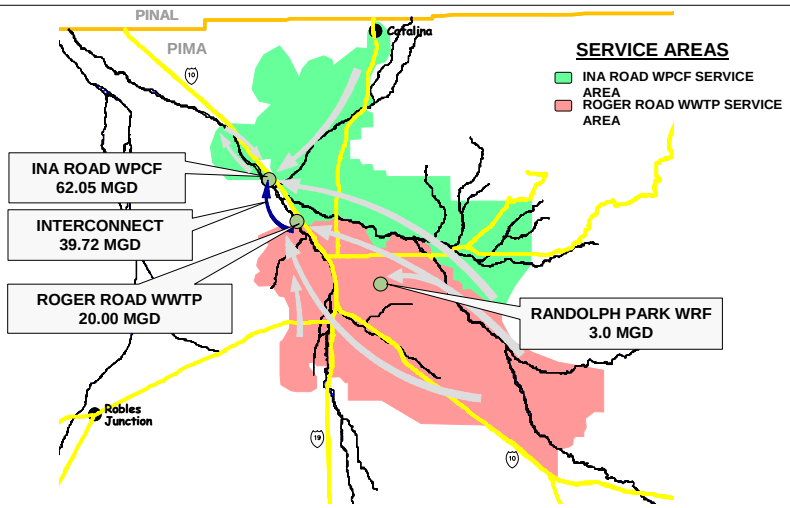
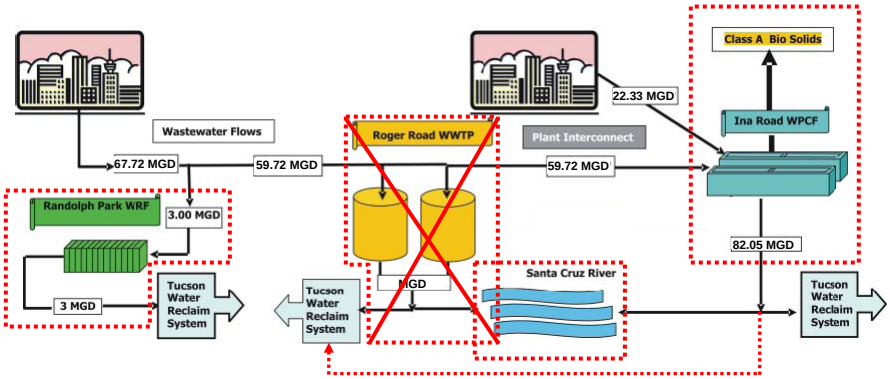
Transfer Some (2030)



23

Transfer All Schematic



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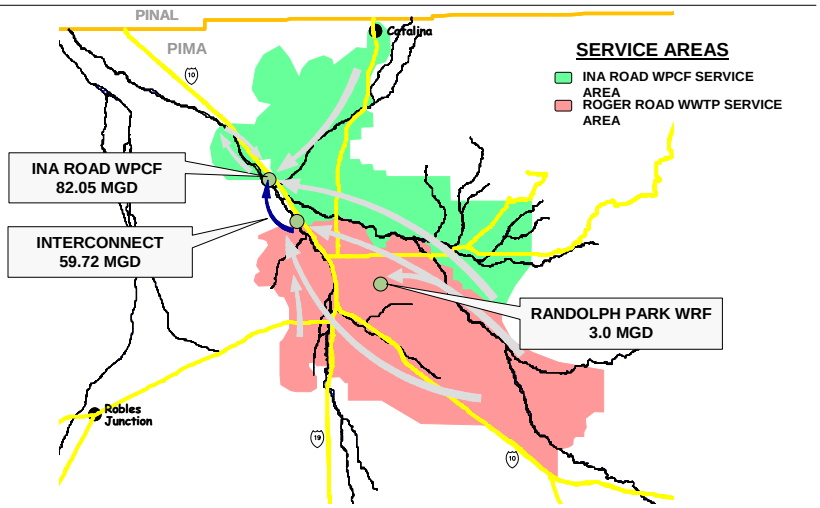
Transfer All (2030)



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Current / Ongoing Projects

- Ina Road BNRAS
- Outlying facilities
  - Avra Valley WWTP
  - Corona de Tucson WWTP
  - Marana WWTP
  - Green Valley WWTF

26

Potential Future Projects

- Existing Plan:
  - Roger Road WWTP (upgrade/downsize)
  - Ina Road WPCF (expand)
  - Randolph Park WRF
- Transfer Some:
  - Roger Road WWTP (upgrade/downsize significantly)
  - Ina Road WPCF (expand)
  - Randolph Park WRF
- Transfer All:
  - Ina Road WPCF (expand significantly)
  - Randolph Park WRF

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Pima County Wastewater Management Department

GREELEY AND HANSEN

NCS

Reclaimed Water Permits

Karen Dotson / Ramesh Narasimhan

Goals and Objectives

- Present and discuss current and future permitting issues
  - Integrate with current and planned improvements
- Outline timelines (establish deadlines) to meet permitting requirements
- Identify needs of all stakeholders
- Identify key issues needed to develop a uniform permitting strategy

29

APP, AZPDES, Reclaimed Water, and Air Quality Permits

- Key issue development by facility
  - Matrices developed for each facility
    - Roger Road WWTP
    - Ina Road WPCF

30

ROGER ROAD WWTP
Reclaimed Water Permit – Eff. 4/29/04 to 4/20/09

- Key Issues
  - Need to upgrade entire facility to higher class??
  - Usage/replacement of Tucson Water facility
- Schedule Considerations
  - Renewal
- Key Standards/Limits
  - Class B/B+ (Pima County uses)
  - Class A/A+ (Tucson Water uses)
  - Other future issues
    - Microbial fouling, UV efficiency, salinity, CAP water importation

31

ROGER ROAD WWTP
Aquifer Protection Permit – Effective 5/26/05

- Key Issues
  - POC location for well 12 replacement
  - Compliance with setback limits
  - Permit reopeners
  - BADCT: need to filter vs. SAT
  - Use of CAP water by Tucson Water
- Schedule Considerations
  - Replacement well
  - Permit modifications

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ROGER ROAD WWTP

Aquifer Protection Permit – Effective 5/26/05 *(continued)*

- Key Standards/Limits
  - POC location
  - Safety factors
  - Interim nitrate AQL
  - Near mid-term, and future contaminant considerations

ROGER ROAD WWTP

AZPDES Permit – Effective 3/2/06 to 3/2/11

- Key Issues
  - Ammonia toxicity
  - Copper variance
  - Chlorine monitoring method and metal translator studies
  - Minimum flows
- Schedule Considerations
  - Compliance for ammonia, copper compliance
  - Chlorine method and metal translators studies

ROGER ROAD WWTP

AZPDES Permit – Effective 3/2/06 to 3/2/11 *(continued)*

- Key Standards/Limits
  - Interim copper level
  - Current and future standards: Cr VI, Cu, Cl_2
  - Toxicity tests, results and follow-up actions

35

INA ROAD WPCF

Reclaimed Water Permit – Effective 1/6/04 to 1/6/09

- Key Issues
  - Need to upgrade to higher class??
  - Microbial fouling in distribution system
  - Reuse customers
- Schedule Considerations
  - Renewal

36

INA ROAD WPCF

Reclaimed Water Permit – Effective 1/6/04 to 1/6/09 *(continued)*

- Key Standards/Limits
  - Two treatment trains: Class B (25 MGD), Class B+ (12.5 MGD)
  - Benefits of upgrading Class
  - Future salinity issues

37

INA ROAD WPCF

Aquifer Protection Permit – Effective 2/26/02

- Key Issues
  - Archeological implications
  - Permit reopeners
  - BADCT: need to filter vs. SAT
  - Use of CAP water by Tucson Water
- Schedule Considerations
  - Pesticides and PCB monitoring
  - Permit modifications

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INA ROAD WPCF

Aquifer Protection Permit – Effective 2/26/02 *(continued)*

- Key Standards/Limits
  - Point of compliance (POC) location
  - Near to mid-term contaminant considerations
    - Fecal coliforms or E. coli, TOC, THMs, HAAs, bromate, arsenic
  - Future contaminant considerations
    - Salinity, endocrine disruptors, pharmaceuticals, NDMA

39

INA ROAD WPCF

AZPDES Permit – Effective 1/2/06 to 1/2/10

- Key Issues
  - High ammonia levels
  - Chlorine and copper exceedances
- Schedule Considerations
  - Compliance for ammonia, copper toxicity, and chlorine
  - BNRAS upgrade

40

INA ROAD WPCF

AZPDES Permit – Effective 1/2/06 to 1/2/10 *(continued)*

- Key Standards/Limits
  - Current standards and ranges for Cr VI, Cu, Cl_2, cyanide, Pb, Ag, phthalate
  - Toxicity tests, results and follow-up actions
  - Future contaminant considerations

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Recharge / Recovery Permits

Wally Wilson

Key Water Quality Issues

Ramesh Narasimhan

Key Issue: Coliforms and Microbial Treatment

- Non-detect compliance criteria for fecal coliform and E. coli anticipated under future APPs
- Plants may need filtration to meet new limits
  - Type of filtration
  - Impact of potential UV system efficiency

44

Key Issue: Coliforms and Microbial Treatment *(continued)*

- Or consider SAT and alternate POC for compliance with more stringent microbial standards

45

Key Issue: Disinfection Process

- Use of chlorine periodically results in problems historically due to ineffective dechlorination (Roger Road WWTP and Ina Road WPCF)
- Monitoring <20 ppb chlorine poses analytical challenges due to interference
- Excess sodium bisulfite, used to dechlorinate, causes DO sag in river

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Disinfection Issues *(continued)*

- Consider use of ozone and/or UV for disinfection, with limited use of chlorine
  - UV and ozonated by-products a potential concern (e.g., bromate)
  - Ozone is complex process
  - Pretreatment critical to UV effectiveness
  - Additional pretreatment likely required for advanced disinfection

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Reclaimed Water Issues

- Standards for reuse not expected to soon change
  - AZ among highest standards in the country
- Microbial fouling and release
- UV system efficiency
- Salinity buildup
- Chlorine residuals
- Turbidity
- Consider differences in treatment needs between PCWMD effluent and Tucson Water reclaimed water

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Recharge / Recovery Permits

- ADWR recharge/recovery permitting activities would be a joint effort between PCWMD and City of Tucson
- Need to meet City of Tucson's future needs
  - Flow requirements by site
  - Develop congruent timelines
  - Treatment and quality standards and impacts on potable supplies (TOC, etc.)

49

Total Organic Carbon

- Potential issue for recharge/injection sites
  - Other states have more stringent standards (e.g., California)
  - Advanced treatment (GAC/enhanced coagulation) to be considered in future?

50

Emerging Contaminants
(Potential APP Issues)

- Endocrine disruptors/pharmaceuticals
  - UV or ozone treatment
  - Requirements for photo degradation and biodegradation of pharmaceuticals to be investigated
- NDMA
  - 20 ng/L action level in California
  - Assess presence
  - Applicable treatment – UV oxidation

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Emerging Contaminants
(Potential APP Issues) *(continued)*

- Perchlorate
  - List 1 UCMR – AZ action level of 14 ppb
  - Perform sampling
- Salinity (also potential reclaimed water issue)
  - Consider use of CAP water by Tucson
- Arsenic
  - 10 ug/L

52

Key Issue: Change in Habitat

- Reduced flow in effluent dependent receiving stream at Roger Road WWTP
  - Loss of riparian ecosystem
  - Need to consider public concerns
- Conduct habitat assessment studies
- Perform public and stakeholder outreach activities
  - Game and Fish, Fish and Wildlife, PAG, Defenders of Wildlife, local interest groups, etc.

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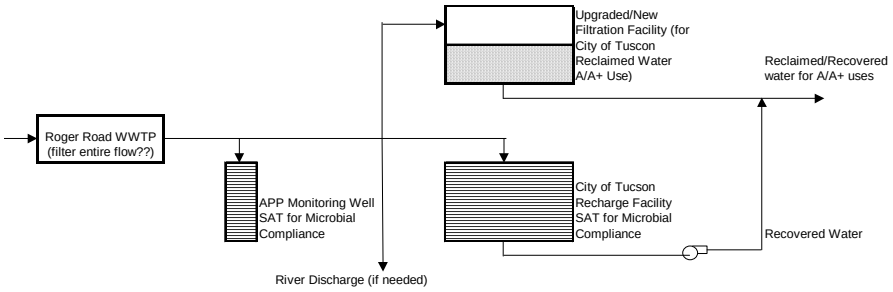
Roger Road WWTP Regulatory Scenarios



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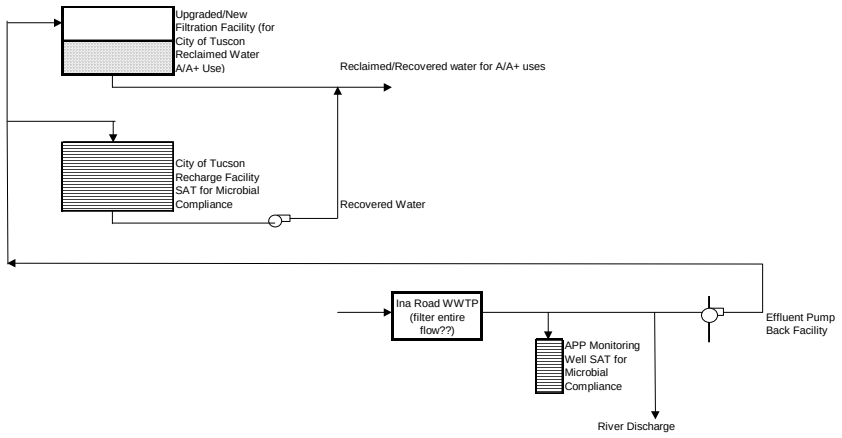
Ina Road WWTP Regulatory Scenarios



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Summary

Andy Richardson

Pima County Wastewater Management Department

GREELEY AND HANSEN

Workshop #4 Meeting Notes
First Brainstorming (Preliminary Process Alternatives) Workshop and Background Data Review

1. The First Brainstorming (Preliminary Process Alternatives) Workshop and Background Data Review Workshop for Pima County Regional Optimization Master Plan was held on June 5, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Jackson Jenkins
PCWMD Staff
David Bartos
Ed Curley
James Doyle
Dennis Froehlich
Frank Gall
David Garrett
Michael Kostrzewski
Frank Luiz
Jing Luo
Pete Magaddino
John Munden
Jeff Nichols
Glen Peterson
Jeff Prevatt
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager
Mandley Rust
Jack Van Riper
Ken Weber
Eric Wieduwilt
Legal
Harlan Agnew

TUCSON WATER
Tucson Water Staff
Karen Dotson
Melodee Loyer
Ralph Marra
Mark Seamans
Tim Thomure
Alan Forrest, CH2M Hill
Ken Thompson, CH2M Hill

METRO WATER DISTRICT
Tom Caito

PIMA ASSOCIATION OF GOVERNMENTS
C. Zucker

GREELEY AND HANSEN PROJECT TEAM
Orrie Albertson
Jerry Bish
Gordon Culp
Joe Popeck
Andrew Richardson
Anne Smith
Dave Stensel

2. Major topics of the workshop were:

- Workshop #4: First Brainstorming (Preliminary Process Alternatives) Workshop and Background Data Review
  - Background / Condition Assessment
  - Interview Summary
  - Initial Screening of WWT Processes
  - Wastewater Flow / Loadings
  - Side Stream Treatment
  - Process Discussion
  - Evaluation Criteria

Handouts were provided to each attendee which included presentation slides used during the workshop.

Throughout the workshop, a list of notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, opened the workshop with a few remarks. For this workshop the goals are to review the evaluation of Roger Road WWTP, reach agreement on the evaluation criteria, and review and narrow, if possible, the wastewater treatment process options to those with the most potential to meet future regulatory requirements. The workshop requires active participation by all in an effort to provide the best plan technically and economically for the community.

4. Andy Richardson defined his role as facilitator to move the group through the agenda and to encourage participation from all in the room. The purpose of this workshop is review the condition of Roger Road WWTP, agree on flow and loading projections, and focus on the probable treatment technologies and firm up the evaluation criteria for selection of the recommended option.
   Agenda, ground rules and objectives of the second workshop were presented and covered on pages 1 through 4 of the handout

5. Joe Popeck reviewed the condition of the Roger Road WWTP, starting with the rating forms and ranking criteria, and proceeding with a rating of each process and system element at the plant. The categories for condition evaluation were Structures, Equipment, Electrical and

Instrumentation and Control. In general the facility was well maintained and in satisfactory condition with a few exceptions considering its age. Except for the electrical service the facilities appear to be able, with continued good operational and maintenance practices, to perform for an additional 10 years or until new facilities are brought on line. The electrical system is not serviceable for the long term without significant modifications and upgrades.
There is a concern on the life of the biotower media. The media is near the end of its useful life, which may be extended by some modifications to the operation to reduce the biomass loading on the system. An initial report by others evaluating the biotower condition is that they are performing satisfactorily. A point was stressed that even though the tankage and equipment may be satisfactory for current service, in the future under the new regulatory requirements the existing systems may be too small or too large to serve an appropriate function, and they may need to be decommissioned and replaced with something more appropriate for the function of the new systems
The Condition assessment was covered on pages 4 through 14 in the handout.

6. Anne Smith provided a summary of the stakeholder interviews conducted to date. In general, those interviewed were cautiously optimistic that the master plan will provide the wastewater management department with a needed roadmap for the future. Conversely, there were concerns over stakeholder buy-in and on how the projects from the plan will be funded and constructed within the timeframe required by the State. Stakeholder interview comments were summarized into four categories – Planning, Stakeholder Buy-in, Decision making and Technical challenges. The stakeholder interview summary was covered on pages 15 through 17 of the handout.

7. Joe Popeck briefly introduced a listing of proven wastewater treatment processes that have successful track records in removing nitrogen. One workshop goal is to reduce the list of potential treatment processes to three or four, which will receive a more detailed examination with regard to their application at Roger Road WWTP and Ina Road WPCF. Processes that are eliminated from consideration will be for cause, which will be further documented after the workshop.
The initial screening of processes was covered on pages 17 and 18 of the handout.

8. Orrie Albertson reviewed the treatment options under consideration in the plan – existing plan, transfer some and transfer all to Ina Road WPCF. The development of flow and loading projections for use in the development of the treatment plant processes was explained. Loadings were derived from a reduction of laboratory data collected at the influent of the plant over the past 30 months. Trends and variations were noted and factored into loading projections. Flow data were taken from the joint task group findings on probable growth projections in the

metropolitan service areas. It was noted that peak and diurnal factors will be considered and that the loadings from the biosolids treatment at each facility will be accounted for. In addition any differences in loadings and flow variations between the two treatment facilities will be included in the evaluation. Harlan Agnew stated that the WET test will control the maximum limit of ammonia that will be allowable in the effluent.

For a complete treatment process analysis, additional laboratory data will be required at both Roger Road WWTP and Ina Road WPCF to confirm the influent parameters. These data include among primary effluent COD, SCOD, TKN, total phosphorous and others.

It was agreed that the wastewater concentration will be based on flows of 85 gcpd for the existing population and 60 gcpd for future population. It was also agreed that the hydraulic loads would be based on 85 gcpd on all population.

Flows and loadings developments were covered on pages 18 through 22 of the handout.

9. Orrie Albertson continued with a review of the treatment options at Roger Road WWTP and Ina Road WPCF with a summary of current and future flow data related to each plant. Each option included the continued use of Randolph Park WRF which treats approximately 3 mgd of flow. With each option general considerations and risks were presented.

   Treatment design options were covered on pages 22 through 24 of the handout.

10. Orrie Albertson began the presentation on wastewater treatment process alternatives with a review of the benefits of bioselection versus chemical addition, and the need to address phosphorous removal in the beginning rather than as an add-on at some future date. It is recognized that phosphorous removal may become part of future wastewater treatment requirements. It is uncertain, if or when, but the accommodation of biological phosphorous removal should be given consideration. Harlan Agnew indicated that California and EPA Region 9 are considering imposing phosphorous limits on wastewater treatment works.

    After the initial review of general treatment considerations, a detailed review of nutrient removal treatment alternatives flow sheets began with the Phoenix NdeN process (modified MLE), 4/5-stage Bardenpho process, AS/NTF process and BT/NAS process. Dave Stensel followed with a review of the Step BNR process, biological aerated filters (Biostyr, Biofor and Biocarbone) processes, integrated fixed film activated sludge process (IF/AS), moving bed reactor (MMBR) and membrane technology. Key factors, process concerns and considerations, and advantages and disadvantages of the processes were addressed for each technology during the presentation.

    The process technologies were covered on pages 25 through 55 in the handout.

11. Dave Stensel presented the rationale for sidestream treatment and the treatment processes currently used in these applications. Sidestream treatment is used to reduce the ammonia loads from the liquid streams of the dewatering processes and provide a more stable and effective wastewater nitrification treatment system. By using sidestream treatment aeration basins can be smaller, but system complexity increases with the additional treatment train. Alkalinity and carbon balances need to be evaluated with each of the sidestream processes. Sidestream treatment can be applied to any of the nutrient removal processes discussed in item 10. Sidestream treatment is not necessary as long as the sidestream impacts are addressed in the wastewater treatment system.
Sidestream treatment systems were covered in pages 55 through 63 in the handout.

12. Andy Richardson opened the floor to workshop group for general discussion on the treatment alternatives. Various issues were raised by the group:
    - How comfortable are we that the selected process will be adaptable in meeting future requirements?
    - How will the treatment alternatives work with the existing tankage?
    - What are the relative costs of each alternative?
    - Could Roger Road become a scalping plant?
    - Which alternatives require significant methanol addition?
    - Do some processes fit the existing facilities better than others?
    - Do the biotowers go away?
    - Do the existing tanks drive the process selection, or does the process drive selection?
    - What impact does future phosphorous removal have on the facilities needed to meet current regulations?

13. Dave Stensel and Orrie Albertson developed a list of questions from the group discussion for comparison of the alternatives. The questions included:
    - Can the process achieve a total nitrogen level less than 8 mg/L if the influent is 55 mg/L?
    - Does the process use high quantities of methanol?
    - Can the process be adapted to phosphorous removal?
    - What is the capital cost relative to the Bardenpho process?
    - Can the process be adapted to emerging contaminants removal technology?
    - Can the system use the biotowers at Roger Road WWTP?
    - Can the system use existing tankage?
    - Can process achieve turbidity less than 2 NTU?
    - Can the process be applied to the high purity oxygen (HPO) system at Ina Road WPCF?
    - What are O&M costs relative to Bardenpho?

Andy Richardson prepared a matrix of the eight wastewater treatment alternatives against the questions developed above. The matrix is provided on the attached "flip chart" notes.

14. With assistance from the group Dave Stensel and Orrie Albertson assigned a pass/fail, yes/no or average/low/high values to each process for each question on the matrix. Results of the exercise are provided in the attached "flip chart" notes. Comments during the value assignment exercise included:

    - The Phoenix plant (modified MLE) was designed for biological phosphorous removal in the first stage. By turning a valve and making the first stage anaerobic the effluent P value went from 2.5 to 0.5 mg/L.
    - Largest capacity of a membrane reactor is 30 mgd. Seattle is building a 36 mgd facility at a cost of $500 million. This was a political as well as a technical decision.
    - Does the high purity oxygen facility at Ina Road WPCF work with any of the processes? In general, the high purity oxygen process inhibits nitrifying bacteria and is not compatible with nitrogen removal.
    - In general, Zenon membrane facilities are more costly than Kubota membrane facilities. However, Zenon may be more favorable for large facilities.
    - Using activated sludge with nitrifying trickling filter (AS/NTF) process at Roger Road WWTP the system could treat approximately 20 mgd. This allows 20 minutes residence time in the filters, which is a short time. Biological phosphorous (P) removal with this process is questionable. Would need to add alum or ferric chloride to meet P removal requirements. In general, there could be difficulty in meeting effluent standards with this process.
    - Using the biotowers and nitrification activated sludge (BT/NAS) alum or ferric chloride would be required for P removal and significant methanol requirements are needed. This system could not treat 32 mgd without more towers and tankage, but could have lower life cycle costs at 20 mgd.
    - With either Biostyr or Biofor utilizing an anoxic zone at the bottom and aerobic zone on top would emulate a MLE system. This would be followed by a second tower where methanol would be applied to meet effluent requirements. This system would require high first costs and high O&M costs.

15. From the matrix development and group discussion five (5) processes appear to have merit for additional study. These include Bardenpho, Step NdeN, IF/AS Kaldnes (KMT), MBR and Phoenix NdeN. The project team will address in a write-up why processes were eliminated from further consideration.

16. The use of existing tankage for each of the five remaining process options will be evaluated to determine how the existing tankage would be utilized with each process along with determining chemical and energy requirements for each. The analysis will include how the system would fit into the footprint of the plant. The Hydromantis process model will be used with identified processes in item 15 above to determine size of the system components necessary with each process at each facility. In addition, the question whether IF/AS works in hot weather will be evaluated along with other aspects of the system performance. Regarding risks it was suggested that using existing tankage at Roger Road WWTP would carry a higher risk than constructing new tankage at Roger Road WWTP

17. For the five alternatives remaining under consideration the advantages and disadvantages of each process for use at the Pima County facilities will be determined along with the order of magnitude costs and present worth. There was an expressed desire to have common wastewater treatment processes at the plants. This will be decided after each process at each plant is evaluated to determine the cost differential.

18. Tim Thomure offered that the Sweetwater reclaimed facilities could be expanded to 20 mgd. This assumes that the pressure filter system at the plant is no longer required.

19. Gordon Culp presented the revised criteria to evaluate options, not processes, and responses to comments from Workshop #1. There were several additional comments related to the evaluation criteria including:
    - Add salvage costs to the end of the life cycle costs to reflect true value,
    - Clarify meaning of community-wide impact for reuse potential,
    - Eliminate Employee Safety as a criteria (this is a given for all options),
    - Include evaluation of staffing for the facilities in operation in 2030
    - Cost sharing means which organization is most efficient at providing the service.
    - Add Operability as a criterion
    - Relocate noise and odor issues into public acceptability category

    A revised evaluation criteria category listing is provided on the attached “flip chart” notes

20. Gordon Culp began the discussion on weighting of the evaluation criteria. With a show of hands most of the workshop attendees favored weighting the criteria. The presentation continued with a discussion of what weights to assign to each category. The outcome of that discussion is provided on the attached “flip chart” notes.

21. Mike Gritzuk offered closing remarks by stating that the day was well spent. He was surprised that the number of treatment processes was narrowed down so quickly. In his opinion the workshop was a preliminary analysis of processes and that much more work was necessary to identify and defend the final process. Further, the treatment process, and the wastewater and reclaimed water option that best serves the community needs to be identified and fit into the timeframe given by the regulatory agency for advanced wastewater treatment systems to be in service in the years 2014 and 20015

22. Andy Richardson previewed the next workshop scheduled for June 21, 2006 on Regulatory Issues. Workshop #3 will be a one-half day workshop with Pima County Wastewater Management Department followed by one-half day workshop with Pima County Wastewater Management Department and Tucson Water to discuss current and future permits and regulations.

Agenda
Workshop #4 – First Brainstorming (Preliminary Process Alternatives) Workshop and Background Data Review
June 5, 2006

Time	Topic	Presenter	Pg
8:00 am	*Continental Breakfast – Tucson Main Library, Basement Meeting Rm, 101 N. Stone*		
8:15 am	Opening Session		
	• Welcoming Remarks	Mike Gritzuk	1
	• Overview of Agenda	Andy Richardson	2
	• Purpose and Objectives		
8:45 am	Background/Condition Assessments	Joe Popeck	4
	Stakeholder Interview Summary	Anne Smith	15
9:05 am	Initial Screening of Processes	Joe Popeck	17
9:15 am	Development of 2030 Flow and Loadings	Orrie Albertson	18
	• Existing Loadings		
	► Rogers Road Service Area		
	► Ina Road Service Area		
	• Future Loadings – Methodology		
	► Rogers Road Service Area		
	► Ina Road Service Area		
9:35 am	Data Needs	Orrie Albertson	21
9:45 am	Treatment Plant Design Options	Orrie Albertson	22
	• Rogers Road WWTP		
	• Ina Road WPCF		
10:00 am	Break		
10:15 am	Process Alternatives		
	• Bioselection	Orrie Albertson	25
	• MLE (Phoenix NDN Processes)		
	• Four/Five Stage (A_2O_2) Bardenpho (UCT Process)		
	• AS/NTF - DeN Filters w/MeOH		
	• BT/NAS - DeN Filters w/MeOH		
	• Step-Feed NdeN	Dave Stensel	28
	• IFAS Biostyr and Biofor		
	• IFAS Kaldnes (KMT)		
	• MBR (Membranes)		
12:15 pm	Lunch		
1:00 pm	Side-Stream Treatment	Dave Stensel	55
1:30 pm	Process Discussion	All	
2:30 pm	Break		
2:45 pm	Evaluation Criteria	Gordon Culp	63
	• Revised Criteria		
	• Evaluation Matrix		
	• Criteria Weighting		
4:40 pm	Summary / Wrap-Up	Andy Richardson	70
	• Comment by Group		
	• Closing Remarks	Mike Gritzuk	
5:00 pm	Adjourn		

Flip Chart Notes – June 5, 2006

Roger Road WWTP Condition Assessment

- With the concrete block baffles walls one-half of one chlorine contact tank cannot be taken out of service.
- Can media last another ten years?
  - Perhaps, but some things will be required to prolong the life.
- Electrical service was given an overall classification of "good"; how does that fit over next 10 years?
  - Good could last 15-20 years
  - Is it sized properly? Do not know yet, but probably no

Stakeholder Interviews

- What percent of interview have been conducted – report represents over 90 percent of the interviews

Data Needs

- Some concerns on getting samplers
- Sampling required at both plants
- Questions on 60/85 gpcd; 60 applied for wastewater constituent concentration of future growth – not flow
- How will the biosolids from Roger Road WWTP impact Ina Road WPCF's treatment capacity?
- Deal/look at impact of upstream WRFs and their solids discharges
- Ratios of constituent concentrations have varied over day; may need diurnal information

Process Alternatives

- Is future dissolved oxygen and phosphorus going to be taken into consideration, as well as, the impact of future TMDL? Yes
- Target level of 6.5 mg/L total nitrogen – ADEQ may use 9.0 mg/L
- IFAS: What is the useful life of the media? 8 to 10 years.

Process Discussion

- Consider future phosphorus removal – need to plan now
- Need to consider 1 to 2 mg/L of phosphorus as the future limit.
- Phosphorus could be a TMDL, California and EPA developing nutrient water quality standards
- Cooling tower customers would like less phosphorus
- If biological phosphorus (BioP) removal is required, best process is Bardenpho or MBR
- In going forward without $ considerations, would it be possible to bring back another process? Answer: Yes
- BioP removal is difficult with a MBBR process; include hydro on IFAS
- Is sidestream treatment still being looked at? Yes – look at process and see impact on sidestreams

- Do the five processes under consideration have an impact on the use of Roger Road WWTP? Answer: Yes, cannot use some of Roger Road WWTP process elements.

Questions for Pass/Fail

1. Can achieve less than 8 mg/L total nitrogen with an influent of 55mg/L of total nitrogen?
2. What about adaptability to remove emerging contaminants of concern (ECC)?
3. Is high methanol usage required? (to remove 50% or more of nitrogen)
4. Can use existing BioTowers at Roger Road WWTP
5. Is it flexible to BioP removal?
6. Are costs in the capital range of Bardenpho?
7. Can use existing tankage?
8. Can achieve turbidity less than 2 NTU
9. Can be applied with pure high purity oxygen (HPO)
10. O&M costs relative to Bardenpho

Process Pass/Fail

Question	*MLE*	*4/5Bardenpho*	*AS/NTF*	*BT/NAS*	*StepNdeN*	*Biostyr/Biofor*	*IF/AS*	*MBR*
1	F	P	P	F	P	P	P	P
2		P	F					
3		P	F	F	P	F	P	P
4	No	No	Yes	Yes	No	No	No	No
5		Yes	No	No	No	No	Yes	Yes
6		Yes	Yes	Yes	Yes	No	Yes	No
7		Yes	Yes	Yes	Yes	No	Yes	Yes
8		Yes	Yes	Yes	Yes	Yes	Yes	Yes w/o Filter
9		No	No	No	No	No	No	No
10		A	H	H	A	H	A+ to H	H

Key: F= fail P= pass A= average H= high

Recommended Processes to Take Forward

- 4/5 Stage Bardenpho
- MLE (Phoenix process)
- Step feed NdeN
- IFAS Kaldnes (KMT)
- MBR

Process Discussion

- First look at application of each plant process independently; if the same process ends up at all plants, that would be great
- Can IFAS be accepted in state?

- Need write-up on why processes were not brought forward
- Need capital and O&M costs and present worth costs on process brought forward
- There is some desire to have common processes at all plants
- Question on size at Roger Road and Sweetwater capacity at 20 mgd.

Evaluation Criteria

- Operator acceptability
- Should the County have a Plan "B"? Pick best that we can, any alternate would be ***enforcement***
- "Setback criteria" – Make sure it is in one of the evaluation criteria
- Clarify what is meant by "water reuse potential"; i.e., "community-wide impact of reuse potential", "wet" water use, or other.
- Next 4 to 6 weeks Pima County and Tucson Water will meet to work out some of the wastewater/water reuse issues
- Employee safety is a given – take off the evaluation list
- "Cost sharing potential" – Look at what this means – which agency is best suited to implement
- Staff utilization may be a criteria to add
- "Operability" added; includes utilization and ergonomics
- Make sure implementation is covered

Evaluation Matrix

- Operability should be weighted at 5
- Look at lowering constructability from 3 to 2
- Water reuse – look at lowering to a 4 or 3; consider holistic approach; Tucson Water says it should be a 5 – make 5
- Support of water providers in community; add to water reuse potential
- Water/wastewater optimization
- Look at moving some of the sub-criteria from environmental impact to public acceptance, odor for example

Criteria Weighting Agreed upon for Evaluation Matrix

Criteria	*Criteria Weight*	*Ranking*			*Weighted Ranking*		
		Existing Plan	*Transfer Some*	*Transfer All*	*Existing Plan*	*Transfer Some*	*Transfer All*
Cost	5						
Schedule	5						
Constructability	3						
Flexibility	4						
Environmental Impacts	4						
Water/Wastewater Optimization Water Reuse	5						
Public Acceptance	5						
System Operability	4						

Cost Sharing	3						
Effects Financing	3						
System Reliability	4						

Evaluation Matrix

- Put in order of highest weighted to lowest weighted criteria
- If phosphorus removal at Roger Road is an issue – further discuss sidestream treatment
- Space limitation at Randolph Park
- Roger Road has plenty of space
- Setback requirements?
- Constructability – need to know what is out there; need to be aware
- For use of existing tankage – need to know flow pattern
- Sometimes easy to build from start
- Discuss in "layman" terms why process dismissed

Pima County Wastewater
Regional Optimization
Plan Study

Workshop #4
First Brainstorming Workshop and Background Data Review

June 5, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
Joe Popeck	Background/Condition Assessment Initial Screening of Processes
Anne Smith	Stakeholder Interview Summary
Orrie Albertson	Development of 2030 Flow and Loadings Data Needs Treatment Plant Design Options Process Alternatives
Dave Stensel	Process Alternatives Side-Stream Treatment
Gordon Culp	Evaluation Criteria

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop Objectives
- Background / Condition Assessment
- Interview Summary
- Initial Screening of WWT Processes
- Wastewater Flow / Loadings
- Side Stream Treatment
- Process Discussion
- Evaluation Criteria
- Closing

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

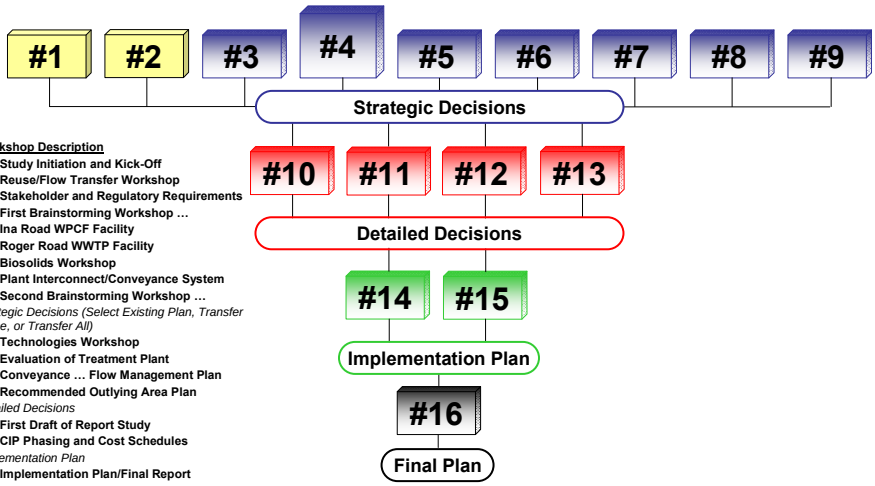
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in "parking lot"

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Workshop Objectives

- Review condition assessments
- Agree on flow and loading projections
- Review WWT Design Options
- Brainstorm/discuss process alternatives
- Agree on viable process alternatives
- Agree on evaluation criteria
- Agree on criteria weighting

11

Pima County Wastewater Management Department

GREELEY AND HANSEN

Pima County Wastewater Management Department

GREELEY AND HANSEN

Background / Condition Assessments

Joe Popeck

Condition Assessment

- Roger Road WWTP assessment team
  - Tim Greif – Civil and Instrumentation & Control
  - Andy Martin – Civil
  - Ron Zanko – Electrical

13

Condition Assessment

- Questionnaires
  - Equipment condition assessment

PIMA COUNTY WASTEWATER MANAGEMENT DEPARTMENT

PIMA COUNTY METROPOLITAN WASTEWATER TREATMENT SYSTEM CAPACITY MANAGEMENT, NUTRIENT REMOVAL, SOLIDS HANDLING/TREATMENT AND CIP DEVELOPMENT STUDY

EQUIPMENT CONDITION ASSESSMENT

Facility: Roger Road WWTP □ Ina Road WPCF □

Name of Greeley and Hansen Interviewer:_____

Date of Assessment: _____ Name of PCWMD Assessor: _____

Phone Number of PCWMD Assessor: _____

Name of Equipment Item or Group:_____

_____

Manufacturer / Model: _____

Age of equipment: _____ years

Power Rating (hp, kw, btu/hr, etc) _____ (include units)

Average Weekly Run Time _____ hours

Condition - Rate each category below by circling the number on a scale of 1 - 4, 1 being excellent, 2 being good, 3 Being Acceptable and 4 being poor.

	Poor	Acceptable	Good	Excellent
Mechanical	4	3	2	1
Electrical	4	3	2	1
Civil [1]	4	3	2	1

[1] Piping, valves, and other appurtenant devices

Additional Comments: _____

_____

14

Condition Assessment

- **Questionnaires**
  - **Structural condition assessment**

PIMA COUNTY WASTEWATER MANAGEMENT DEPARTMENT

PIMA COUNTY METROPOLITAN WASTEWATER TREATMENT SYSTEM CAPACITY MANAGEMENT, NUTRIENT REMOVAL, SOLIDS HANDLING/TREATMENT AND CIP DEVELOPMENT STUDY

STRUCTURE CONDITION ASSESSMENT

Facility: Roger Road WWTP □ Ina Road WPCF □

Name of Greeley and Hansen Interviewer:_____

Date of Assessment: _____ Name of PCWMD Assessor: _____

Phone Number of PCWMD Assessor: _____

Name of Structure:_____

_____

Type of Service [1]: _____

[1] Wastewater Tankage, Sludge Tankage, Equipment Room, Personnel Room (office, break, lab, etc,) or other (define).

Age of Structure: _____ years

Condition - Rate the Structural category below by circling the number on a scale of 1 - 4, 1 being excellent, 2 being good, 3 Being Acceptable and 4 being poor.

	Poor	Acceptable	Good	Excellent
Structural	4	3	2	1

Additional Comments: _____

_____

15

Condition Assessment

- **Ranking criteria**

DISCIPLINE/RATING	CRITERIA
STRUCTURAL:	
Poor	Older, excessive age related concrete or building structure weathering and deterioration, not properly sized for the function, may have safety related issues and excessive age related maintenance issues
Acceptable	Older, some normal age related concrete or building structure weathering, not exactly sized for the function but provides service and some additional age related maintenance issues
Good	Older, some normal age related concrete or building structure weathering, properly sized for the function and some additional age related maintenance issues
Excellent	Relatively new, sound concrete tankage or building structure, properly sized for the function and no significant maintenance issues

16

Condition Assessment

- **Ranking criteria**

DISCIPLINE/RATING	CRITERIA
MECHANICAL:	
Poor	Generally Older, no longer functions, replacement parts may not be available, unreliable or not operable
Acceptable	New or Older, functions but needs frequent attention, some maintenance problems, may have reliability issues
Good	New or Older, functions well, some additional PM required, reliable
Excellent	New, everything functions perfectly, mfgr's recommended PM only, extremely reliable

Condition Assessment

- **Ranking criteria**

DISCIPLINE/RATING	CRITERIA
ELECTRICAL:	
Poor	Generally Older, no longer functions, replacement parts may not be available, unreliable or not operable, leaking, unacceptable odor
Acceptable	New or Older, functions but needs frequent attention, some maintenance problems, may have reliability issues
Good	New or Older, functions well, some additional PM required, reliable
Excellent	New, everything functions correctly, mfgr's recommended PM only, extremely reliable

Condition Assessment

- **Ranking criteria**

DISCIPLINE/RATING	CRITERIA
CIVIL[1]:	
Poor	Generally Older, no longer functions, replacement parts may not be available, unreliable or not operable
Acceptable	New or Older, functions but needs frequent attention, some maintenance problems, may have reliability issues
Good	New or Older, functions well, some additional PM required, reliable
Excellent	New, everything functions perfectly, mfgr's recommended PM only, extremely reliable
(1) Piping, valves, and other appurtenant devices	

19

Condition Assessment

- **Structures**
  - **Headworks – good**
  - **PST & PS – good**
  - **Bio-Towers PS – acceptable**
  - **Bio-Towers – good**
  - **Aeration Tanks – good**

20

Condition Assessment

- Structures
  - Blower Building – good
  - Secondary Clarifiers – good
  - RAS PS – good
  - Chlorine Contact Basins – acceptable to poor

21

Condition Assessment

- Structures
  - Gravity Thickeners – acceptable to poor
  - Floatation Thickener Building – good
  - Anaerobic Digesters – good to acceptable

22

Condition Assessment

- Equipment
  - Sewage Screens & Equipment – good to acceptable
  - Pista Grit Mechanisms, Grit Pumps & Washers – good to acceptable
  - Odor Control Biofilter – good

23

Condition Assessment

- Equipment
  - PST Collector Mechanism – unknown
  - PS Pumps – good
  - Bio Tower Engine Driven Pumps – good to Acceptable
  - Bio Tower Motor Driven Pump – good

24

Condition Assessment

- Equipment
  - Bio Towers Flow Distributor – good
  - Bio Towers Media – acceptable to poor
  - Aeration Diffusers – acceptable to poor

25

Condition Assessment

- Equipment
  - Aeration Blowers – acceptable
  - FST Collector Mechanism – unknown
  - WAS Pumps – good

26

Condition Assessment

- Equipment
  - Chlorination – Dechlorination Equipment – good
  - Non-Potable Water Pumps – good
  - Effluent Pumps – acceptable to poor

27

Condition Assessment

- Equipment
  - Thickened Sludge Pumps – good
  - Center Drive Mechanisms – acceptable
  - Odor Control Systems – acceptable to poor

28

Condition Assessment

- Equipment
  - Sludge Gas Equipment, Waste Gas Burners, Gas Compressors – good
  - Heat Exchangers, Sludge Pumps, Roof Mounted Mixers – good

29

Condition Assessment

- Electrical
  - 2400 volt Plant SWGR – acceptable
  - Power Center 1 – good
  - Power Center 2 – good to Acceptable
  - Power Center 3 – good
  - Power Center 4 – good

30

Condition Assessment

- Electrical
  - Power Center A – good
  - Power Center B – good
  - Power Center C – acceptable

31

Condition Assessment

- Electrical
  - Motor Control Centers (most) – good to excellent
  - Motor Control Center MCC CA – poor

32

Condition Assessment

- Electrical
  - Engine Generators – acceptable to good
  - Generator Main Breakers – good
  - New GDC – excellent

Condition Assessment

- Electrical
  - Generator Paralleling Controls – acceptable

Condition Assessment

- Instrumentation and Controls
  - Metering Flumes – good
  - Metering Weirs – good to acceptable

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Condition Assessment

- Instrumentation and Controls
  - Magnetic Flow Meters (Sludge) – good
  - Orifice Plates (Process Air) – acceptable to poor

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Condition Assessment

- Instrumentation and Controls
  - No flow metering to individual PST's
  - No flow metering to individual Bio Towers

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Condition Assessment

- Instrumentation and Controls
  - Remote monitoring of equipment operating status and valve status mostly not available
  - Remote operation of equipment mostly not available
  - Automatic operation of equipment mostly not available

38

Condition Assessment

- Instrumentation and Controls
  - Fiber optic system installed
  - PLC's and other SCADA devices to permit remote monitoring/operation not fully utilized

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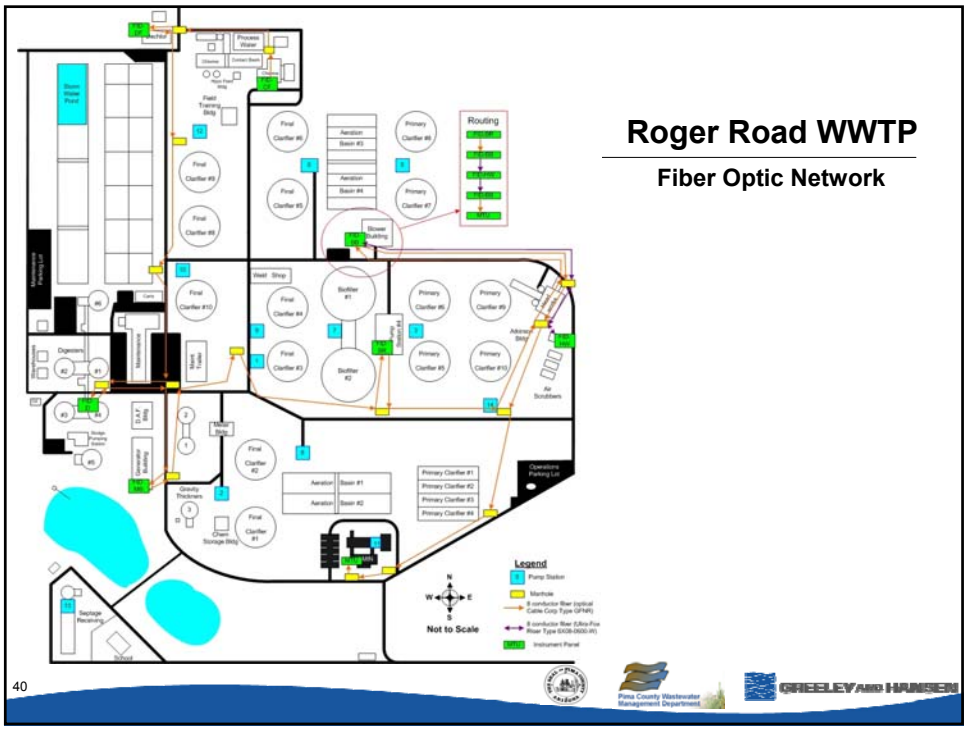

40

Condition Assessment

- Summary of condition assessment
  - Most major structures appear in generally good condition
  - Most major equipment appear in generally good condition
  - Most major electrical components appear in generally good condition
  - Significant lack of I&C

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Condition Assessment

- Summary of condition assessment
  - Potential reuse of Roger Road Facilities depends largely upon whether facilities are appropriate for conversion to BNR
  - Planned improvements for several areas of the plant are necessary to maintain treatment effectiveness regardless of the final decision on the long-term continued use of Roger Road WWTP

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Stakeholder Interview Summary

Anne Smith

Planning

- *Need long-term plan that integrates all wastewater aspects for the benefit of the whole community*
- *Need a short-term plan that addresses critical issues and decisions so "on-hold" improvements can proceed*
- Lack of consistency in how planning is done by member and regulatory agencies

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Stakeholder Buy-in

- *Satisfying all interests related to the Roger Road plant operation and associated wetland and riparian habitat impacts will be challenging*
- *Need to build trust between the Pima County Board and PCWMD. Recent PCWMD management change seen as positive for culture*
- *Need to address odor issues quickly to gain community trust*

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Stakeholder Buy-In

- *Need buy-in at all levels, staff, the Board, local agencies, and regulatory agencies*
- The stakeholder workshop approach is good
- Public doesn't understand the difference and impacts of managed recharge vs. constructed recharge on water rights

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Decision Making

- *Final recommendations need to allow maximum flexibility in balancing funding with regulatory requirements and needs*
- *Wastewater/Reuse/Water planning decisions need to be coordinated and made holistically*

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Decision Making

- *There is confidence that the best technical solution can be identified but that the regulatory deadlines will be missed due to procurement decisions/procedures*
- Have procedures to prevent backsliding of decisions after workshops
- There are differing perspectives at all levels as to the drivers for decisions

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Technical Challenges

- *Sizing of the Interconnect pipeline between Ina and Roger Road plants*
- *Alternative methods for biosolids disposal due to shrinking land availability*
- Site and setback issues at Ina Road plant
- Increase in influent wastewater concentrations due to conservation and gray water use

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Initial Screening of Processes

Joe Popeck

Initial Screening of Processes

- Overview presentation and discussion of processes for N&P removal
  - Bioselection
  - MLE (Phoenix NdeN processes)
  - Four/Five Stage (A2O2) Bardenpho (UCT Process)
  - AS/NTF – DeN filters w/MeOH
  - BT/NAS – DeN Filters w/MeOH
  - Step-feed NdeN
  - IFS Biostyr and Biofor
  - IFS Kaldnes (KMT)
  - MBR (membranes)

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Initial Screening of Processes

- Today's objective
  - Reduce number of alternatives – three or four most promising
  - Eliminate alternatives for cause, by experienced based examination:
    - Alternative not proven on large scale or number of installations
    - Alternative not proven on duration of operation
    - Alternative overly complex or costly to install or operate
    - Alternative not able to effectively utilize existing process tankage
    - Other experienced based cause from Workshop Participant's input

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Development of 2030 Flow and Loadings

Orrie Albertson

Development of Y2030 Flow and Loadings

- Existing conditions (Y2004-2006)
  - Reduction of most recent 30 months of data
    - Define trends
    - Establish monthly average, maximum, minimum standard deviations
    - Determine data needs
- Future conditions (Y2030)
  - Hydraulic capacity – December 2030 projections
  - Domestic loading – population projections
  - Industrial allocation – Pima County
  - Lower flow/capita effects

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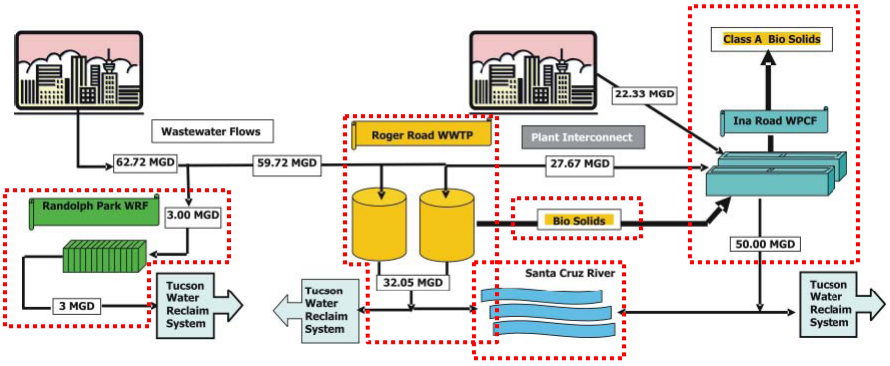
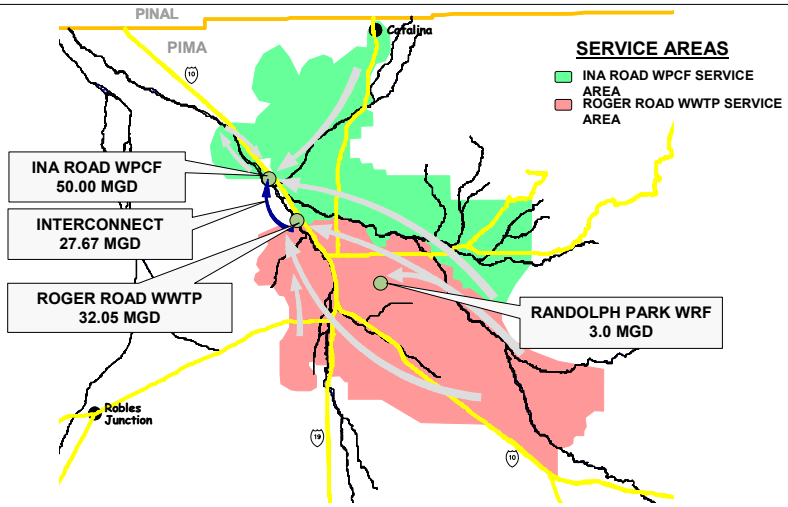
Existing Plan Schematic



55

Existing Plan (2030)



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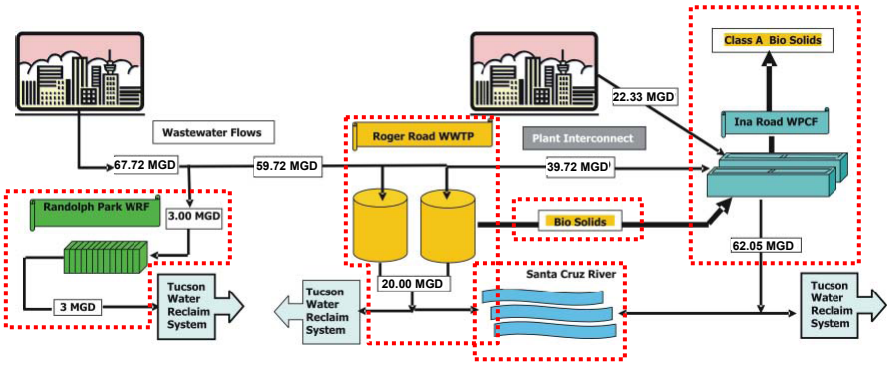
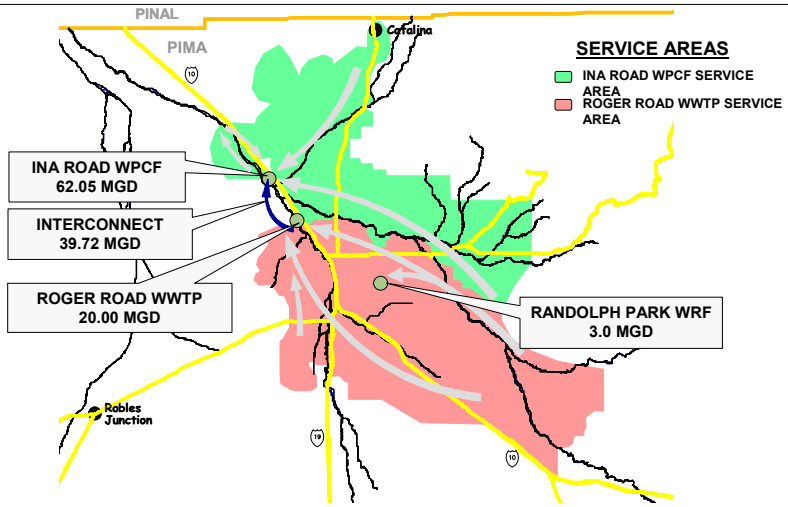
Transfer Some Schematic



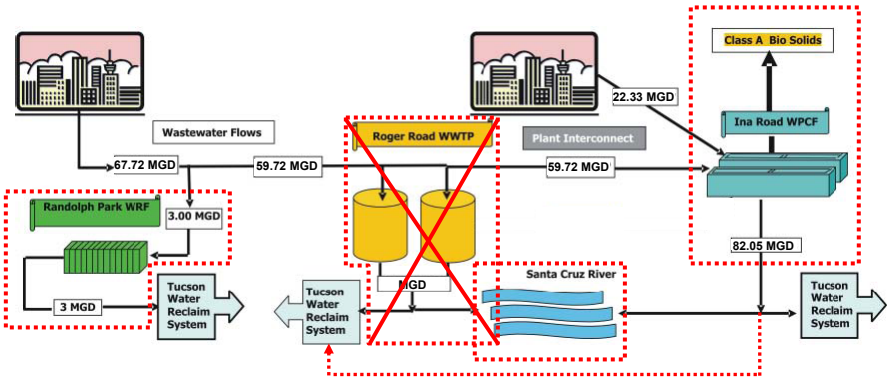
57

Transfer Some (2030)



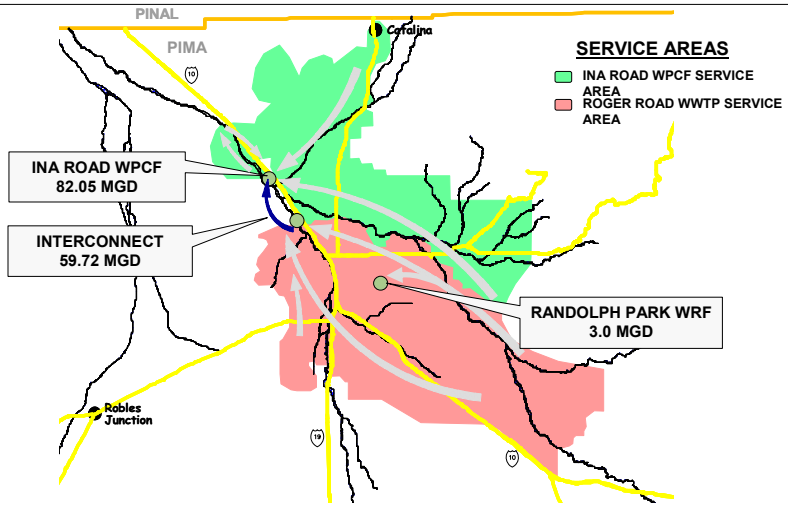
58

Transfer All Schematic



59

Transfer All (2030)



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Ina Road WPCF Wastewater Characteristics

		Raw Influent WW				Primary Effluent			
Date	Flow	COD	BOD_5	TSS	TKN	COD	BOD_5	TSS	TKN
2006	mgd	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1/1/2006	23.26		230	181			149	79	
1/2/2006	26.29		264	235			152	93	
1/3/2006	25.44	790	230	236			125	80	
1/4/2006	24.4		230	243			115	78	
1/5/2006	22.43		246	262			125	78	
1/6/2006	22.35		244	269			121	64	
1/7/2006	24.58		264	281				82	
1/8/2006	24.19		252	254			144	98	
1/9/2006	23.01		240	260			136	70	
1/10/2006	19.87		253	281					
1/11/2006	18.2	624	270	275			143	90	
1/12/2006	18.33		265	280	48.1		113	74	58.3
1/13/2006	17.36		233	277			114	73	
1/14/2006	17.65	581	276	294				84	
1/15/2006	17.22		218	289			133	76	
1/16/2006	17.59		246	254			151	135	
1/17/2006	17.17		281	340			113	64	
1/18/2006	15.69	630	296	296			129	59	
1/19/2006	16.31		276	290			122	61	
1/20/2006	17.14		268	345			122	58	
1/21/2006	17.96	362	254	300				67	
1/22/2006	19.22		277	274			139	79	
1/23/2006	17.77		264	282			125	80	
1/24/2006	18.62		246	248			122	60	
1/25/2006	18.4	631	254	266			128	73	
1/26/2006	17.44		292	308			129	51	
1/27/2006	18.52		248	242			121	72	
1/28/2006	19.17		258	272				77	
1/29/2006	19.38		232	266			150	84	
1/30/2006	19.16		250	264			140	70	
1/31/2006	18.99		253	286			138	71	
Average	19.78	603	255	273	49.1		131	77	58.3
Minimum	15.69	352	218	181	49.1		113	51	58.3
Maximum	26.29	790	298	345	49.1		152	135	58.3
Std. Dev.	2.96	138	19	31			12	15	

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Ina Road WPCF Wastewater Characteristics *(continued)*

	Raw Influent WW				Primary Effluent				Primary Removals	
Date	COD	BOD_5	TSS	TKN	COD	BOD_5	TSS	TKN	BOD_5	TSS
2006	lb/d	lb/d	lb/d	lb/d	lb/d	lb/d	lb/d	lb/d	%	%
1/1/2006		44617	35112			30349	16091		35.2	56.4
1/2/2006		57884	51526			34994	21411		42.4	60.4
1/3/2006		48799	50072			27847	17822		45.7	66.1
1/4/2006	160762	46804	49450			24572	18688		50	67.9
1/5/2006		46018	49011			24552	15321		49.2	70.2
1/6/2006		45481	50141			23682	12528		50.4	76.2
1/7/2006		54119	57504				17650			70.8
1/8/2006		50840	51243			30504	20760		42.9	61.4
1/9/2006		46057	49895			27404	14105		43.3	73.1
1/10/2006		41926	48566							
1/11/2006	94716	40983	41742			22791	14344		47	67.3
1/12/2006		40511	42804	7506		18138	11878	9358	5734	73.6
1/13/2006		33734	40105			17330	11098		51.1	73.6
1/14/2006	85524	40627	43277				12983			71.4
1/15/2006		31308	41505			20056	11460		39	73.7
1/16/2006		36088	37262			23259	20795		38.6	46.9
1/17/2006		40239	48687			16990	9623		59.8	81.2
1/18/2006	82438	38995	38733			17724	8106		56.7	80.1
1/19/2006		37543	39447			17425	8712		55.8	79
1/20/2006		38310	49317			18312	8706		54.5	83.2
1/21/2006	54223	38048	44938				10537			77.7
1/22/2006		44402	43921			23395	13298		49.8	71.2
1/23/2006		39125	41793			19451	12449		52.7	71.6
1/24/2006		38202	38512			19893	13044		50.4	67.7
1/25/2006	96831	38978	40819			20624	11782		49.6	72.6
1/26/2006		42471	44798			19701	7789		55.8	83.4
1/27/2006		38305	37379			19624	11677		51.2	70.2
1/28/2006		41248	43487				12926			71.7
1/29/2006		37498	42993			25457	14256		35.3	68.4
1/30/2006		39949	42186			23490	11745		44	73.5
1/31/2006		40069	45296			22949	11807		45.5	75.2
Average	95749	41909	44504	7506		22712	13378	9358	48.2	71.2
Minimum	54223	31308	35112	7506		16990	7789	9358	35.2	46.9
Maximum	160762	57884	57804	7506		34994	21411	9358	59.8	83.4
Std. Dev.	35313	5683	5181			4641	3643		8.7	7.8

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Data Needs

Orrie Albertson

Data Needs

- Additional data
  - Primary effluent COD, sCOD
  - Primary effluent TKN and TP
  - Composite samples – 20
    - COD, sCOD, BOD_5, TSS, VSS, TKN, NH_4-N and TP
- Agreements
  - Domestic growth at 85.05 (Y2030) gal/capita day
  - Typical COD, BOD_5, etc. contributions
  - Industrial allocation – flow and loads

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Preliminary Wastewater Characteristics

Parameter	*Units*	*Primary Influent*	*Primary Effluent*
COD	mg/L	649	420
BOD_5	mg/L	300	207
sBOD	mg/L	122	122
TSS	mg/L	281	112
VSS	mg/L	219	92
TKN	mg/L	54.4	51.5
TP	mg/L	9.8	9.2

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Pima County Wastewater Management Department

GREELEY AND HANSEN

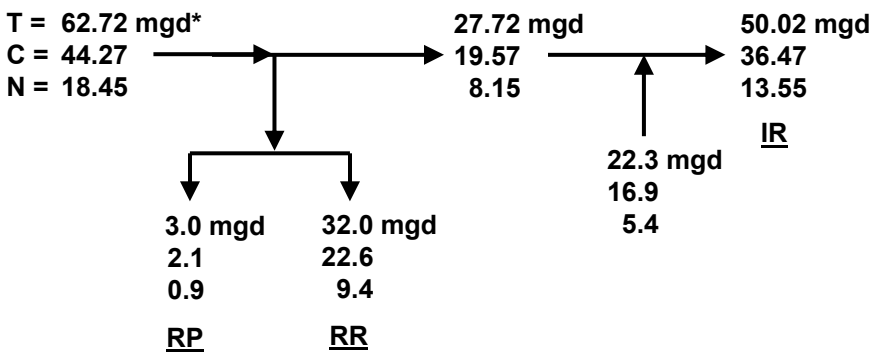
Pima County Wastewater Management Department

GREELEY AND HANSEN

Treatment Plant Design Options

Orrie Albertson

Pima County Treatment Plant Flows – Existing Plan (A)



*T = Total Flow; C = Current Flow; N = New Flow

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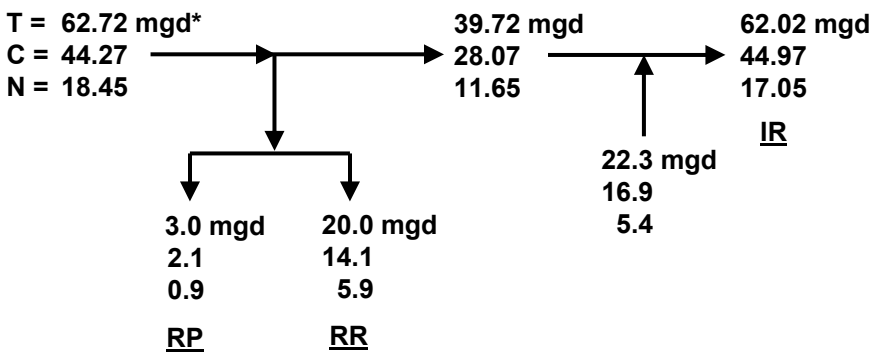
Pima County Treatment Plant Flows – Transfer Some (B)



*T = Total Flow; C = Current Flow; N = New Flow

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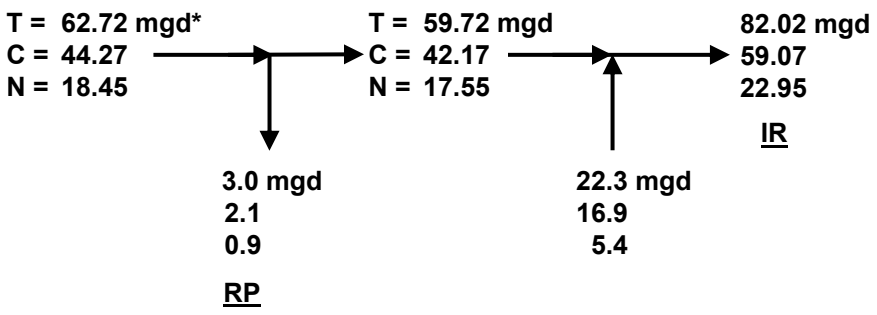
Pima County Treatment Plant Flows – Transfer All (C)



*T = Total Flow; C = Current Flow; N = New Flow

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Treatment Plant Design Options

- Rogers Road WWTP
  - A. 32 mgd B. 20 mgd C. 0 mgd
- Ina Road WPCF
  - A. 50 mgd B. 62 mgd C. 82 mgd
- Randolph Park WRF
  - A. 3 mgd B. 3 mgd C. 3 mgd

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General Considerations/Risks

- Existing facilities / components
  - Rehabilitation / reuse?
  - Retire?
- Process reliability
  - Accepted design methodology
  - No black box systems
  - Multiple successful plants

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General Considerations/Risks
(continued)

- Economical / practical / minimal complexity
- Common flowsheet?
  - Rogers Road WWTP
  - Ina Road WPCF
  - Satellite WRF

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Process Alternatives

Orrie Albertson

Process Alternatives

- Overview presentation and discussion of processes for N&P removal
  - Bioselection
  - MLE (Phoenix NdeN processes)
  - Four/Five stage (A_2O_2) Bardenpho (UCT Process)
  - AS/NTF – DeN filters w/MeOH
  - BT/NAS – DeN Filters w/MeOH
  - Step-feed NdeN
  - IFS Biostyr and Biofor
  - IFS Kaldnes (KMT)
  - MBR (membranes)

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Bioselection

- Bioselection: Natural control of those organisms which cause sludge bulking
- Benefits:
  - Eliminate need for chemical control
    - Lower turbidity in effluent
    - Stable process
    - Lower costs
  - Higher secondary overflow rates
    - Smaller units
  - Higher aeration MLSS
    - Smaller aeration volume
  - Higher RSS concentration
    - Lower RAS rate, less power

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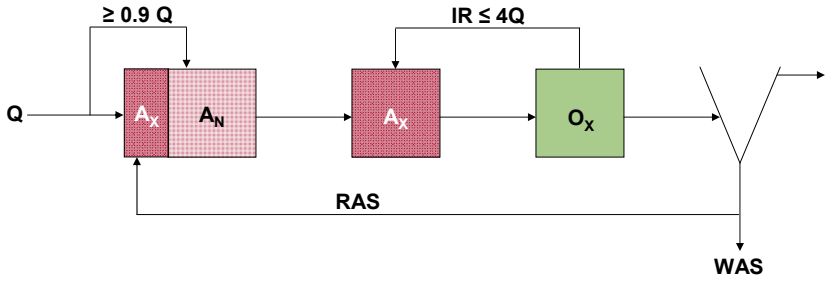
RAS DeN to Enhance Bio P Removal



Modified MLE 3-Stage Bio P_R and NdeN

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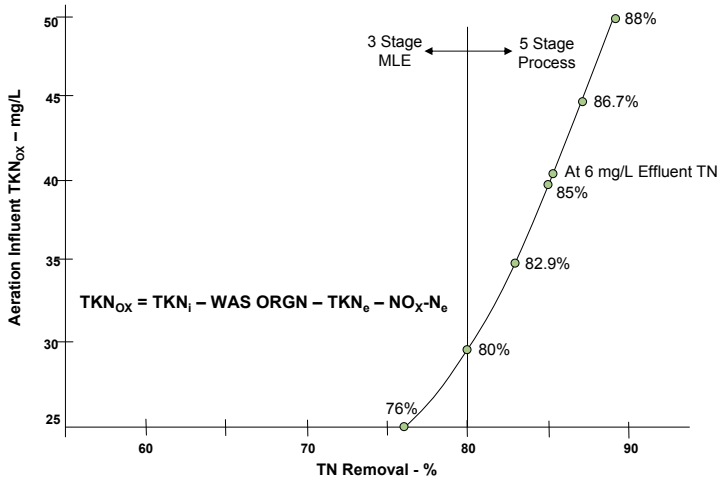
Process Alternatives vs. TKN_{OX} Concentration



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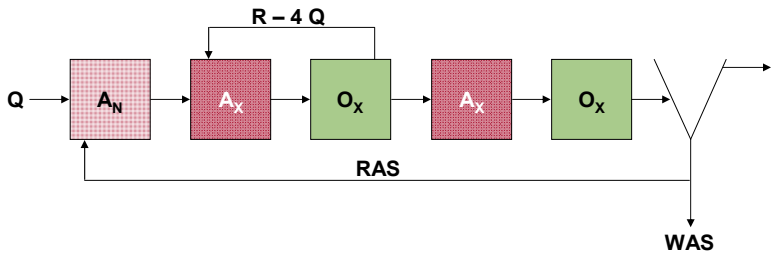
Process Design for ≤ 3 to 5 mg/L Effluent TN and Bio P_R



5-Stage Bardenpho Process

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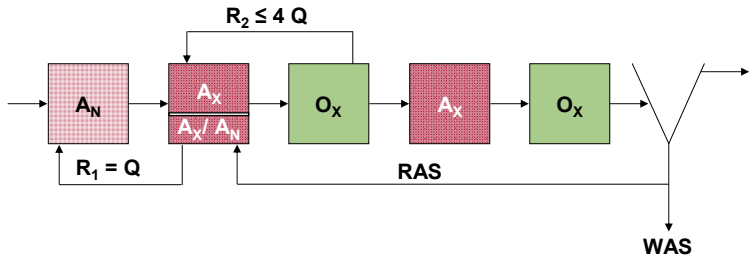
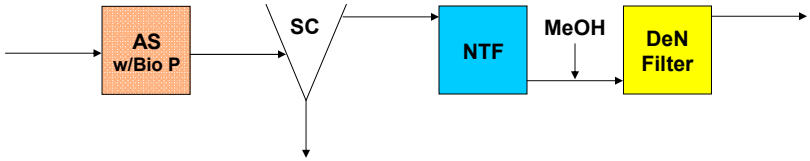
Process Design for ≤ 3 to 6 mg/L TN and Bio P_R



5-Stage UCT Process

AS/NTF- DeN Filter w/MeOH Flowsheet



AS – Activated Sludge

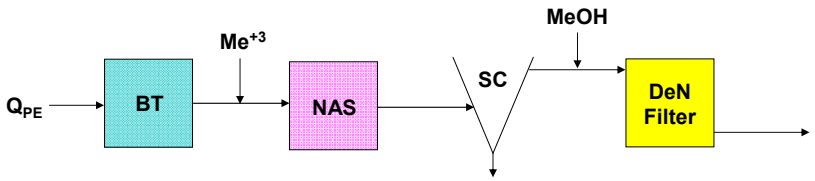
NTF – Nitrifying Trickling Filter

SC – Secondary Clarification

MeOH – Methanol

AS / NTF – DeN Filter w/MeOH Flowsheet

BT/NAS – DeN Filter w/Me^{+3} and Methanol Flowsheet



BT – Biotower

SC – Secondary Clarification

Me^{+3} – Metallic ion, Al or Fe

NAS – Nitrifying Activated Sludge

MeOH – Methanol

BT / NAS - DeN Filter w/Me^{+3} and Methanol Flowsheet

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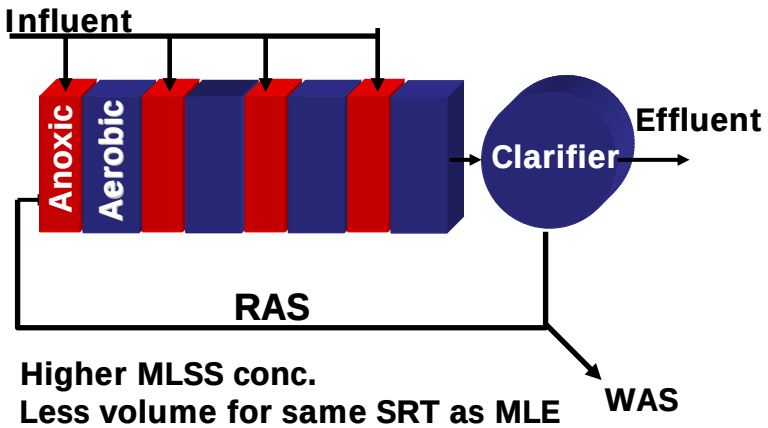
Process Alternatives

Dave Stensel

Step BNR Process



Higher MLSS conc.
Less volume for same SRT as MLE
No internal recycle piping and pumps required
NO_3-N < 5-8 mg/L

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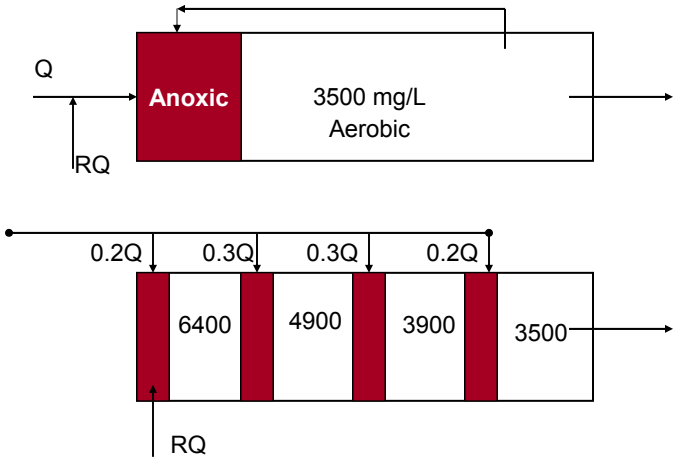
Higher Avg. MLSS Concentration in Step Feed May Reduce Total Volume Needed Compared to MLE



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Issues in Step NdeN Design

- Final tank influent flow split ratio affects effluent NO_3-N concentration
  - i.e., if split = 0.20Q and influent oxidized N = 25 mg/L, effluent NO_3-N will be ~5.0 mg/L
- Need to match influent feed and anoxic tank sizing with amount of nitrate fed from previous stage or RAS flow
- DO concentration in feed to downstream anoxic tank should be kept low
- How will flow split be controlled and measured?
- Can flow split match model flow split within reason and thus provide expected performance?

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Issues in Step NdeN Design

- More baffles and mixer needed
- Are specific nitrification rates at high MLSS comparable to that at conventional MLSS of 3500 mg/L?
- Simulation models extremely useful for design
- Can add internal recycle in last pass to obtain lower effluent N concentration

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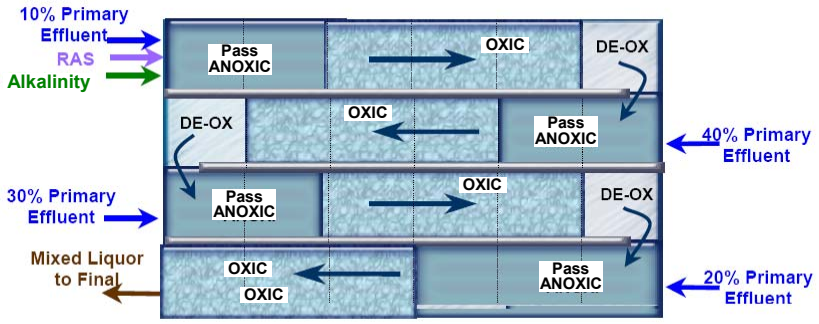
NYC Step Feed BNR



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Advantages of Step Feed NdeN

- Eliminates piping and pumping for internal recycle
- May increase treatment capacity for a given tank volume
- Compatible with retrofit of existing multiple pass basin or step feed systems
- Provides means to handle high wet weather flows and maintain solids inventory

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Disadvantages of Step Feed NdeN

- More mixers and treatment zones
- More foam handling locations
- DO control important for preanoxic zones for more locations
- Control of influent feed split and flow measurements

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Biological Aerated Filters Biostyr and Biofor

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Biological Aerated Filters are Useful Where Space is Limited

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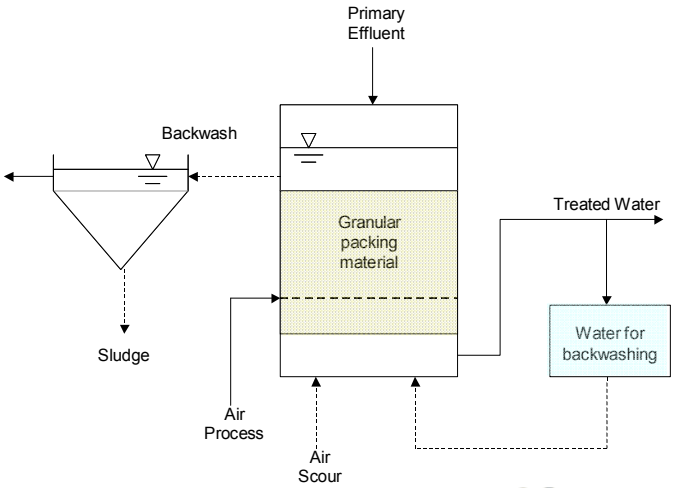
Biological Aerated Filter (BAF) Processes are Used in Land Limited Situations



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BAF Process Description

- Submerged fixed film process
  - Bacteria attached to media
- Media size 2 to 4 mm
- Biomass conc. 6000 – 8000 mg/L
- Diffused aeration provided
- Media provides solids filtration
  - No final clarifier needed
  - Requires backwash as in water treatment filters
- Depth 1.5 to 3.0 m
- Empty bed detention time 30 – 60 min

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BAF Process Description (cont)

- Air sparging needed to provide oxygen
- Upflow and downflow proprietary processes
- Area requirements less than half of that for activated sludge process
- Process technology has evolved since 1982

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BAF Cells – Easy to Cover System Due to Small Space

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Most Common BAF Processes

- Biofor
  - Degremont / Infilco
- Biostyr
  - OTV
- Biocarbone
  - First commercial BAF

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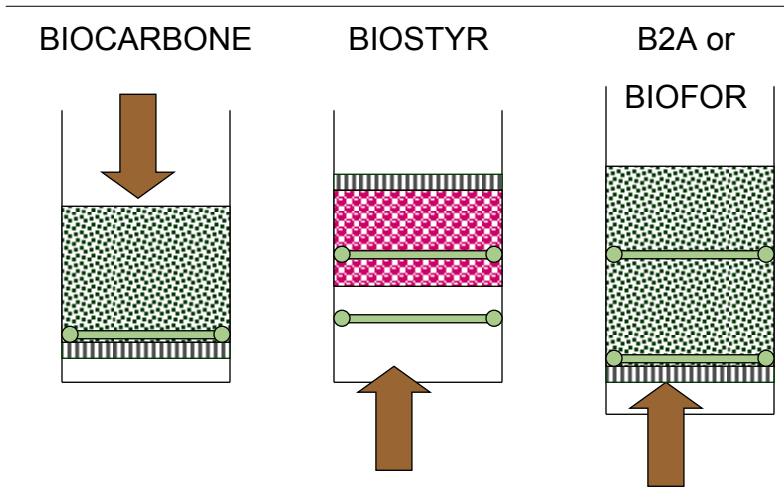

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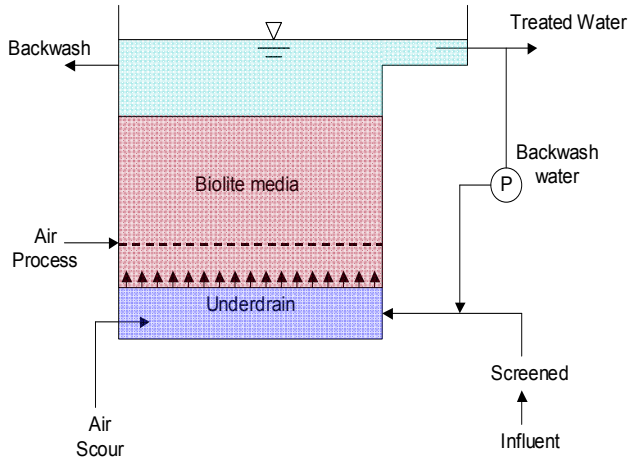
Schematic of Biofor



Flow is upflow and media is dense

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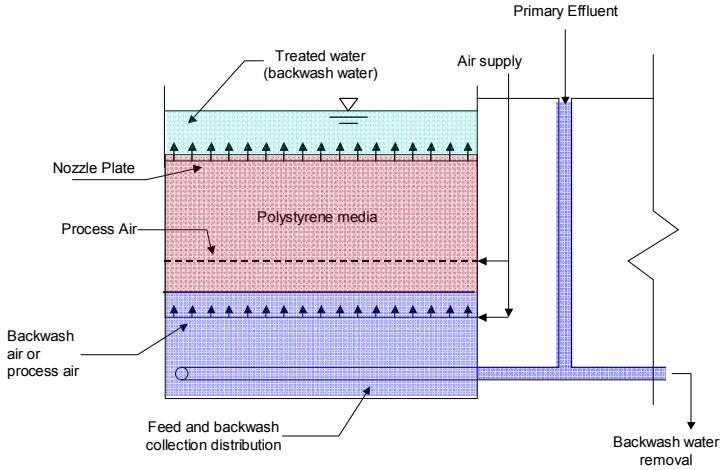
Typical Design Loadings Reported for the Biofor® Process

Application	*Loading**
BOD Removal	**3.5-4.5 kg BOD/m^3-d**
Tertiary Nitrification	**1.5-1.8 kg NH_4-N/m^3-d**

Hydraulic application rates range from 5.0-6.0 m^3/m^2-h

99

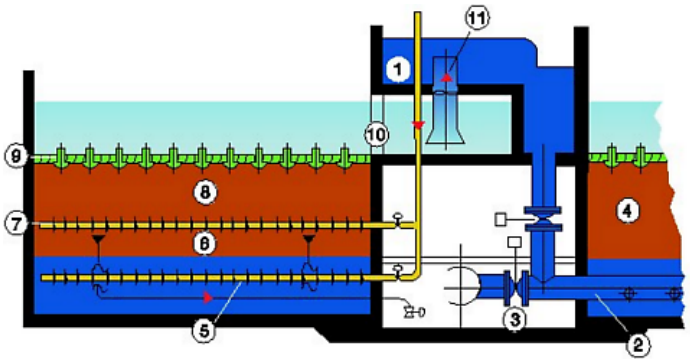
Schematic of Biostyr



Flow is upflow and media is buoyant

100

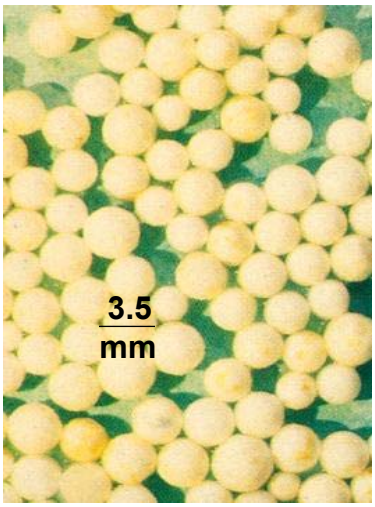
BIOSTYR



1. Feed Box
2. Feed / Drain Pipe
3. Drain Valve
4. Media
5. Scour Air Grid
6. Anoxic Zone
7. Process air Grid
8. Aerated Zone
9. Nozzle Deck
10. Storage Tank
11. Recirculation Pump

101

Polystyrene Beads used for Biostyr Media



3.5 mm nominal diameter

bulk density - 40 kg/m3

Uniformity Coefficient - 1.2

102

Biostyr System Structure; Underdrain, Air Headers, and Upper Nozzle Plate

103

Typical Design Loadings Reported for the Biostyr® Process

Application	*Loading**
BOD Removal	**3.5-4.0 kg BOD/m^3-d**
BOD Removal and Nitrification	**1.8-2.2 kg BOD/m^3-d**
Tertiary Nitrification	**1.0-1.7 kg N/m^3-d**

*Based on empty bed volume

104

Comparison of BAF Processes

Parameter	*Biofor*	*Biostyr*
Media	**Expanded Clay**	**Polystyrene**
Size (mm)	**2 – 4**	**2 - 4**
Feed Flow	**Upflow**	**Upflow**
Air Flow	**Upflow**	**Upflow**
Flow Distribution	**Inlet Nozzles***	**Effluent Nozzles**

*3 mm screening required

105

Differences in BAFs

- Favoring Biostyr
  - 120 TO 150% autotrophic capacity
  - Less backwash power
  - Lighter media > less structure $$
  - Nozzles at the top of the filter
  - No loss of media
  - Better filtration into cycle (between washes)

106

Favoring Dense Media

- Less expensive to build
- Handles high flows when dirty
- Higher solids loading capacity (TSS and heterotrophic growth)
- Better filtration on clean wastes

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Nitrogen Removal

- I. Internal NdeN – Biostyr
- II. Pre-Anoxic BAF
- III. Post Anoxic BAF

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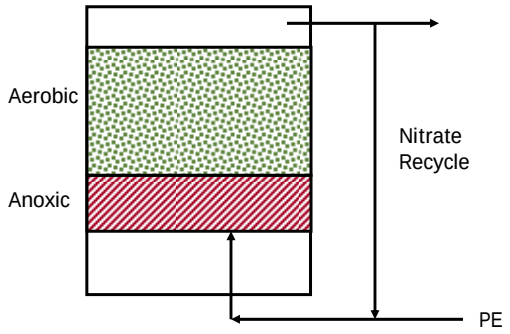
Internal Anoxic Biostyr

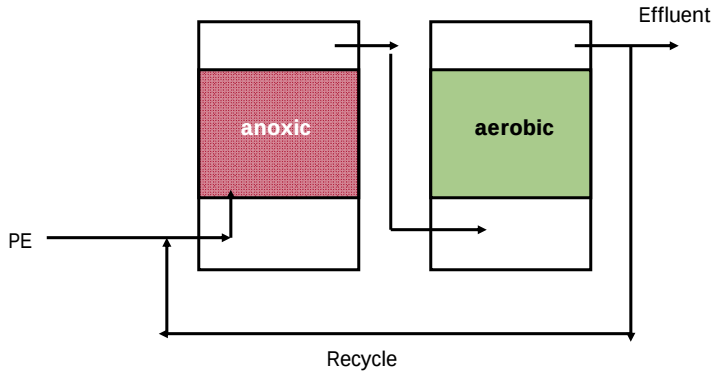
- Aerobic zone is above bottom of bed where anoxic conditions exist



109

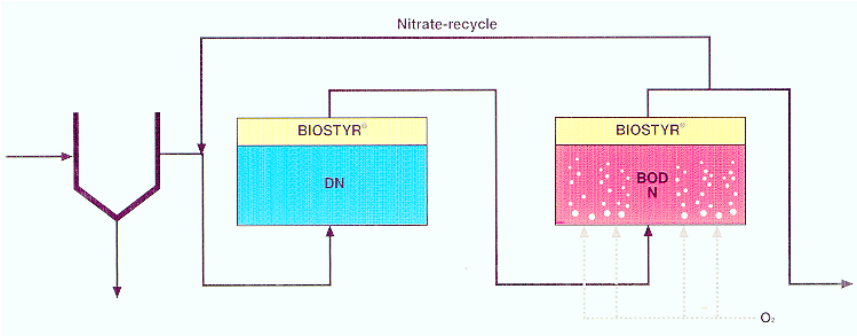
Pre-Anoxic BAF

- A separate anoxic tank is used before the aerobic BAF



110

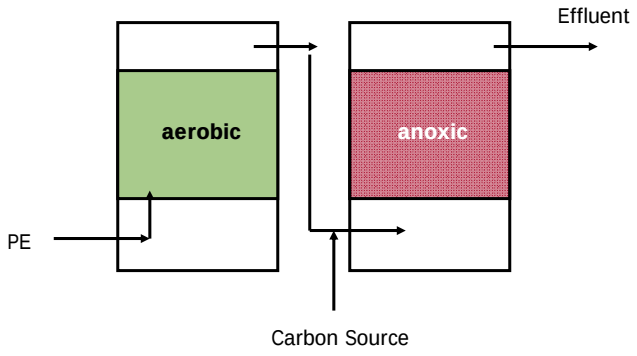
Recirculating Denitrification



111

Post Anoxic BAF

- An anoxic tank is used after the aerobic BAF and carbon must be added



112

Pre-Anoxic Loadings (Biofor)

Nitrogen kg NO_3-N/m^2-d	**1.0 – 1.5**
Hydraulic application (including recycle) m^3/m^2-hr	**24 – 31**

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Post Anoxic Loadings

Loading	*Biofor*	*Biostyr*
kg NO_3-N/m^3-d	**3.0 – 4.0**	**0.8 – 4.0**
Hydraulic Appl m^3/m^2-hr	**10 – 15**	**6 - 15**

Requires methanol or carbon source

114

Schematic of Design for Cergy – Pontoise, France

- Showing BAF Cells, backwash collection, thickeners and digesters

115

Example of Compact BAF System – Assens, Denmark

116

Full-Scale Results of NdeN with BAF Process

- Frederikshavn WWTP, Denmark
- 1998 results
- Biostyr process
- 15 other Biostyr installations since 1998

117

Biostyr Performance Frederikshavn WWTP

Parameter	*Influent, mg/L*	*Effluent Required, mg/L*	*Average Effluent, mg/L*
BOD	200	15	2.7
TSS	92	20	4.9
TN	39	8	3.2
NH_4-N	22		1.0
TP	4	1.5	0.7

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Frederikshavn Operating Conditions

- Loadings (kg/m^3-d)
  - BOD 1.5 kg/m^3-d
  - TKN 0.32 kg/m^3-d
- Reactor
  - Media polystyrene
  - Anoxic depth 0.9 m
  - Aerobic depth 2.1 m
  - HRT 2.2 hrs
  - % backwash 15% of treated flow

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Advantages / Disadvantages

- Advantages
  - Minimal space needed
  - Simple operation
  - No sludge settling, bulking issues
  - Attractive looking facility
- Disadvantages
  - More complex equipment
  - Requires good instrumentation and controls skills
  - Can be more costly
  - Limited economies of scale
  - Vulnerable to high influent solids loadings

120

Integrated Fixed-Film Activated Sludge Process (IF/AS)

121

What is IF/AS or "Hybrid" System?

- Combination of fixed-film and activated sludge
- Media provides surface area for microbial growth
- Higher equivalent MLSS concentration – 4000-6000 mg/L *without higher solids load on secondary clarifier*
- Higher SRT than that based on MLSS concentration and tank volume
- Many types of media available

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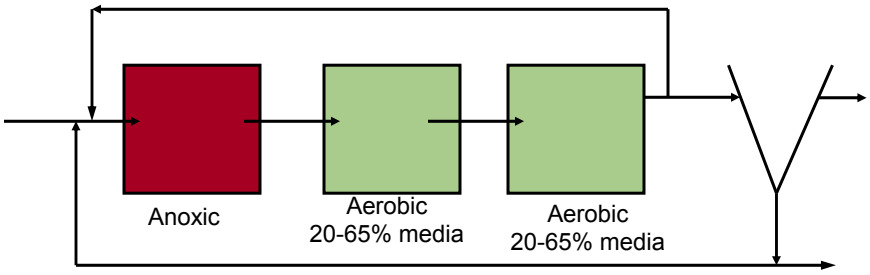
Schematic Example of IF/AS Nitrogen Removal System



123

Common Proprietary Media

120 – 500 m^2 area/m^3

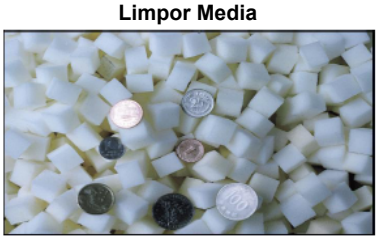
9-12 g biomas/m^2 media area

Name	*Material*
Kaldnes US Filter AGAR Hydroxyl	Plastic
Linpor Captor	Polyurethane

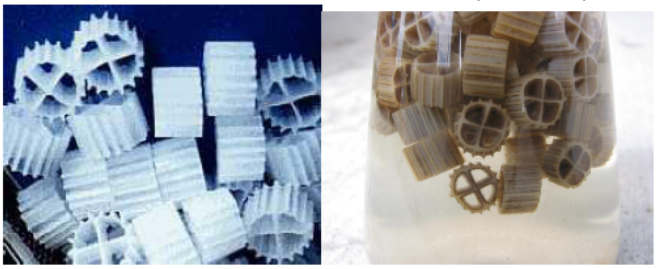
124

Ringlace Media in Service

Limpor Media



AnoxKaldnes K1 Media – New and Used (500 m^2/m^3)



125

MBBR (Moving Bed Bioreactor) versus IF/AS

- Kaldnes polyethylene media – density 0.95 g/cm^3
- Filling fraction about 67% and media specific surface area is 465 m^2/m^3
  (effective area estimated at 335 m^2/m^3)
- Most biomass growth is on media
- Media kept in reactor by outlet screen
- Coarse bubble aeration provides oxygen and circulation
- No sludge return from secondary clarifier
- Over 300 systems in 22 countries

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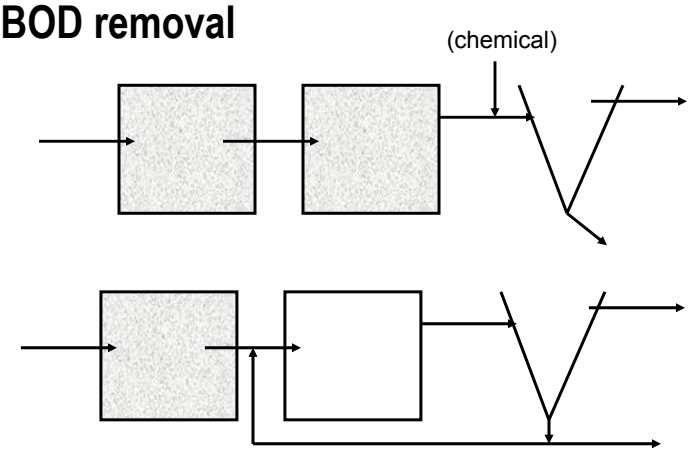
MMBR Applications (All with Primary Treatment)

- **BOD removal**



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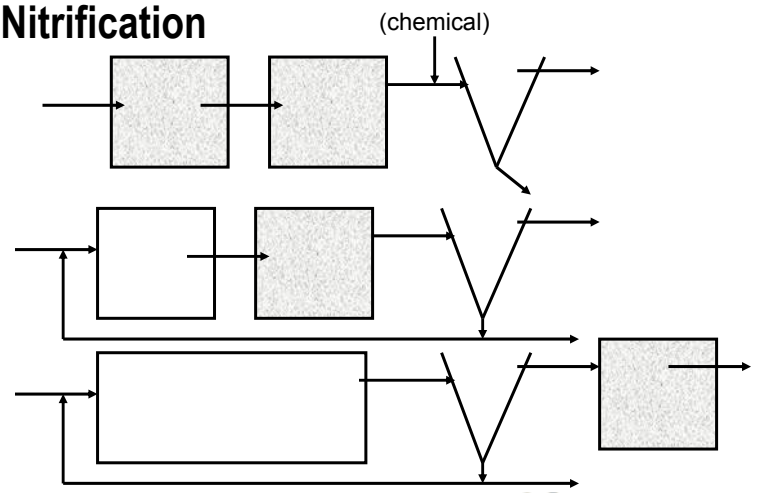
MMBR Configuration for Nitrification

- **Nitrification**



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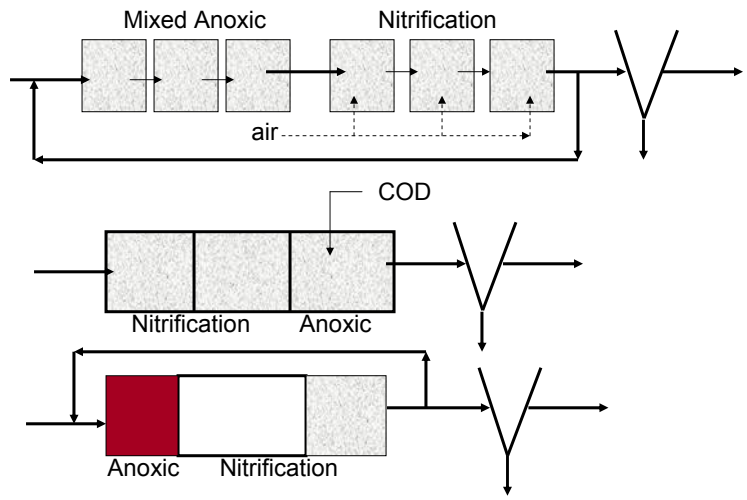
Example of MMBR for NdeN



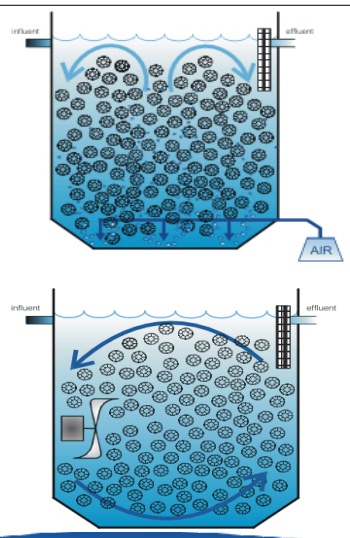
129

Facilities Needed for Kaldnes Systems

- **Pre-treatment**
  - Primary clarifier /fine screens (<6 mm)
- **Baffle walls**
- **Reactor effluent screens**
  - Automatic self-cleaning or via air knives
- **Aeration and mixing system 0.03 scfm/ft^3**
- **DO concentration**
- **Media mixing in anoxic**
- **Media packing density**

130

Aeration/Mixing of Hybrid Systems



- **Aerobic Basin**
  - Usually use coarse bubble diffusers
  - Higher transfer efficiency due to media (close to fine bubble system)
- **Anaerobic/Anoxic**
  - Submerged internal mixers

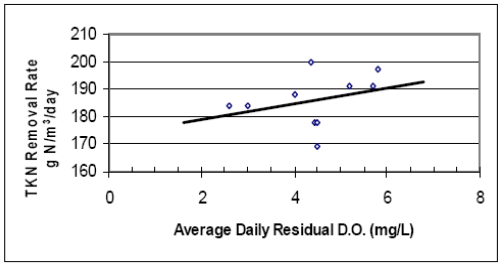
131

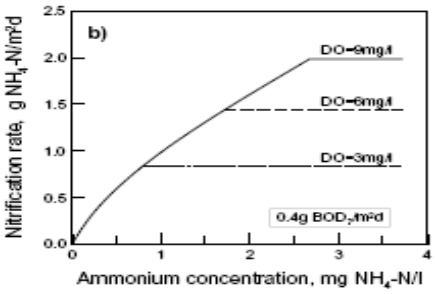
Media and Effluent Separation

Cylindrical Sieves

132

Impact of DO on Specific TKN Oxidation Rate





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Design Parameters and Criteria

Parameters	*IFAS*	*MBBR*
Media Fill (%)	**20-50**	**20-70**
MLSS (mg/L)	**1500-3500**	**100-250**
SRT of AS (d)	**>3**	**0.15**
HRT in Aerobic (hrs)	**>3.5**	**3**
DO (mg/L)	**>2**	**>2**

134

Performance

Parameters	*IFAS*	*MBBR*
Nitrification Rate	**(gN/m^2.d)**	**(gN/m^2.d)**
	0.4 - 0.8	0.4 - 1.0
Denitrification Rate	**(gN/gVSS.d)**	**(gN/m^2.d)**
Pre-Denitrification	0.03 - 0.12	0.25 - 0.8
Post-Methanol / Ethanol	0.1 - 0.32	3

* Rates at 10-12 ^{o}C

135

Key Factors – Affect Performance

- **sBOD**
  - Affects bio-film thickness
  - Affects OUR in both bulk phase and inside biofilm
- **NH_4-N**
  - NH_4 concentration in bulk phase affects nitrification rate
- **DO**
  - Linear increase of nitrification rate for DO 2-5 mg/L
  - DO transfer rate through biofilm
- **Mixed liquor SRT**
  - Affect nitrification rate of the mixed liquor
- **Mixing Pattern**
  - Uniformity of contact between media and liquid

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Operating Concerns

- Wear Rate of Media
  - Normal Media Life expectancy: 10-30 years
- Media Clogging
  - Biofilm thickness affected by mixing pattern and BOD loads
  - Place media of different pore size in different zones
- Screen Plugging
  - Starvation of organics may leads to ciliates buildup
  - Plug flow push media towards screens
  - Effects system headloss and hydraulics

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Operating Concerns

- Maintenance of aeration system
  - System to pump and place media
- Predators – worms
  - Pore size
  - Organic loads fluctuation
- Peak flow conditions
  - Flow over baffle and screens
  - Media recycle pump capacity

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Municipal Installation in U.S.

A number of municipal WW hybrid systems in U.S.

Location	*Flow, mgd*	*Process*	*Status*
Cheyenne, WY	12	NdeN	construction
Cheyenne, WY	7.5	N	in operation
Broomfield, CO	8.0	BNR	in operation
South Adams, CO	5.5	NdeN	in operation

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BNR Performance Examples – Norway

Parameter	*Lillehammer*	*Nordre Follo*	*Gadermoen*
Flow, Mgal/d	7.6	4.8	5.8
BOD_L, kg/d	2900	2660	2680
TKN_L, kg/d	755	460	700
HRT, hrs	3.2	4.9	6.3
TN in, mg/L	35	30	51
TN out, mg/L	4.5	8.0	10.0
% N removal	85	73	81

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Pros and Cons – IF/AS and MBBR

- Pros
  - Smaller footprint
  - Increase capacity of existing facilities
  - Good biomass control
  - High solids inventory
- Cons
  - Cost of media
  - Less operational experience in U.S.

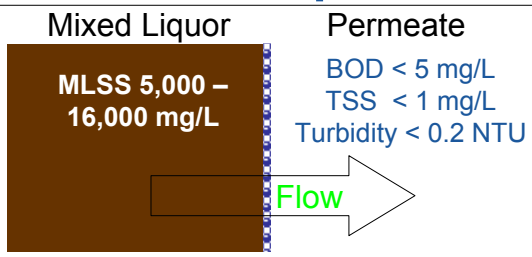
141

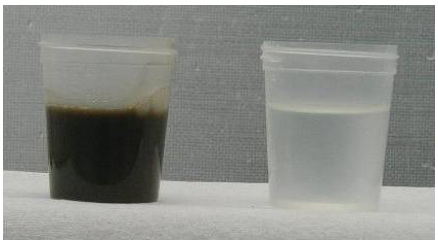
Membrane Separation for Biological Wastewater Treatment

- Used for liquid-solids separation
- Microfiltration –0.04 to 0.40 um
- Can replace clarifier and filter in terms of performance
- Used in biological nutrient removal processes

142

Low-Pressure Polymeric Membrane Provides Solids Separation





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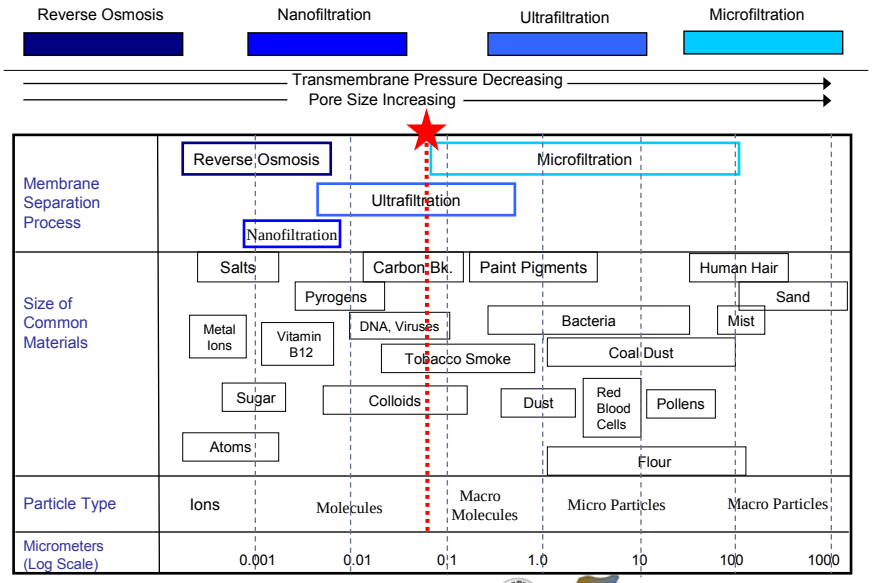
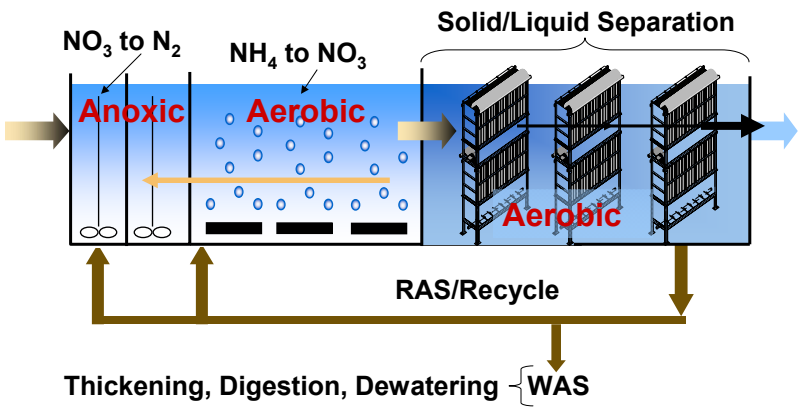
Membrane Filtration Spectrum



144

MBRs Use Membrane Equipment within a Biological Process Design Commonly Applied for N Removal



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Membrane Suppliers (U.S.) - Membranes, Process Configurations, Aeration, and Fouling Control Equipment

- Zenon – Hollow fiber membrane (UF)
- Kubota – Flat plate membrane (MF)
- U.S. Filter - Hollow fiber membrane (UF)
- Mitsubishi – Hollow fiber membrane (UF)
- Huber – Plate –Rotating disc (UF)

146

Kubota 515 Type Cartridge

Polyethylene

148

Zenon

Polyolefin

149

GREELEY AND HANSEN

Immersed Membrane Product: U.S. Filter

150

Pima County Wastewater Management Department

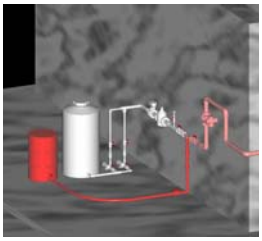
GREELEY AND HANSEN

Huber Plate

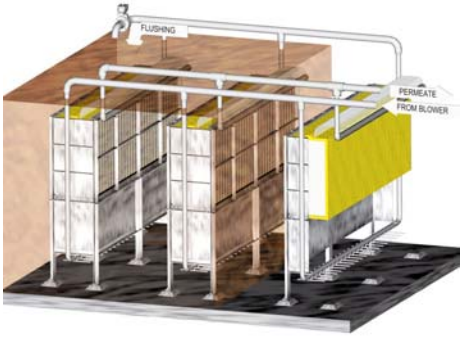
151

Membrane Manufacturers Provide Membrane Equipment Systems

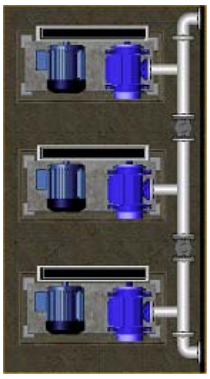
Cleaning System



Membrane Equipment



Blowers



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Process Considerations for MBRs

- Pretreatment – fine screening (2-3 µm)
- Flow equalization – control peak/Avg flow
- Effluent (permeate) pumping and headloss
- Membrane flux
- Membrane fouling control
  - Air agitation
  - Backwash systems
  - Cleaning method

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MBR Characteristics

Manufacturer	*Zenon*	*Kubota*	*US Filter*
Pore Size, µm	0.04	0.40	0.04
Avg Flux gpd/ft^2	10-15	10-15	10-15
Peak (<6 hr) gpd/ft^2	<23	<36	<30
TMP, psi	4-10 psi	0.7-3 psi	2-8 psi
Membrane life, yrs	8	>10	5-10
SRT, days	10-15	10-15	10-15
MLSS, mg/L	≤ 10,000	≤ 10,000	≤ 10,000
HRT, hrs	4-8	4-8	4-8

154

Oxygen Transfer Efficiency Inversely Related to Alpha

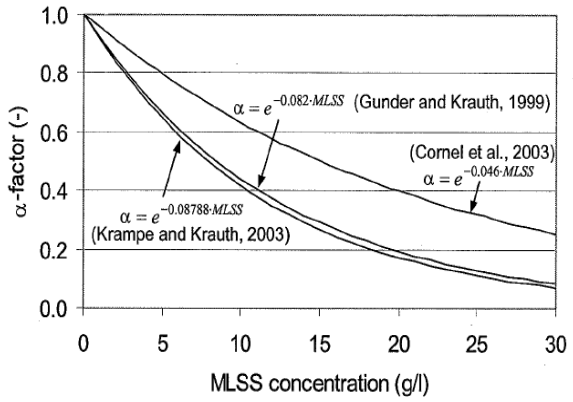
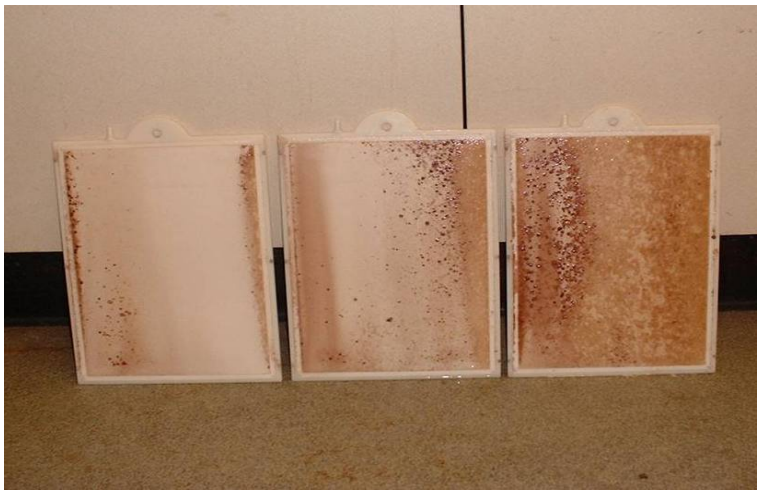


FIGURE 7
α-MLSS CONCENTRATION RELATIONSHIPS FOR FINE-BUBBLE SYSTEMS[6]

155

Lab Membrane Plates Showing Effect of Air Scour



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Membrane Fouling Control

- Agitate membrane with aeration to control solid cake formation on membrane
  - Adds 40 to 80% to A.S. aeration energy
- Use special operating conditions
  - Backpulse, relaxation period
- Cleaning in Place (CIP)
  - Daily or weekly flush with hypochlorite –hollow fiber
  - 1/6 months for flat plate
- Maintenance Cleaning
  - Soak with citric acid
- Fine screening pretreatment
  - 1.0 to 3.0 µm
- Minimize oil and grease in influent

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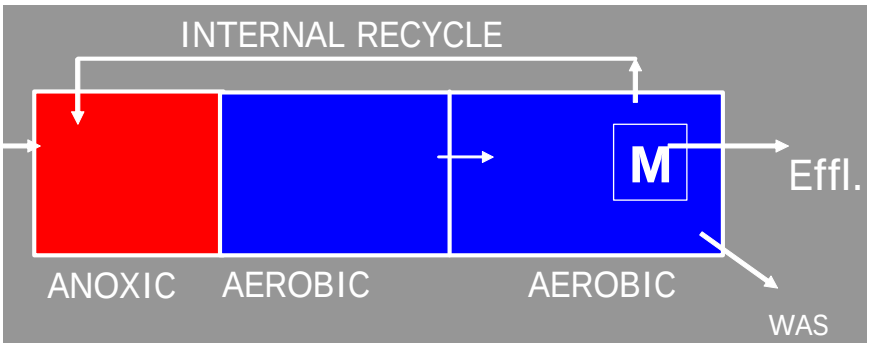
MBRs Commonly used with BNR Processes

158

Anoxic-Aerobic Process is Applied in Membrane Bioreactors



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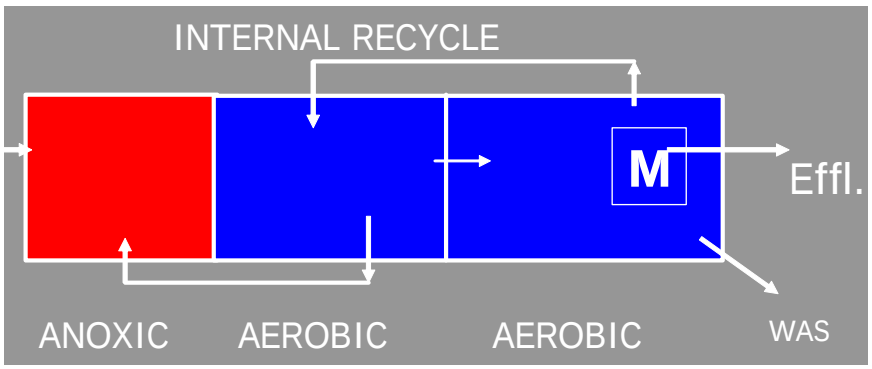
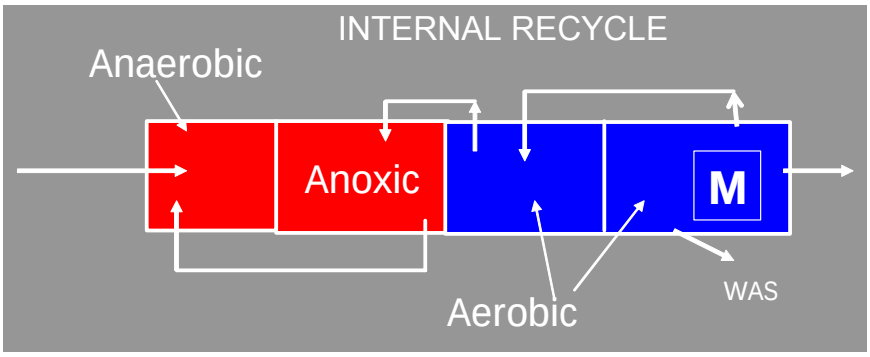
Anoxic-Aerobic Process Uses Additional Recycle Due to High DO



160

EBPR Process is Used in MBRs



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Features of Membrane Technology

Parameter	*Membrane*	*A.S. Clarif.*
Footprint	**Less**	
Aesthetics	**Better**	
Effl. Turbidity	**<0.50 NTU**	**<2.0 NTU with Filter**
Disinfection Cost	**Less**	
N Removal	**Similar**	**Similar**
Virus Removal	**Better**	

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Features of Membrane Technology

Parameter	*Membrane*	*A.S. Clarif.*
Energy Demand	Higher	
Capital Cost	Higher	
Effect of Filaments	May be Good	Bad
Operating Reliability	High	Medium
Removal of Micropollutants	May be Better	

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Advantages of MBRs

- Saves Space
  - Eliminates secondary clarifiers/smaller aeration tanks/no filters
- Increase capacity for existing aeration tanks
  - Much higher MLSS conc. Possible/shorter HRT
  - Size may be limited by oxygen transfer capacity per unit volume
- Longer SRTs
- Bulking/filamentous sludge not an issue
- Easy to retrofit
- High quality effluent – common for water reuse
- Automated operation

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Side-Stream Treatment

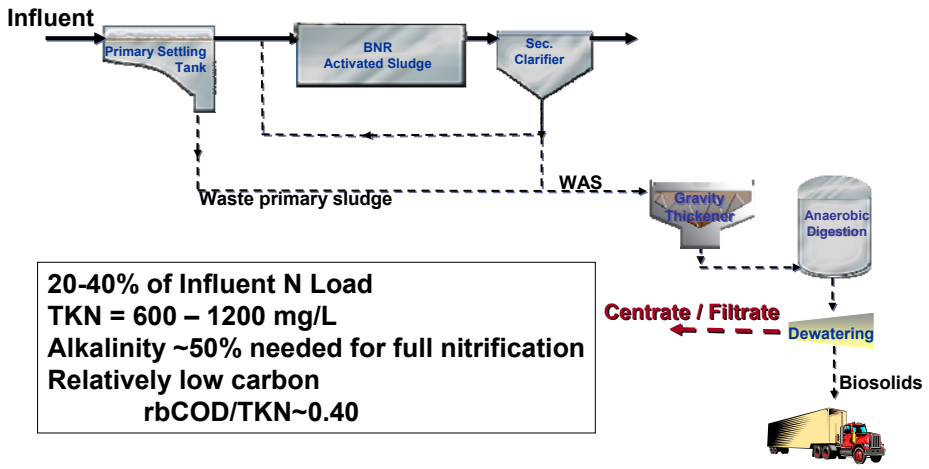
Dave Stensel

Outline

- Impact of nitrogen in sidestream
- Process goals for sidestream treatment
- Getting much attention
  - BABE
  - SHARON
  - MAUREEN
  - ANA – (MMOX)
  - And others

166

Dewatering Centrate/Filtrate Rich in Ammonia Nitrogen



20-40% of Influent N Load
TKN = 600 – 1200 mg/L
Alkalinity ~50% needed for full nitrification
Relatively low carbon
rbCOD/TKN~0.40

167

Why Consider Treatment of Centrate Recycle?

- Impact of high NH_4-N loads on nitrification and denitrification process performance
  - Load equalization
- Minimal nitrification capacity of liquid treatment process
  - Bioaugmentation of nitrification from recycle stream
- Insufficient influent BOD for necessary denitrification for nitrogen removal goals – carbon limited
  - Decrease carbon needed for nitrogen removal

168

Alternatives to Side Stream Treatment

- More treatment capacity volume
- Equalization basin

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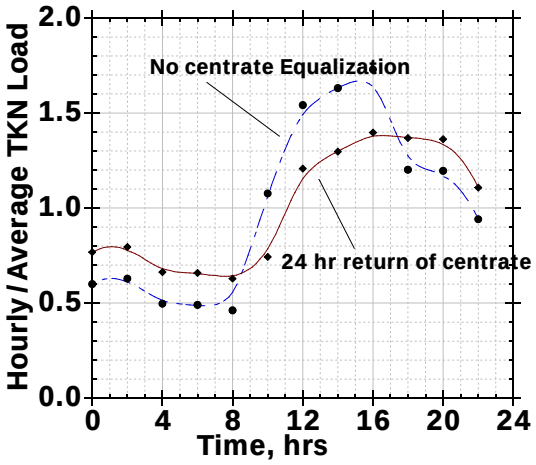
Possible Impacts of Centrate Return

- High peak ammonia loads on nitrification system



170

Centrate Recycle Equalization Improves Performance

BioWin Simulations

SRT=15 days, Temperature = 10˚C, Avg. TKN = 41 mg/L

NH4-N Concentration, mg/L (weighted composite)

System	*Constant Load*	*Diurnal with Centrate Fed 8 hr/day*	*Diurnal with Centrate Equalization*
CMAS	**0.7**	**2.1**	**1.1**
3 tanks in series			
Stage 1	**6.3**	**8.9**	**7.7**
Stage 2	**0.7**	**3.5**	**2.3**
Stage 3	**0.1**	**0.8**	**0.4**

171

Bioaugmentation with Recycle Treatment

- Nitrification of centrate recycle in side stream reactor
- Mixed liquor added to liquid treatment nitrification process
- Nitrifier seed enhances nitrification rate and thus complete nitrification occurs at lower SRT
- Useful for systems with limited tank volume and SRT and thus limited nitrification capacity
- Processes
  - BABE, InNITRI, AT#3

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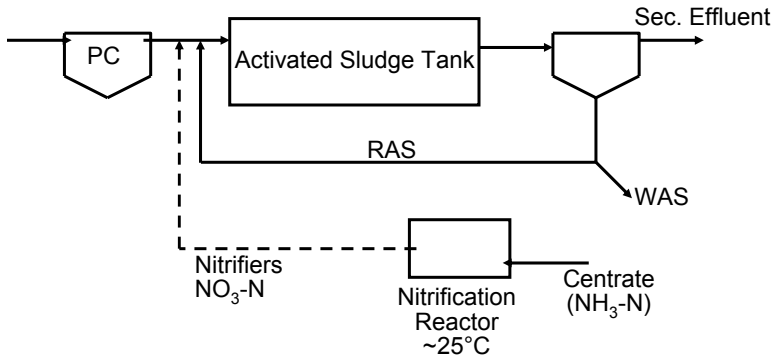
InNitri Process was the First Bioaugmentation Scheme



Expected benefit may not have been fully realized
- Temperature change
- Poor capture of recycle stream nitrifiers
- Predation
- Change in total dissolved solids content – osmotic pressure

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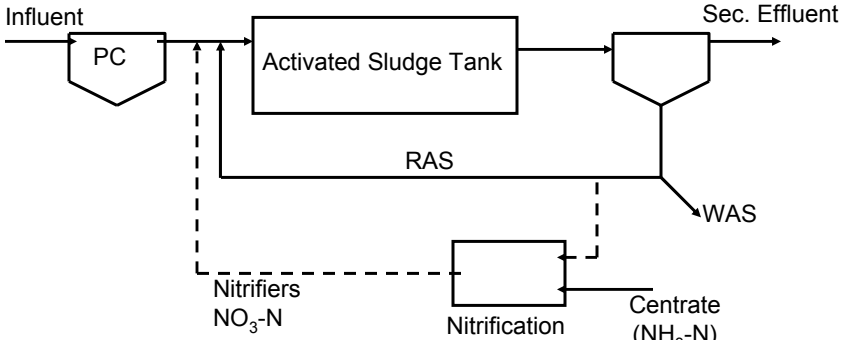
BABE Process
Bio-Augmentation Batch Enhanced



RAS addition is key:
Allows nitrifiers to grow in A.S. floc
Acclimated to both environments

Delft U.
DHV
STOWA

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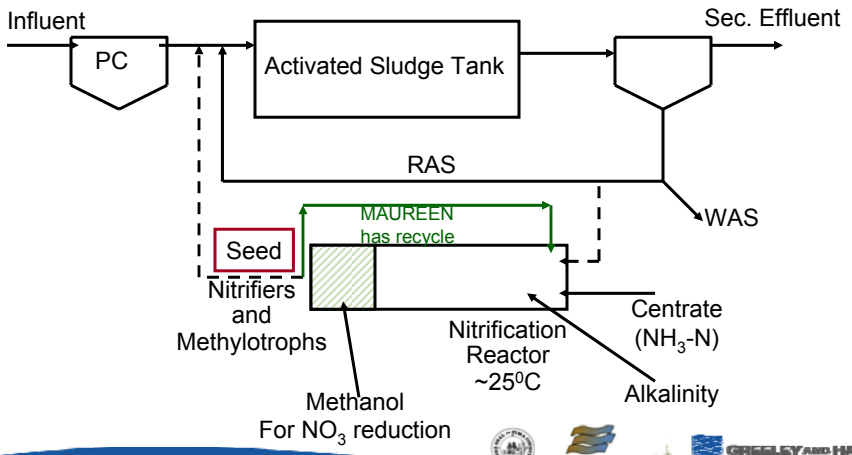
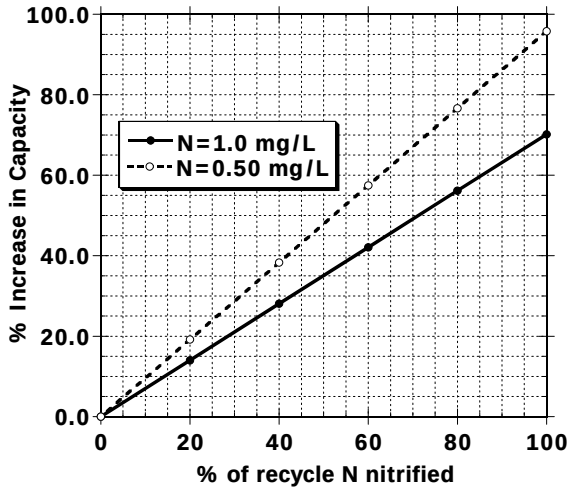
New York City AT-3 Process

MAUREEN IS A MODIFIED VERSION
(Mainstream Autotrophic Recycle Enabling Enhanced N-removal)



175

Percent Increase in Nitrification Tank Capacity as a Function of % of Recycle N Nitrified and Effluent NH_4-N Concentration (Theoretical Maximum)



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Insufficient Carbon for Nitrate Reduction

- Purchase additional carbon (methanol, acetate)
- On-site fermentation of primary sludge
- Use Nitritation process in recycle stream
  - SHARON
- Use De-Ammonification process in recycle stream
  - ANAMMOX
- Fixed film nitritation and de-ammonification processes
  - OLAND
  - CANON

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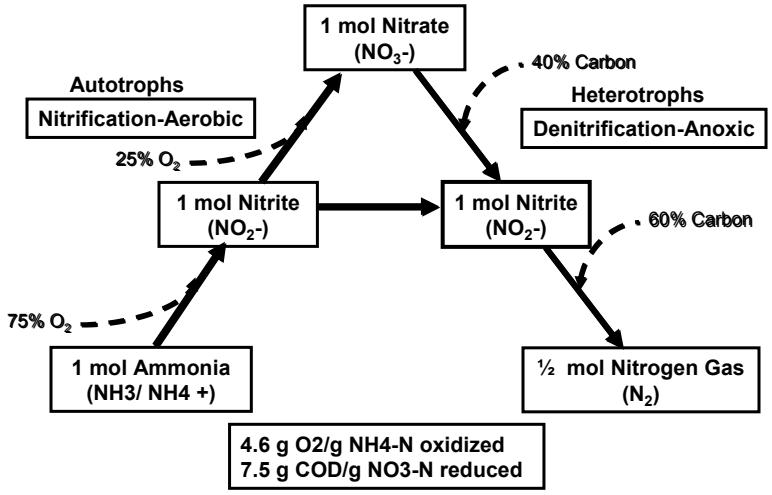
Nitrification – Denitrification



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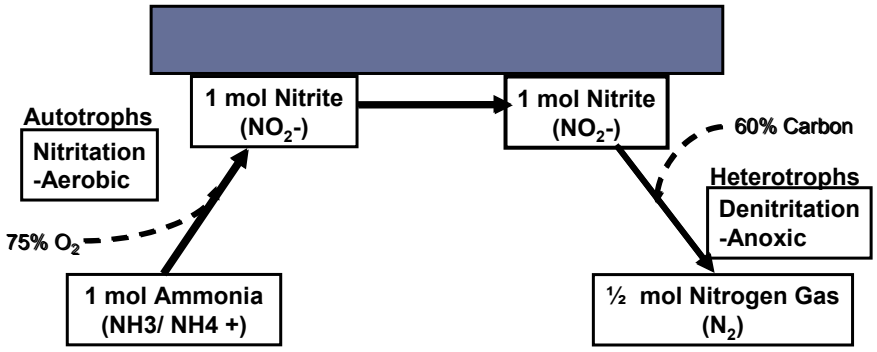
Nitritation – Denitritation



Advantages;
25% Reduction in Oxygen Demand
40% Reduction in Carbon (e- donor) Demand
40% Reduced Biomass Production

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SHARON Process
(Single reactor High activity Ammonia Removal Over Nitrite)

Developed at Delft University – Netherlands

Location	Nitrogen Load lbs N/day	Commissioning Date	Status
Utrecht	1980	1997	O
Rotterdam	1830	1999	O
Zwolle	1190	2003	O
Beverwijk	2650	2003	O
Groningen	6200	2004	O
Haag – Houtrust	2900	2005	

New York City 2007 (Bowery Bay WWTP) 14,500 lbs N/day

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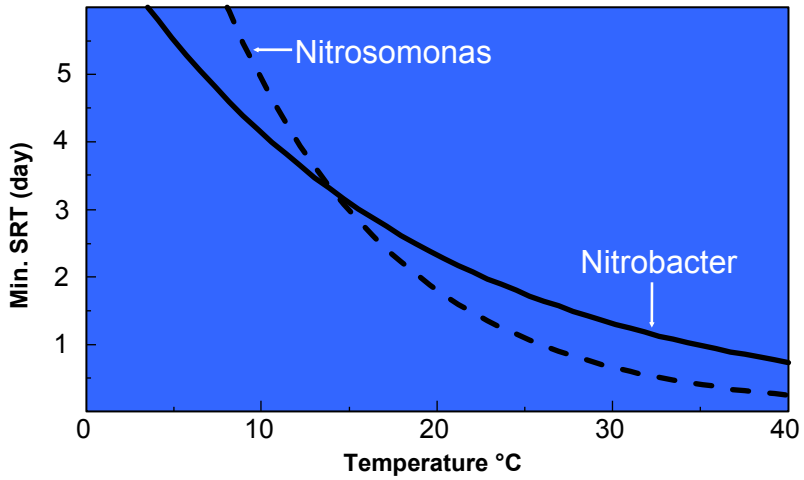
NH_4 Oxidizers grow faster than NO_2 oxidizers at temperatures above 25°C



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Sharon Process Features

- SRT=HRT (~2.0 days)
- Temperature = 30°-35°C
- Temperature control (heat exchangers)
- Higher temperature favors NH_4 oxidizers over NO_2 oxidizers at low SRT
- Alkalinity must be added or produced to promote maximum NH_4+ oxidation to NO_2-
  - Provide methanol for denitrification, which produces alkalinity
    - Add alkalinity
- Time is about 2/3 nitritation and 1/3 denitritation

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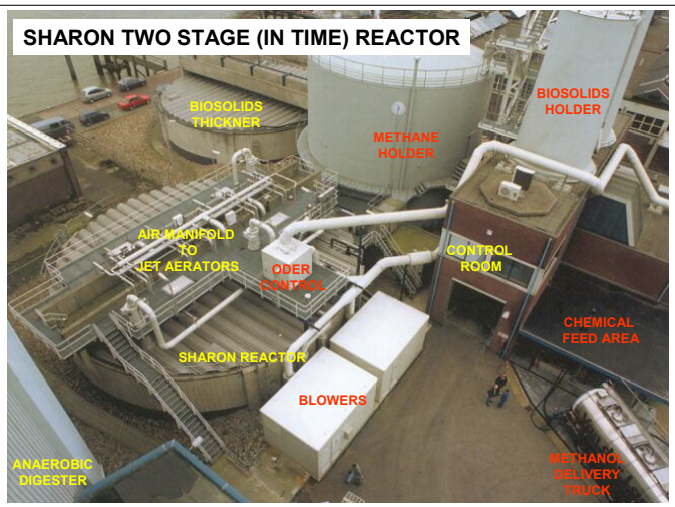
Rotterdam



Mixing and Mass Transfer Technologies INC LOTEPRO Environmental Systems and Services

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Design Parameters Rotterdam, the Netherlands

Parameter	Units
Flow $_{design}$	199,735 gal/day
Flow $_{maximum}$	317,040 gal/day
NH_4 $_{influent}$	1000-1500 ppm
Nitrogen Load $_{design}$	1190 lbs/day
Nitrogen Load $_{maximum}$	1830 lbs/day
Reactor Size	
oxic/anoxic	475,560 gallons
Oxic Retention Time	1.0 day
Anoxic Retention Time	0.5 day

184

De-Ammonification Ammonia and Nitrite Removal with no Carbon Requirement

- **Nitrosomonas Bacteria – microaerophilic**
  - NH_3 oxidized to hydroxylamine (NH_2OH) by ammonia monooxygenase enzyme
  - $NH_2OH + HNO_2 \longrightarrow N_2O + 2H_2O$
- **Nitrosomonas Bacteria – anoxic**
  - $NH_3 + 5HNO_2 \longrightarrow 6NO + 4H_2O$
- **ANAMMOX Bacteria – anaerobic**
  - $NH_4^+ + 1.32NO_2^- + 0.066HCO_3^- + 0.13H^+ \; 0.26NO_3^- + \longrightarrow 1.02N_2 + 0.066C(H_2O)_{0.5}N_{0.15} + 2.03H_2O$

    Biomass

185

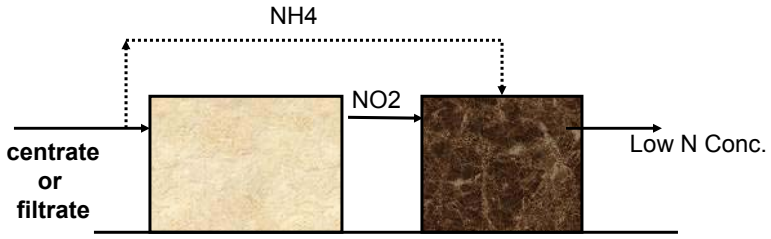
ANAMMOX Process
ANerobic AMMonia OXidation

- ANAMMOX process developed at Delft University
- Testing at Rotterdam – slow start up
- Bacteria
  - Autrophic
  - In order Planctomycetales
- Growth Conditions
  - Anaerobic-sensitive to oxygen
  - Temperature @ 30-35°C
  - Very slow growers –
    - μ_m = 0.069 g/g-d (consider nitrification μ_m = 0.85 g/g-d)
    - Doubling time = 10 days
    - SRT (30-50+ days)
  - $NH_4^+ : NO_2^-$ ratio ≈ 1 : 1.32
    - pH (neutral range)
    - Nitrite (maintain at <40 mg/L)
    - Free Ammonia (maintain at <10 mg/L)

186

Where to get NO_2- for ANAMMOX Process?

- SHARON Process



Underway at Rotterdam Dokhaven WWTP (The Netherlands)

187

Summary

- Recycle sidestream treatment can provide more stable and effective nitrification
  - Equalization
- Recycle sidestream treatment can increase nitrification capacity of existing system
  - BABE, InNITRI, AT-3, MAUREEN
- Recycle sidestream treatment can help reduce carbon demand for nitrogen removal
  - SHARON, ANAMMOX

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Evaluation Criteria

Gordon Culp

Cost Matrix

System Element	Existing Plan	Transfer Some	Transfer All
Treatment-Capital Cost			
Conveyance-Capital Cost			
Treatment-Annual O&M			
Conveyance-Annual O&M			
Total, Present Worth Cost			

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Evaluation Matrix

Criteria		Ranking			Weighted Ranking		
	Criteria Weight	Existing Plan	Transfer Some	Transfer All	Existing Plan	Transfer Some	Transfer All
Cost							
Schedule							
Constructability							
Flexibility							
Env. Impacts							
Water Reuse							
Public Acceptability							
Employee Safety							
Cost Sharing Potential							
Effects on Financing							
System Reliability							
TOTAL							

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Evaluation Criteria

- Feasibility
- Cost
- Schedule
- Constructability
- Flexibility
- Environmental impacts
- Water reuse potential
- Public acceptability
- Public acceptability
- Employee safety
- Cost sharing potential
- Effects on ability to optimize financing
- System reliability

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Evaluation Criteria

- Feasibility (treatment alternatives)
  - Can existing facilities be converted to BNR?
  - Will the conversion result in a user-friendly treatment facility that is readily and reliably operable as a BNR plant?
  - Are there any other aspects of the alternative that are fatal flaws?
  - Only alternatives that pass this initial screening will be ranked against other criteria

193

Evaluation Criteria

- Cost (treatment plant, water reclamation system and wastewater conveyance system)
  - Capital
  - O&M
  - Life cycle (includes consideration of probable life of rehabilitated vs. new facilities)
  - Potential for cost saving from alternative delivery method

194

Evaluation Criteria

- Schedule, consideration of time requirements for:
  - Permitting
  - Financing
  - Land or easement acquisition
  - Construction
  - Potential for time saving from alternative delivery method
  - New multi-party agreements
  - Addressing other legal issues

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Evaluation Criteria

- Constructability
  - Maintaining treatment capacity while constructing new facilities
  - Transition of operation from old system to new system
  - Construction staging
  - Compatibility with land available at and near existing sites

196

Evaluation Criteria

- **Flexibility**, includes consideration of ability to cope with:
  - Changing development pace and patterns
  - Changing discharge and reuse requirements
  - NdeN requirements
  - Changing biosolids demands and regulations
  - Future expansion
  - Advances in available technology

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Evaluation Criteria

- **Environmental impacts**, includes consideration of:
  - Nature of land uses impacted
  - Odor
  - Noise
  - Construction activities
  - Riparian habitat/wetlands
  - Archeological impacts
  - Surface water quality
  - Use of alternative, sustainable energy sources

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Evaluation Criteria

- Water reuse potential, includes consideration of:
  - Location of reclaimed water
  - Location of potential demand for reclaimed water
  - Quantity of reclaimed water
  - Quality of reclaimed water
  - Groundwater recharge – effects on quality and quantity
  - Community-wide impact of reuse potential

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Evaluation Criteria

- System reliability
  - Conveyance system
  - Treatment technology reliability-wastewater
  - Treatment technology reliability-biosolids
  - Treatment redundancy-wastewater
  - Treatment redundancy-biosolids
  - Compatibility with system-wide standardization

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Evaluation Criteria

- Public acceptability
- Employee safety
- Cost sharing potential
- Effects on ability to optimize financing

201

Comments at Workshop 1

- Technology reliability
- Value of reuse to entire community
- Recharge potential
- What extent using proven technology
- How measure risk
- User friendly, consider labor impacts
- Employee safety

202

Comments at Workshop 1

- Odor generation potential
- Transition from old to new system
- Flexibility to expand over time
- Archeological impacts
- Compatibility with system-wide standardization
- Alternative energy sources

203

Comments at Workshop 1

- Cost impacts on reclaimed water system
- SCADA, impact on O&M
- Space issues, e.g. new laboratory
- Risks of not looking at new technology
- How to make the technology work vs. experience at other locales
- Business case of using existing facilities if O&M costs are driven up

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Comments at Workshop 1

- Ease of operation related to uniformity throughout the system
- "Bleeding edge" vs. proven technology

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Cost Matrix

System Element	*Existing Plan*	*Transfer Some*	*Transfer All*
Treatment-Capital Cost			
Conveyance-Capital Cost			
Treatment-Annual O&M			
Conveyance-Annual O&M			
Total, Present Worth Cost			

206

Evaluation Matrix

Criteria		Ranking			Weighted Ranking		
	Criteria Weight	Existing Plan	Transfer Some	Transfer All	Existing Plan	Transfer Some	Transfer All
Cost							
Schedule							
Constructability							
Flexibility							
Env. Impacts							
Water Reuse							
Public Acceptability							
Employee Safety							
Cost Sharing Potential							
Effects on Financing							
System Reliability							
TOTAL							

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Evaluation Matrix

Criteria		Ranking			Weighted Ranking		
	Criteria Weight	Existing Plan	Transfer Some	Transfer All	Existing Plan	Transfer Some	Transfer All
Cost	5						
Schedule	5						
Constructability	3						
Flexibility	4						
Env. Impacts	4						
Water Reuse	5						
Public Acceptability	5						
Employee Safety	4						
Cost Sharing Potential	3						
Effects on Financing	3						
System Reliability	5						
TOTAL							

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Summary

Andy Richardson

Workshops #5 and #6 Meeting Notes
NdeN Process Selection

1. The NdeN Process Selection Workshop for Pima County Regional Optimization Master Plan was held on July 12, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Jackson Jenkins
Mike Bunch
PCWMD Staff
David Bartos
James Doyle
Frank Gall
David Garrett
Michael Kostrzewski
Jing Luo
Pete Magaddino
Byron McMillan
John Munden
Steve Munsell
Jeff Prevatt
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager
John Sherlock
Jack Van Riper
Legal
Harlan Agnew
Chuck Wesselhoft

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Dennis Rule
Tim Thomure

BUREAU OF RECLAMATION
Deborah Tosline

PEER GROUP
Joe Husband, MPI
Gary Newman, B&C
Denny Parker, B&C
Cindy Wallis-Lage, B&V

GREELEY AND HANSEN PROJECT TEAM
Orrie Albertson
Jerry Bish
Gordon Culp
Carl Koch
Jong Lee
Joe Popeck
Anne Smith

2. Major topics of the workshop were:
   - Workshops #5 and #6: NdeN Process Selection
     - Condition Assessment of Ina Road
     - Wastewater Treatment Design Options Short List
     - Short Listed Options for Roger Road WWTP
     - Short Listed Options for Ina Road WPCF

- Process Selection to Evaluate Plan Options:
  - Existing Plan
  - Transfer Some
  - Transfer All

Handouts were provided to each attendee. Handouts included presentation slides of the Ina Road WPCF Condition Assessment and review of the short listing of wastewater treatment alternatives used during the workshop. Other slides numbered 78 through 189 were used during the workshop presentations, but not handed out to attendees, were sent electronically to attendees following the workshop. The other slides were identified as Workshops #5 & #6 NdeN Process Selection, July 12, 2006 "amended pages – July 14, 2006."

Throughout the workshop, notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and considerations to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, opened the workshop by inviting all to actively participate, especially the peer group who were attending their first project workshop. He stated the theme of the workshop was to narrow the wastewater treatment process alternatives down to the most cost effective system(s) for the County. Process selection is the most important decision to be made for the study.

4. Anne Smith defined her role as facilitator to move the group through the agenda and to encourage participation from all. The purpose of the workshop was to review the condition assessment report of Ina Road WPCF and spend most of the time to narrow down the wastewater process alternatives for further study in the system alternatives evaluation for Roger Road WWTP and Ina Road WPCF. The framework for the treatment process selection was outlined.

   Agenda, groundrules, objectives of the workshop and treatment process evaluation framework were presented and covered on pages 1 through 4 of the handout.

5. Gordon Culp previewed the alternative evaluation matrix to be used later in the workshop to narrow the treatment process selection. The evaluation criteria include life cycle costs and resource consumption considerations among others. Comments from the attendees ranged from what varies among the processes, to usability of the effluent, whether Class A+ water was the basis of process performance, how recycle streams were addressed, would power generation continue at the facilities and whether Bio P (biological phosphorus) removal was considered.

Responses included that Class A+ Water was used as the basis for the process development, that recycle loads were taken into account for the Ina Road WPCF plant loadings (assumes Roger Road WWTP solids are thickened/dewatered at Ina Road WPCF) and that Bio P removal was a basis for the process criteria. There were differing opinions amongst the attendees on whether Bio P removal should be used as a basis for the process design.

It was agreed that the Bio P removal issue would be revisited by the project team, especially after the upcoming Biosolids workshop. In response to the power generation comment, it was stated that power generation was under evaluation since the condition assessment of those facilities had been completed.

The evaluation preview was covered on pages 5 through 7 of the handout.

6. Joe Popeck provided a quick condition summary review of Ina Road WPCF. Since this facility is much newer than Roger Road WPCF and a portion had just been newly constructed, this facility was generally rated in good condition. Concrete and mechanical equipment appeared to be in good condition throughout. The existing instrumentation and control system was rated as good, but appeared to be under utilized for a facility this size. There were some notes made on an electrical motor control center that require some attention. It was noted that any wastewater facility must continually renew and replace components and systems to remain a viable operation.

   The Ina Road WPCF condition assessment was covered on pages 8 through 23 of the handout.

7. Orrie Albertson reviewed the results of Workshop #4 to screen or narrow down eight possible wastewater treatment processes to a fewer number through a qualitative process. There were 10 questions applied to each potential process. The use of Bio P removal affected the decision as to whether a process should continue for consideration. It was previously concluded, although not required by current or near future regulations, that provisions for Bio P removal could have beneficial operational cost impacts, if it were required, versus the approach of adding chemical to address phosphorous removal. It was suggested by the peer group that the decision to include Bio P removal in the initial facilities be reconsidered.

   Denny Parker offered that utilities elsewhere are experiencing “sticker shock” at the cost of facilities and it may not be a good idea to include Bio P removal capability that might not be needed in the near future with the initial projects based on cost considerations. To keep costs down, there should be emphasis on reusing tankage wherever reasonable. (As stated in item 5 above, Bio P removal is to be revisited by the project team.) Five processes were selected from

Workshop #4 for continued evaluation. These processes were the basis for the more detailed analysis to be addressed in the items below.

There were many questions related to the basic assumptions used in the evaluation criteria for narrowing the alternatives. Among other comments, the peer group questioned whether on a "first cut" basis that the wastewater characteristics between the facilities should be considered similar, and whether denitrification and Bio P removal were viable based on the available carbon in the wastewater. It was agreed that available carbon should be allocated to nitrogen removal first and removal P second.

Recent construction costs information indicates that new treatment facilities are expensive and that existing structures and systems, if worthy, need to be considered in future plans. It was stated that the two metro plants need to be looked at separately to effectively address the utility of the existing structures and facilities. Further, it was suggested that the evaluation criteria be weighted to provide a higher value to reuse of existing tankage.

Dennis Froehlich noted that the MBBR process was ruled out on Bio P removal criteria, but is may be a very cost effective way forward.

It was agreed that the process evaluation team including the peer group would re-examine the screening criteria apply it to each plant. It was further stated that processes of merit would be noted for future consideration in the study, but it was needed to narrow the processes to one for the evaluation of overall system options between the metro plants. After complete regional systems (with a process) are developed for the options, the processes of merit will be tested against the process used for the comparative studies to decide on the most cost effective approach for the County. It is possible, and maybe likely, that the process used in the comparative analysis will not be the final selected process at each plant. Therefore, no process is ruled out at this time, but to be efficient in moving the study forward a process for comparative analysis needs to be identified.

The screening of alternatives review was covered on pages 24 and 25 in the handout.

8. Joe Popeck proceeded through the presentation of the five wastewater processes that were shortlisted in Workshop #4. The bases of the additional analysis of treatment plant processes included treatment plant flows at Roger Road WWTP and Ina Road WPCF under the three study options, raw wastewater characteristics and effluent criteria. In addition to describing the treatment components of each system, site layouts at Roger Road WWTP and Ina Road WPCF

and preliminary costs for comparative purposes were provided. Treatment processes were developed in two modes: 1) nitrification, and 2) nitrification-denitrification. Processes included MLE, Bardenpho, Step-Feed, IFAS and MBR.

Comments included why flows higher than 32 mgd at Roger Road WWTP were not considered and how much flow remains in the Santa Cruz River after reuse water should be considered. Higher flows at Roger Road WWTP will be addressed in future workshops. Higher flow is to be determined in part by the Tucson Water reuse water needs and Ina Road WPCF existing systems capacity. The flow in the Santa Cruz River to sustain riparian habitat has been reported to be 7 mgd. This river flow was attributed to Frank Postillon, who was not present at the workshop.

In the site layouts, tankage and facilities are shown to illustrate the space they would require not necessarily where they would finally reside after more engineering analysis. It was noted by PCMWD Staff that at Roger Road WWTP the distribution pipes in the ground will significantly impact future construction implementation and costs within and near the existing facilities.

On costs issues it was stated that the present worth analysis was based on 20 years with an approximate 8 percent interest and a 3 percent escalation. It was further noted that the costs did not account for demolition, if required. There was a Peer Group comment that the aeration costs looked low and asked if it included mechanical equipment. The answer was that the aeration costs did include mechanical equipment costs.

Mike Gritzuk asked if all the existing tanks would be required at Roger Road WWTP for the processes considered. The response was no, that there was excess primary and secondary clarification capacity. It was further stated that primary tanks 1 though 4 are not useful as constructed.

Setback requirements used for new facilities on the site layouts were based on 350 feet. There still appears to be an open issue on set backs. Paul Bennett has some map information that addresses setbacks at each plant.

Frank Gall asked if the process designs included a peaking factor. The answer was yes based on a historical factor of 1.4 for maximum day and 2.0 for maximum hour.

Jing Luo asked why the MLE process was still being considered as it was discarded in Workshop #4. The response was that the MLE process was added back into the mix at the end of Workshop because with denitrifying filters the process meets the effluent criteria.

Questions arose from the peer group on specific values and assumptions used in the various analyses, such as depth of new aeration tanks (16 feet), MLSS used, SRT (days), power consumption and dissolved oxygen concentration by process stage . Each was answered by the project team.

There was discussion of the step feed process and it was eliminated from further consideration based on the complexity of achieving Bio P removal. The comment was made that step feed would be expected to provide superior performance for nitrogen removal.

Gary Newman asked if the biotowers were removed at Roger Road WWTP whether wastewater could flow by gravity from the primary tanks to the aeration tanks. The answer is yes, but there is very limited hydraulic head available.

IFAS requires fine screens in front of the system to prevent fouling. The metro plants have 6 mm clear screen openings in the headworks which are sufficient for the process media.

For the IFAS system there was a question on the density (500 square meters per cubic meter) considered and how the media is handled during maintenance. After some discussion it was concluded that the density utilized in the analysis was appropriate. Cindy Wallis-Lage indicated that the media of a higher density may have oxygen transfer difficulties in this service. For maintenance of the system the media would be pumped to another operating tank while the maintenance proceeds and pumped back after it is returned to service. A question was raised by the peer group about the approach to sizing of the IFAS basins and some disagreement with the approach was voiced. Cindy Wallis-Lage indicated that within the system analysis the DO assumed in some zones may be unnecessarily high.

There remains an issue of warm weather performance with IFAS. While there may be a facility approved in a warm weather area, there is no operating experience.

With the membrane technology it has proven very difficult to place membrane bundles into existing tankage. Usually after structural analysis the existing tanks are abandoned and new tanks constructed for the membranes.

9. Once the alternatives for each process at each plant were presented, a present worth summary table for all the alternatives was provided. The summary information did not show much

difference between Bardenpho and IFAS, but indicated that those two were significantly lower than MLE and MBR.

Mike Gritzuk asked if the cost of Bardenpho and IFAS are equal, then what are the advantages and disadvantages of each. Advantages and disadvantages of Bardenpho and IFAS include: Bardenpho is one of the oldest BNR technologies in the US and has been proven. There are many in warm climates (20 in Florida).

IFAS is a newer technology and it is harder to understand the science within its operation. IFAS has proven to be successful at achieving an effluent N of 10 mg/L, but not at 6 mg/L as required for Pima County. IFAS can be operated with a lower MLSS than Bardenpho which makes the final clarifiers more tolerant of higher flows. The IFAS does not have a track record in warm weather areas. Also, if the IFAS needs to carry a DO of 2 mg/L, it will lose in a comparative analysis on energy. It is cautioned that the IFAS should not be used unless piloted tested in Pima County.

10. Denny Parker offered an alternative at Roger Road WWTP to reuse of the biotowers in a nitrification mode with the existing aeration tanks. It is possible to concurrently achieve some denitrification in the biotowers. The process is being used at Littleton-Englewood, Colorado. This would maximize the use of the existing facilities, but would require chemical addition for P removal. This alternative remains a potential for further consideration, particularly if flows are 20 mgd or less.

11. For the Ina Road WPCF the NdeN processes analyses, HPO tanks were converted to an anoxic zone. There was a question on how the model handled the recycle of nitrogen. There is a concern that the system could be “poisoned” with a large recycle load from the sludge treatment process. It was noted that sludge treatment is to be addressed in the next workshop.

Joe Husband indicated that the new BNRAS system at Ina Road WPCF is designed to add a fourth stage. It may accommodate a fifth stage, if necessary.

The rapid sand filters were based on a 4 gpm loading rate at average flows. If the peaking factor is 2.0, the bases may need to change to 3 gpm to allow for a peak of 6 gpm trough the filters.

Items 8, 9 and 11 were covered in pages 25 and 26 of the handout and slides numbered 78 through 182 at the workshop. Slides were provided electronically to attendees after the workshop.

12. Gordon Culp introduced the evaluation matrix with two items for the group to discuss and rate operability and proven process. Operability includes items, such as, higher I&C skills, mixed liquor control and SRT control. For proven process the MBR has had difficulty in nutrient removal applications while IFAS has had very limited experience (one plant) with nutrient removal. Ron Riska expressed concerns for the complexity that membrane systems require. Franks Gall indicated that Bardenpho appears to be the safest process based on experience. IFAS is more difficult to deal with because of the media in the water.

The matrix evaluation table was completed by the group for operability and proven process and then the table was reviewed and revised in the other evaluation categories, which were completed ahead of the workshop by the project team as they required quantitative values, such as costs.

It was agreed by the group that processes with nitrification only would be removed from further consideration. It was further agreed to prepare a separate evaluation matrix for Roger Road WWTP and Ina Road WPCF in the workshop. With the remaining processes each evaluation category by each process was reviewed and some adjustments made. The completed matrix for Roger Road WWTP and Ina Road WPCF are provided below.

Roger Road	*MLE NIT*	*MLE NdeN*	*Bardenpho NIT*	*Bardenpho NdeN*	*IFAS NIT*	*IFAS NdeN*	*MBR NIT*	*MBR NdeN*
Operability		o		o		o		-
Proven Process		+		+		o		-
Present Worth Cost, Capital + O&M		-		+		-		-
Site Compatibility		o		o		o		o
Resource Consumption		-		+		+		-
Ease of Maintaining Treatment Capacity during Construction		-		-		-		-
Recommended Process								

Ina Road	*MLE NIT*	*MLE NdeN*	*Bardenpho NIT*	*Bardenpho NdeN*	*IFAS NIT*	*IFAS NdeN*	*MBR NIT*	*MBR NdeN*
Operability		o		o		o		-
Proven Process		+		+		o		-
Present Worth Cost, Capital + O&M		-		+		-		-
Site Compatibility		-		+		+		+
Resource Consumption		-		+		-		-
Ease of Maintaining Treatment Capacity during Construction		+		+		+		+
Recommended Process								

From the matrix evaluation analysis it was decided, but not as a final process decision at each plant, that Bardenpho would be taken forward to evaluate the three system options -- existing plan, transfer some, and transfer all. There were no objections from the group that Bardenpho would be used in the system alternative evaluations.

With the completed tables additional comments were made on the results and included: when are the other costs, such as sludge process and conveyance added *(other costs will be considered in comparing complete system configurations)*, the decision to provide Bio P removal needs to be revisited (*NdeN plants typically remove 65 to 80 percent of P in addition to nitrogen)*, look at how flows will increase to each plant over time, and need to consider the detail on how to maximize the use of existing structures.

The evaluation matrix was covered in the slides numbered 183 through 189 at the workshop, but provided electronically to the attendees after the workshop.

13. Joe Popeck indicated that in working with existing facilities and structures that contractor risk needs to be factored into the evaluation. This is particularly true at Roger Road WWTP due to age and the existing facility arrangements.

14. Mike Gritzuk summarized the areas for additional clarification.

    - What are the capacity needs of Tucson Water and at what location? More discussion required with Tucson Water.
    - What is the minimum flow to the Santa Cruz River to maintain a green riparian habitat?
    - What is the future regulatory requirement for phosphorus?
    - What is the best way to plan for phosphorus removal?
    - Reconciliation needed on the pass/fail screening chart amongst the process team, County and peer group.
    - What are the costs of contractor's risk related to rehabilitation and adding on to existing facilities construction, especially at Roger Road WTTP?

15. Anne Smith reviewed the day's activities and listed the action items.

    - Provide Dennis Froehlich with the GPS-X layouts for the processes and costs
    - Paul Bennett to forward the setback maps to the project team.
    - Project team to provide information on how influent characteristic were developed.
    - Peer group to provide notes of additional issues and concerns form the workshop and request any additional information to Ron Riska.
    - Reconciliation of the pass/fail screening matrix is required between the project team, peer group and County staff.
    - Additional cost considerations for rehabilitation at Roger Road WWTP need to be developed.

16. Anne Smith indicated that the next workshops on Biosolids and conveyance were scheduled for July 19, 2006.

Agenda
Workshops #5 & #6 – NdeN Process Selection
July 12, 2006

Time	Topic	Presenter
7:30 am	*Continental Breakfast – Rio Nuevo Upstairs Conference Room, 52 W. Congress*	
8:00 am	Opening Session	
	• Welcoming Remarks	Mike Gritzuk
	• Overview of Agenda	Anne Smith
	• Purpose and Objectives	
8:20 am	Background/Condition Assessments – Ina Road WPCF	Joe Popeck
8:55 am	Wastewater Treatment Process Review	Orrie Albertson
9:15 am	Wastewater Treatment Process Short List Review	Joe Popeck
9:30 am	Peer Group Discussion of WWT Processes	Anne Smith
9:45 am	Break	
10:00 am	Roger Road Evaluations	Joe Popeck/Jong Lee
	• Process Evaluations	
	• Site Layouts	
	• Preliminary Costs	
11:40 am	Peer Group Discussion	Anne Smith
12:00 pm	Lunch	
12:45 pm	Ina Road Evaluations	Joe Popeck/Jong Lee
	• Process Evaluations	
	• Site Layouts	
	• Preliminary Costs	
2:25 pm	Peer Group Discussion	Anne Smith
2:45 pm	Break	
3:00 pm	Matrix Evaluation of WWT Processes	Gordon Culp
	• Roger Road WWTP	
	• Ina Road WWTP	
4:15 pm	Summary Wrap-Up	Anne Smith
	• Comment by Group	
	• Closing Remarks	Mike Gritzuk
4:30 pm	Adjourn	

Flip Chart Notes – July 12, 2006

Process Criteria Comments

- Disposal – options – Class A+ needs to be confirmed
- Regulatory position on P removal needs to be confirmed
- Sidestream treatment not included in cost estimates

Questions for Pass / Fail Matrix

- Ina/Roger Questions – similar influent characteristics
  - Need real numbers for influent (to be done soon); could skew processes (solids/liquid)
  - Impact of sidestream on N (County has some influent data on Roger Road)
  - P removal – should it be driver?
  - P & N removal may not both be possible without sufficient carbon source
  - Trickling filters should not eliminated because of P & N removal
  - Bio P removal should not be on the pass/fail criteria; favors certain processes
  - BT/NAS P failed on methanol need
  - ASNTF/BTNAS/Step/Biostyr – failed on P removal
  - Different evaluation if just look at Roger Road/Ina Road separately vs. all together
  - Consider comparing processes at 10 mgd increments.
  - Consider a range of flow values

<u>ROGER ROAD WWTP</u>

Process Options

- Questions
  - Why not 50 mgd at Roger Road?
  - 32 mgd not locked in fro Roger Road
  - Do larger flows affect process selection?
  - Tucson Water not married to 20 mgd at Roger Road;
  - Maybe get rid of river discharge at Roger Road – operate as scalping plant for reuse
  - 20 & 32 mgd at Roger Road are included in study options
  - 7 mgd in river – Roger Road to Ina Road needed for habitat

MLE(N) Process

- Cost of demolition not included
- 6.5 days aerobic SRT used
- Present worth: 20 yr 8% Interest 3% Inflation Net approximately 5%
- deN filters – cost based on current plant (Greeley and Hansen) cost/SF
- Focusing on major capital and O&M costs
- Flow distribution not included as it applies to all processes
- Grandfathering (assumed) for setbacks – maybe a problem with odors
- Open question: power requirements may be different for each (MLEN/MLENdeN)

5-Stage Bardenpho

- Total SRT 9.8 to 9.9 days total; aerobic SRT 6 to 6.5 days
- Could demolish #1 – 4 clarifiers at Roger Road , if space needed

Step Feed (with Alum/Methanol)

- General – piping costs excluded; will be addressed later in detail
- AN/anoxic process can be used to make step feed work for Bio P removal, but complex
- Surprised that step feed higher than MLE for methanol and chemical costs

IFAS N

- Assumed 4 mg/L DO in tanks
- Fine screens not included – not needed, already have 6 mm screens

MBR

- Cost evaluation of membrane includes initial plus two replacements over 20 years
- New tanks (membrane) have been more economical in past than using aerating existing tanks
- Mixed liquor concentration seems low – 8,000 to 10,000
- 10 mgd – $0.80 - $1m/m membrane tank (experienced elsewhere)– SRT 12 days MLSS – 8,000 aeration, 10,000 membrane
- Need equalization of flows
- Wastewater peak – 2 times average flow (Q)
- Experience indicates flux rates used are conservatively lower
- Experience with new facilities has MBR lower capital costs than conventional plus filters – present worth is higher
- More cost with retrofit

Cost Comparisons

- Need to consider piping/routing
- Power costs need refinement
- Cost basis – different; mixing actual plant costs and water cost model
- Need sensitivity analysis on processes present worth – O&M/cap
- May not be differentiated by cost
- The four processes considered - 3500 mixed liquor at 20 mgd; higher Q/conc. may be problem
- Option to consider – trickling filters with acetate addition and polishing – retrofit flocculator center wells and fine bubble aeration/anoxic zones (16 mgd)

IFAS

Con	Pro
High DO	Ease of O&M

Bardenpho

Con	Pro
Clarifier limits process	More plants in more climates
	Bio P and N removal good

Bio P removal can skew options
Need to capitalize on carbon source

INA ROAD WPCF

- MLE-N
  - Rated capacity needs to be checked seems low
  - Limiting factor – nitrogen
- MLE NdeN
  - Check volume of tanks at 82 mgd
- 5-Stage Bardenpho N
  - Check capability for process: removal of P and N
  - Need to control P on the return stream
- Bardenpho NdeN
  - New BNR planned for expansion to 25 mgd
  - May move final clarifier to accommodate digesters
  - How will peak flows be handled in rapid sand filters?
- MBR NdeN: May have opportunity to do MBR at Ina when considering new tankage
- Comparison
  - Need to consider other facilities (sludge) expansion at Ina when the largest flows are considered not just NdeN processes
  - Less problem increasing Roger Road capacity than Ina Road, or make Ina Road tanks deeper
  - Details may change evaluation
- Look at Other Configurations of IFAS

Matrix Evaluation Criteria Comments

- Proven Process
  - Is process proven in BNR setting?
  - Concern that a process works in hot/cold weather
  - IFAS may be required to be piloted by ADEQ
- Operability
  - MBR – size of units – many hard to operate when not as designed properly
- IFAS economics may change if DO changes
- Site: Constructability issue with MBR; issue also with MLE

Ina Road Evaluation

- No difference on operability/proven process between Roger Road and Ina Road
- Have plants been proven for influent N of 55 mg/L → effluent 6 mg/L

Comments

- If 20 mgd at Roger Road, then trickling filters should be looked at
- Make sure decision is not totally driven by Bio P
- Leave real estate for Bio P removal; consider flow projections in system alternative evaluation,
- Evaluate processes to a higher level detail now, not later, to avoid skewing of the evaluation
- Risk element to using existing tankage
- Need to look at existing tanks – taking out of operation to assess condition/maintain
- What capacity does Tucson Water need?
- Minimum Q needed for river 7 or 12 mgd?
- Regulatory requirement for P removal?

Action Items

- GPS-X layouts to Dennis
- PC (Paul) provide IGA maps for setbacks
- Peer Group, Greeley and Hansen, and Pima County to reconcile process evaluation criteria (Ron R.). Comments to Jerry/Ron prior to next meeting
- Peer group to submit additional comments after workshop, request for additional information and provide comments on pass/fail matrix changes within 2 weeks
- Comments on last set of meeting notes to Ron Riska
- Use Bardenpho for system alternative evaluation
- Peer group
  - Any additional input
  - What do you want to see?
  - Comment on matrix (within two weeks, conference call)
- Use August 9th meeting for brainstorming meeting vs. technical processes. Ron Riska/Jerry Bish to organize early August meeting with Peer Group, which will include reconciling the pass/fail chart
- How good are costs at Roger Road for rehabilitation? Will start to address these in the August workshop.

Pima County Regional Optimization Master Plan

Workshop #5 and #6
NdeN Process Selection

July 12, 2006

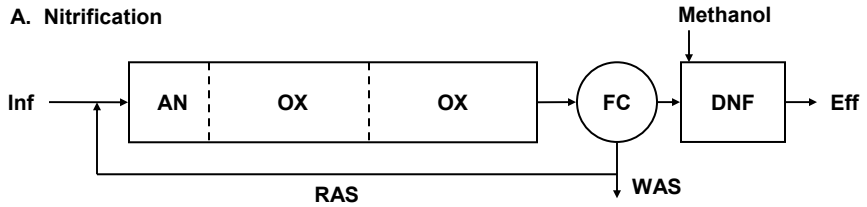
(Amended Pages–July 14, 2006)

Roger Road WWTP

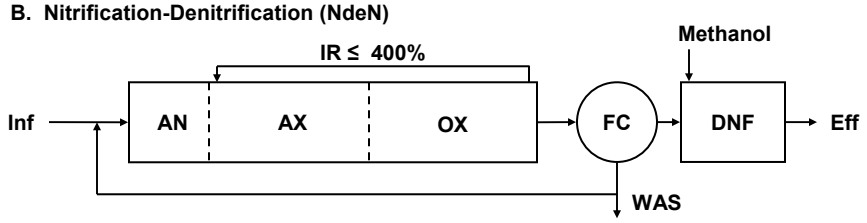
MLE

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

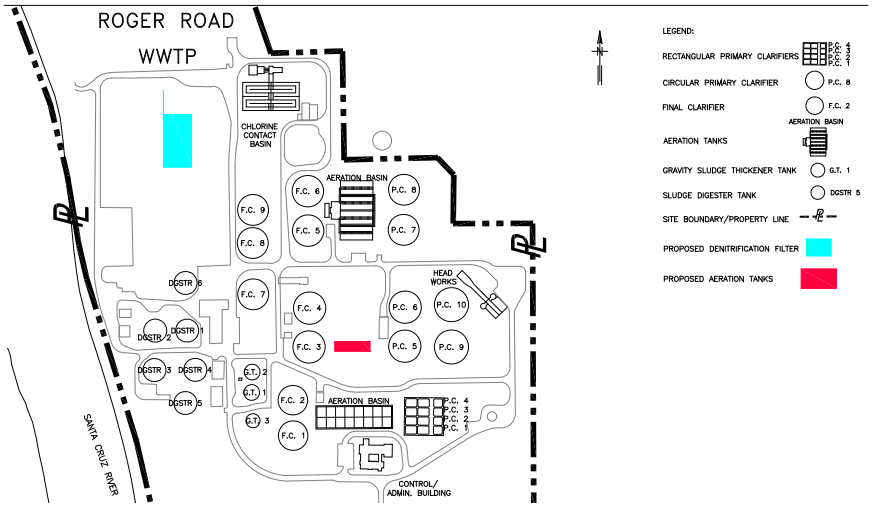
A. Nitrification



B. Nitrification-Denitrification (NdeN)



Process Type: MLE Nitrification
Plant Capacity: 20 MGD

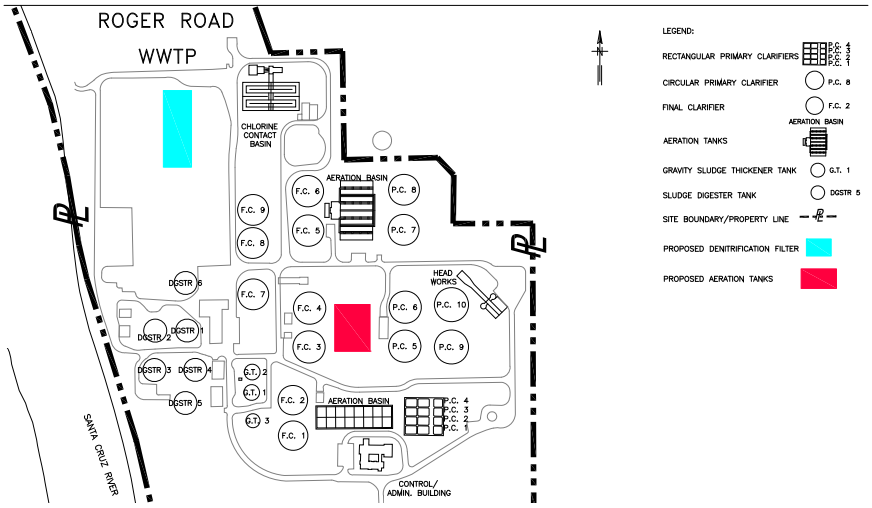


Process Type: MLE Nitrification
Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$1,400
Denitrification Filters	$21,000
Estimated Annual Power Cost	$900
Estimated Annual Methanol Cost	$700
Present Worth	$38,100

82

Process Type: MLE Nitrification
Plant Capacity: 32 MGD



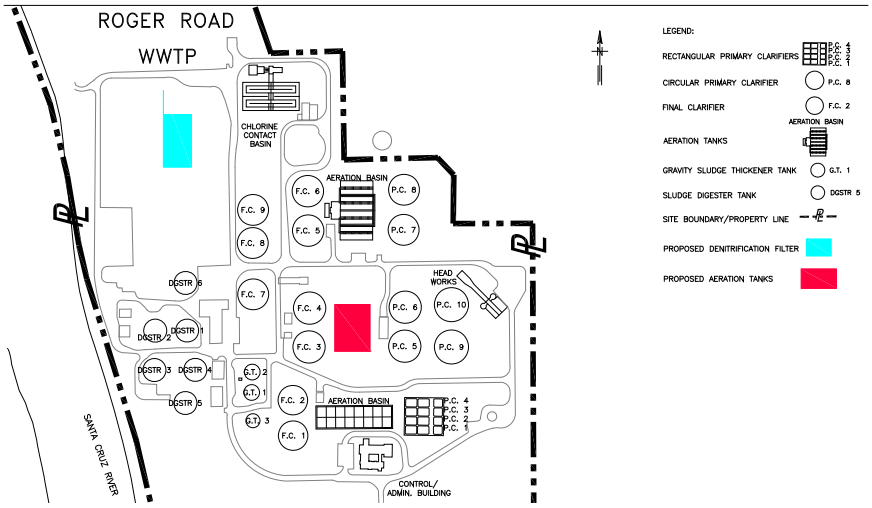
83

Process Type: MLE Nitrification
Plant Capacity: 32 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$7,700
Denitrification Filters	$33,600
Estimated Annual Power Cost	$1,400
Estimated Annual Methanol Cost	$1,100
Present Worth	$65,800

84

Process Type: MLE NdeN
Plant Capacity: 20 MGD



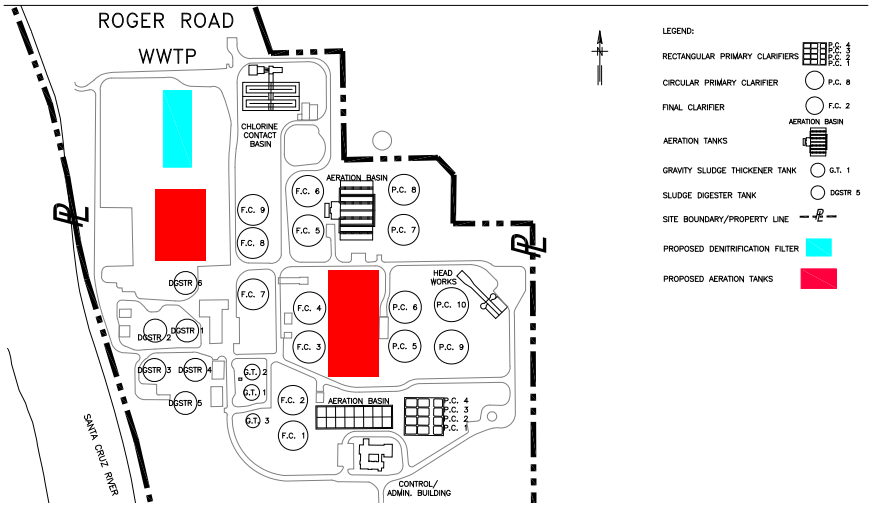
85

Process Type: MLE NdeN
Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$7,700
Denitrification Filters	$21,000
Estimated Annual Power Cost	$900
Estimated Annual Methanol Cost	$100
Present Worth	$37,800

86

Process Type: MLE NdeN
Plant Capacity: 32 MGD



87

Process Type: MLE NdeN
Plant Capacity: 32 MGD

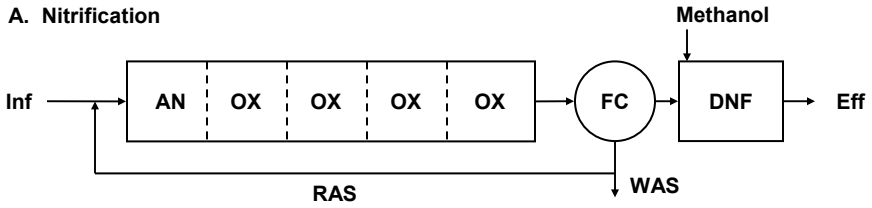
Item	*Cost ($1000's)*
Aeration Tanks	$17,900
Denitrification Filters	$33,600
Estimated Annual Power Cost	$1,500
Estimated Annual Methanol Cost	$160
Present Worth	$67,800

88

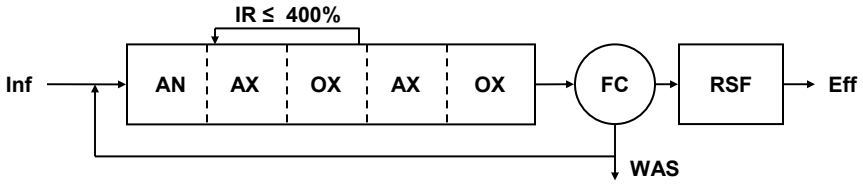
5-Stage Bardenpho

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

A. Nitrification

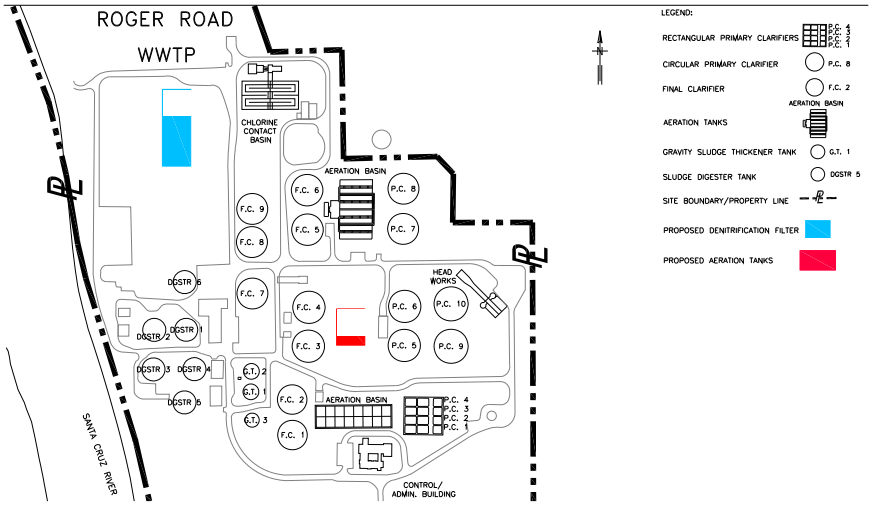


B. Nitrification-Denitrification (NdeN)



89

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 20 MGD



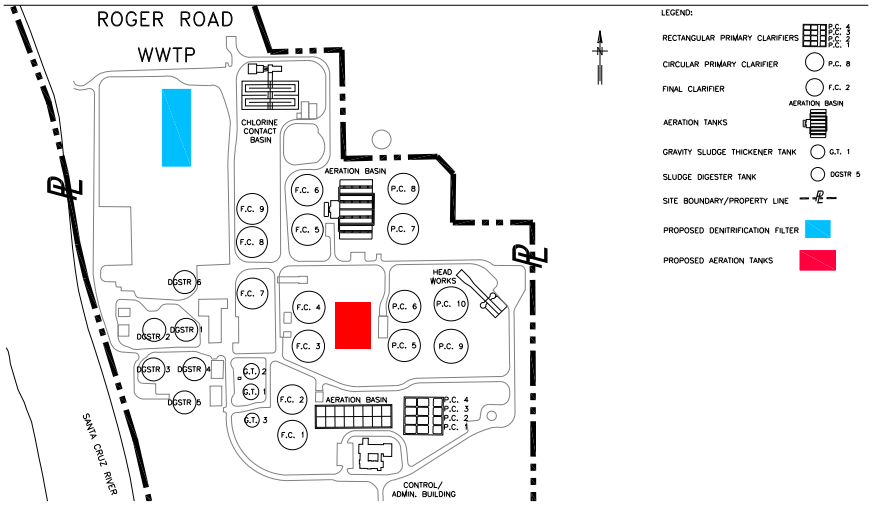
90

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$1,400
Denitrification Filters	$21,000
Estimated Annual Power Cost	$1,000
Estimated Annual Methanol Cost	$700
Present Worth	$39,100

91

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 32 MGD



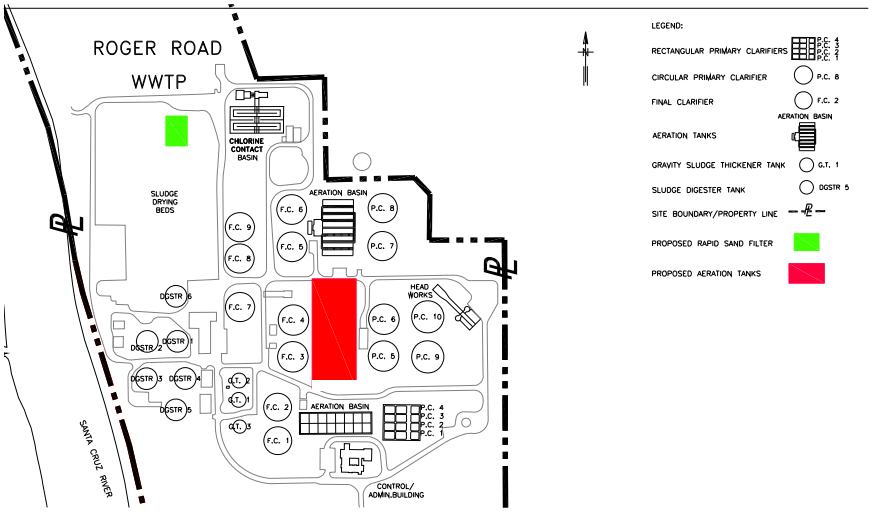
92

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 32 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$7,700
Denitrification Filters	$33,600
Estimated Annual Power Cost	$1,600
Estimated Annual Methanol Cost	$1,100
Present Worth	$67,800

93

Process Type: 5-Stage Bardenpho NdeN Plant Capacity: 20 MGD



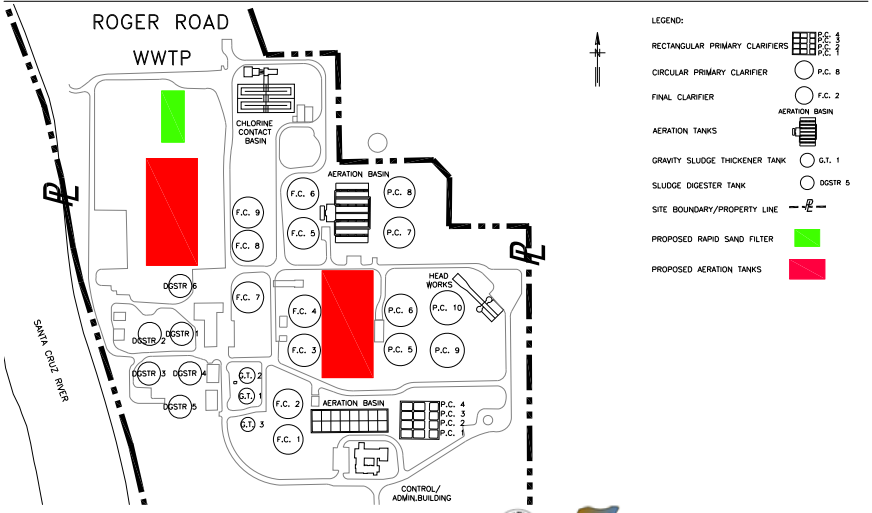
94

Process Type: 5-Stage Bardenpho NdeN Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$10,400
Rapid Sand Filters	$8,100
Estimated Annual Power Cost	$1,000
Estimated Annual Methanol Cost	$0
Present Worth	$28,300

95

Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 32 MGD



96

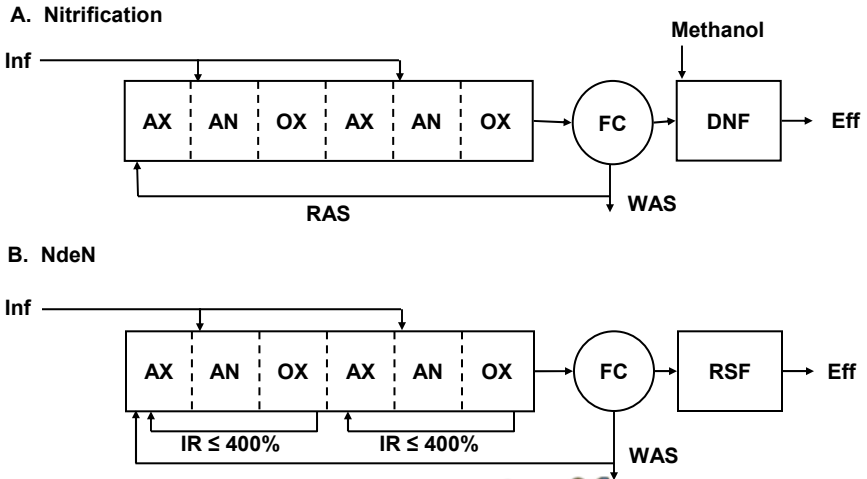
Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 32 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$22,300
Rapid Sand Filters	$12,900
Estimated Annual Power Cost	$1,600
Estimated Annual Methanol Cost	$0
Present Worth	$50,900

97

Step Feed

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter



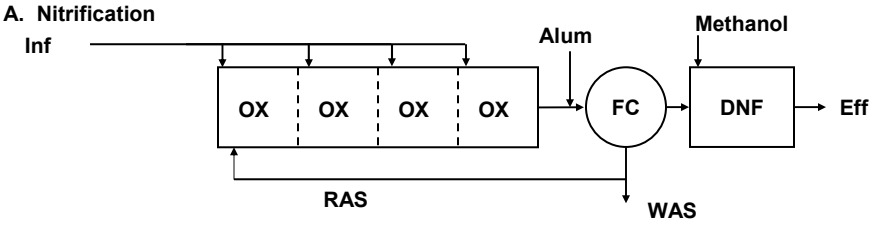
Step Feed

- Step Feed dropped for further consideration:
  - Does not utilize tankage efficiently for complete Nitrification
  - Does not utilize tankage efficiently for Bio P
  - Requires two sets of Recycle Pumps

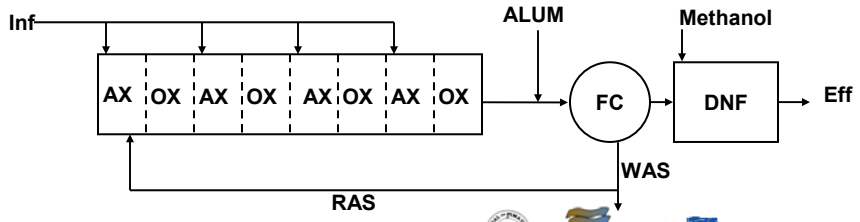
Step Feed – With Alum and Methanol

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

A. Nitrification

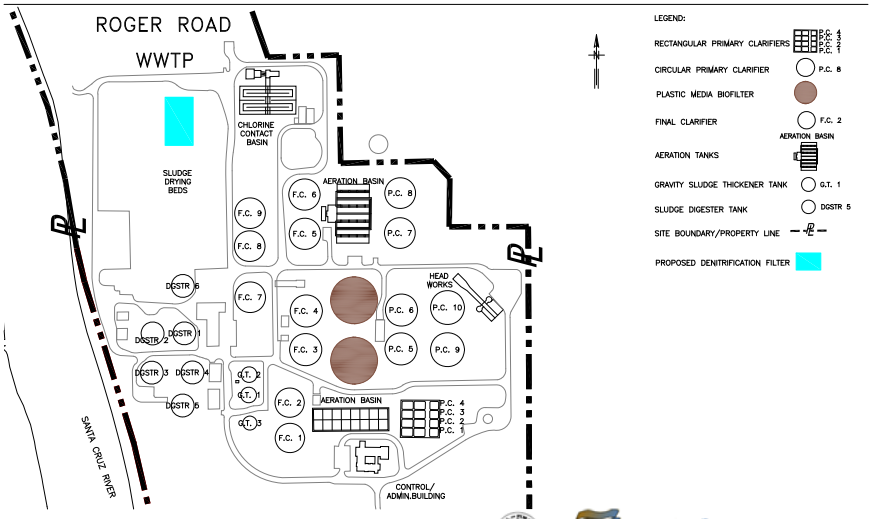


B. NdeN



100

Process Type: Step Feed Nitrification – With Alum and Methanol: Plant Capacity: 20 MGD



101

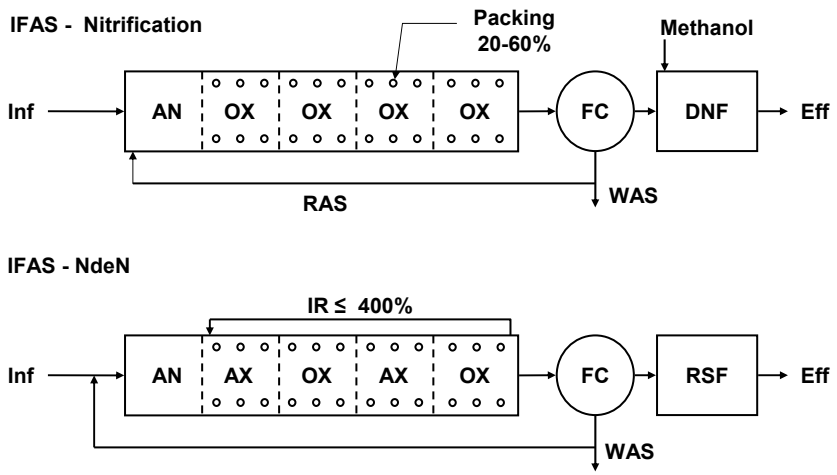
Process Type: Step Feed Nitrification – With Alum and Methanol: Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$0
Denitrification Filters	$21,000
Estimated Annual Methanol Cost	$900
Estimated Annual Alum Cost	$1,600
Estimated Annual Power Cost	$900
Estimated Annual Add'l Sludge Cost	$400
Present Worth	$58,400

102

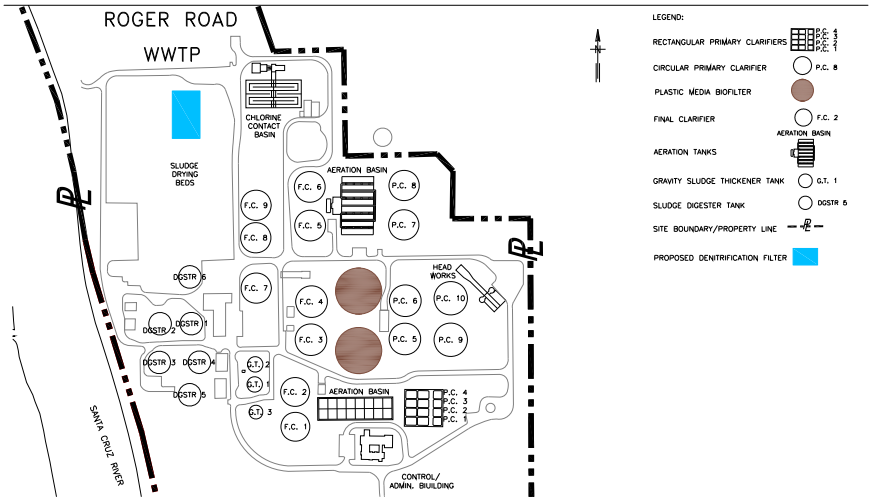
IFAS

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter



103

Process Type: IFAS Nitrification
Plant Capacity: 20 MGD



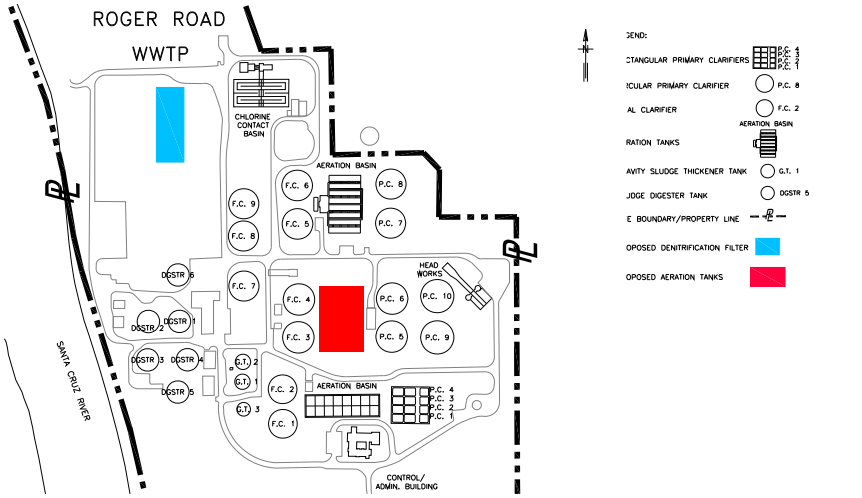
104

Process Type: IFAS Nitrification
Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks (Addition of IFAS Media)	$5,700
Denitrification Filters	$21,000
Estimated Annual Power Cost	$1,500
Estimated Annual Methanol Cost	$600
Present Worth	$41,600

105

Process Type: IFAS Nitrification
Plant Capacity: 32 MGD



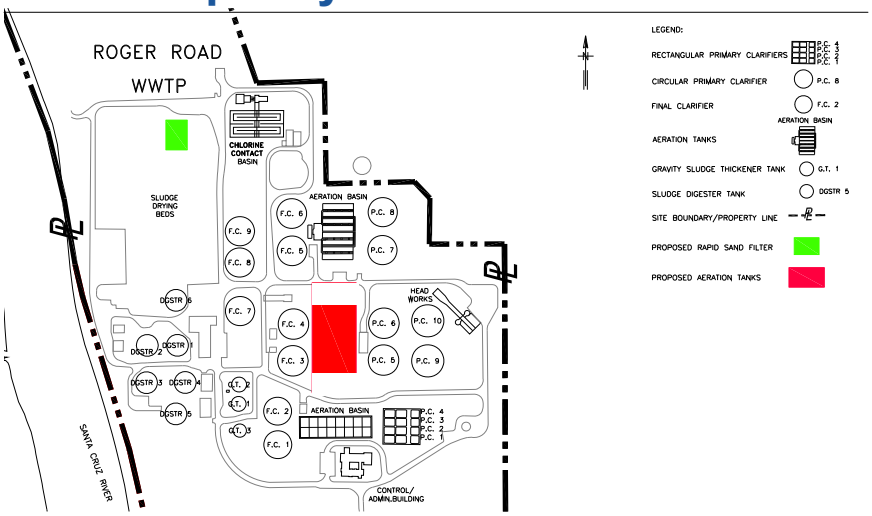
106

Process Type: IFAS Nitrification
Plant Capacity: 32 MGD

Item	Cost ($1000's)
Aeration Tanks	$10,500
Denitrification Filters	$33,600
Estimated Annual Power Cost	$2,400
Estimated Annual Methanol Cost	$1000
Present Worth	$76,800

107

Process Type: IFAS NdeN
Plant Capacity: 20 MGD



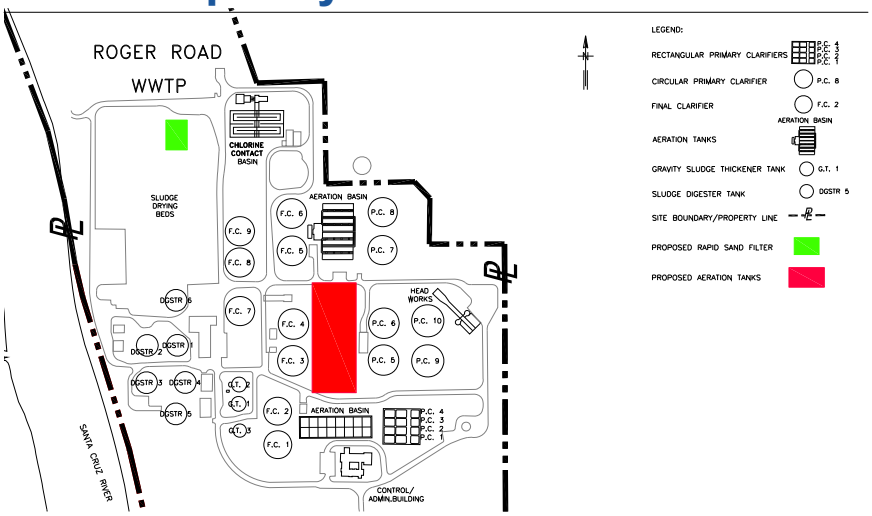
108

Process Type: IFAS NdeN
Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$10,200
Rapid Sand Filters	$8,100
Estimated Annual Power Cost	$1,500
Estimated Annual Methanol Cost	$0
Present Worth	$33,000

109

Process Type: IFAS NdeN
Plant Capacity: 32 MGD



110

Process Type: IFAS NdeN
Plant Capacity: 32 MGD

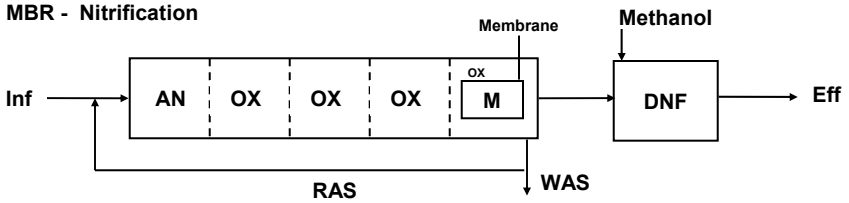
Item	*Cost ($1000's)*
Aeration Tanks	$21,900
Rapid Sand Filters	$12,900
Estimated Annual Power Cost	$2,400
Estimated Annual Methanol Cost	$0
Present Worth	$58,400

111

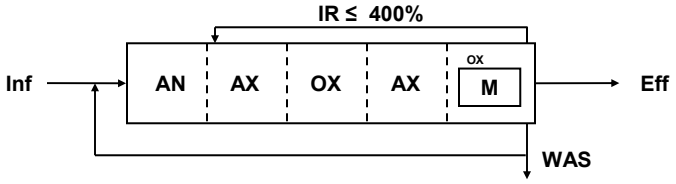
MBR

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

MBR - Nitrification

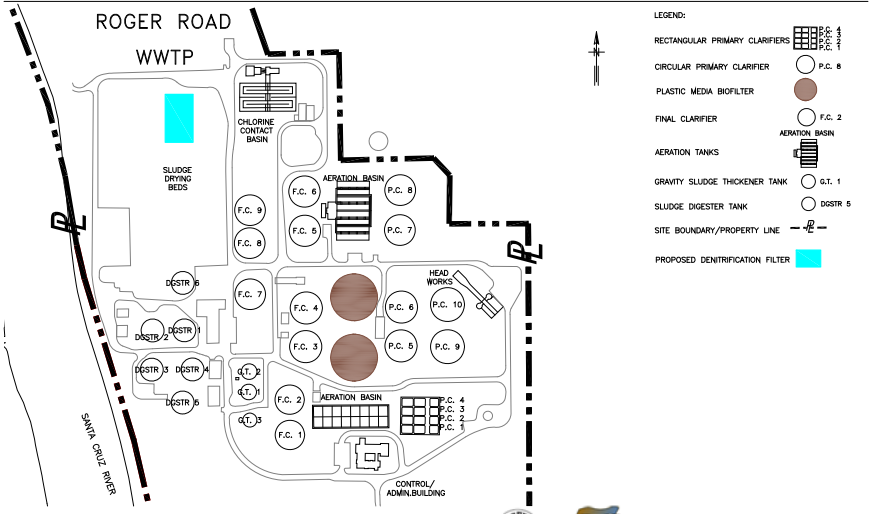


MBR - NdeN



112

Process Type: MBR Nitrification
Plant Capacity: 20 MGD



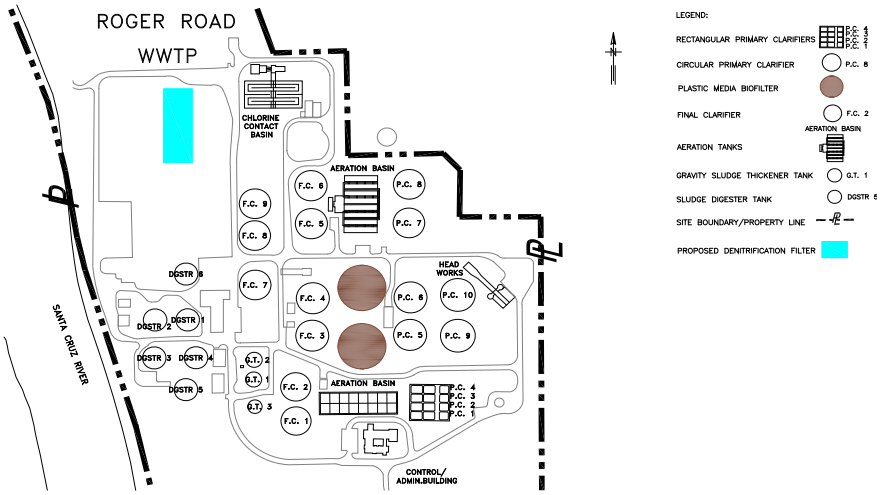
113

Process Type: MBR Nitrification
Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks (Add Membrane System to Existing AT's)	$71,500
Denitrification Filters	$21,000
Estimated Annual Power Cost	$2,900
Estimated Annual Methanol Cost	$500
Present Worth	$125,900

114

Process Type: MBR Nitrification.
Plant Capacity: 32 MGD



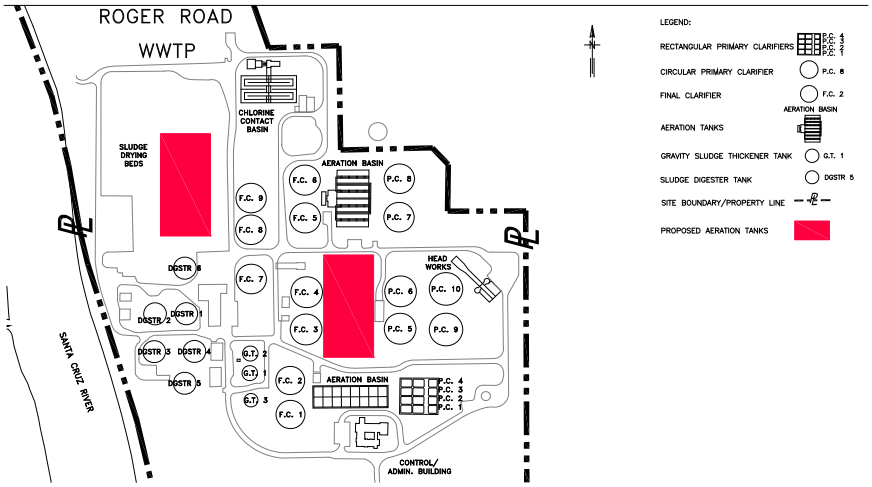
115

Process Type: MBR Nitrification
Plant Capacity: 32 MGD

Item	*Cost ($1000's)*
Aeration Tanks (Add Membrane System to Existing AT's)	$114,400
Denitrification Filters	$33,600
Estimated Annual Power Cost	$4,700
Estimated Annual Methanol Cost	$800
Present Worth	$201,900

116

Process Type: MBR NdeN
Plant Capacity: 20 MGD



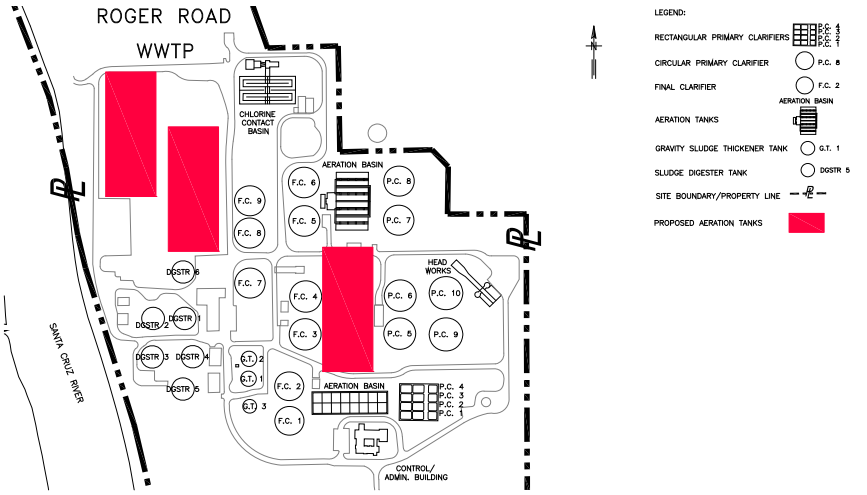
117

Process Type: MBR NdeN
Plant Capacity: 20 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$78,900
Rapid Sand Filters	$0
Estimated Annual Power Cost	$2,900
Estimated Annual Methanol Cost	$0
Present Worth	$107,400

118

Process Type: MBR NdeN
Plant Capacity: 32 MGD



119

Process Type: MBR NdeN
Plant Capacity: 32 MGD

Item	*Cost ($1000's)*
Aeration Tanks	$148,000
Rapid Sand Filters	$0
Estimated Annual Power Cost	$4,600
Estimated Annual Methanol Cost	$0
Present Worth	$193,200

120

20-mgd Capacity – Nitrification vs. NdeN

Process	*Nitrification* *Present Worth ($1000's)*	*NdeN* *Present Worth ($1000's)*
MLE	$38,100	$37,800
5-Stage Bardenpho	$39,100	$28,300
IFAS	$41,600	$33,000
MBR	$125,900	$107,400

121

32-mgd Capacity – Nitrification vs. NdeN

Process	*Nitrification* *Present Worth ($1000's)*	*NdeN* *Present Worth ($1000's)*
MLE	$65,800	$67,800
5-Stage Bardenpho	$67,800	$50,900
IFAS	$76,800	$58,400
MBR	$201,900	$193,200

122

Pima County Wastewater Management Department

GREELEY AND HANSEN

Pima County Wastewater Management Department

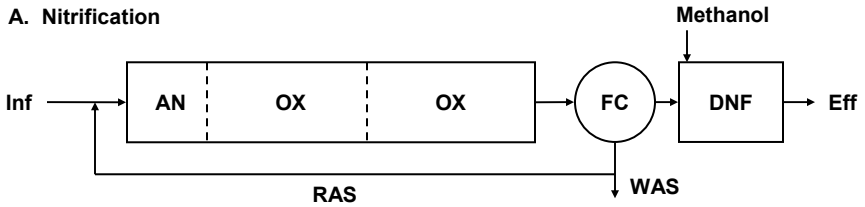
GREELEY AND HANSEN

Ina Road WPCF

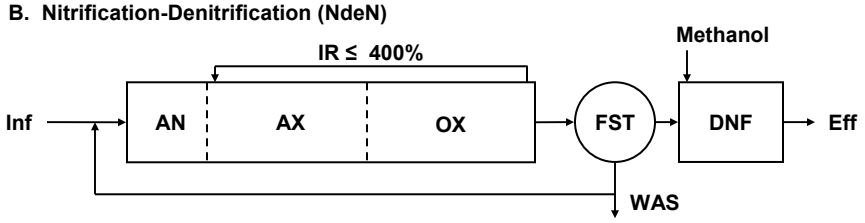
MLE

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

A. Nitrification

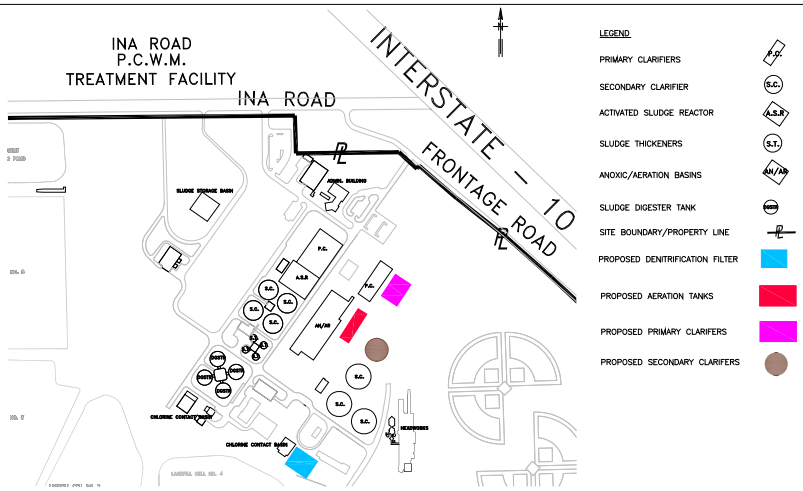


B. Nitrification-Denitrification (NdeN)



124

Process Type: MLE Nitrification
Plant Capacity: 50 MGD



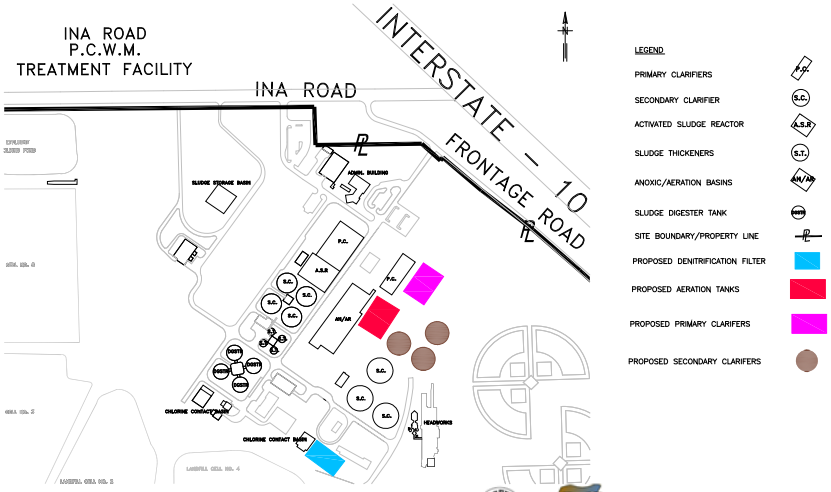
125

Process Type: MLE Nitrification
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$22,800
Denitrification Filters	$52,500
Estimated Annual Power Cost	$2,500
Estimated Annual Methanol Cost	$1,700
Present Worth	$116,000

126

Process Type: MLE Nitrification
Plant Capacity: 62 MGD



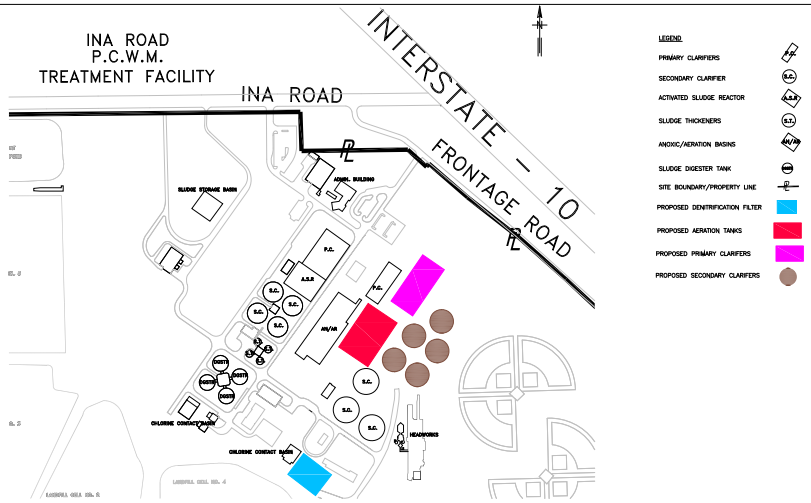
127

Process Type: MLE Nitrification
Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$59,900
Denitrification Filters	$65,100
Estimated Annual Power Cost	$2,900
Estimated Annual Methanol Cost	$2000
Present Worth	$156,000

128

Process Type: MLE Nitrification
Plant Capacity: 82 MGD



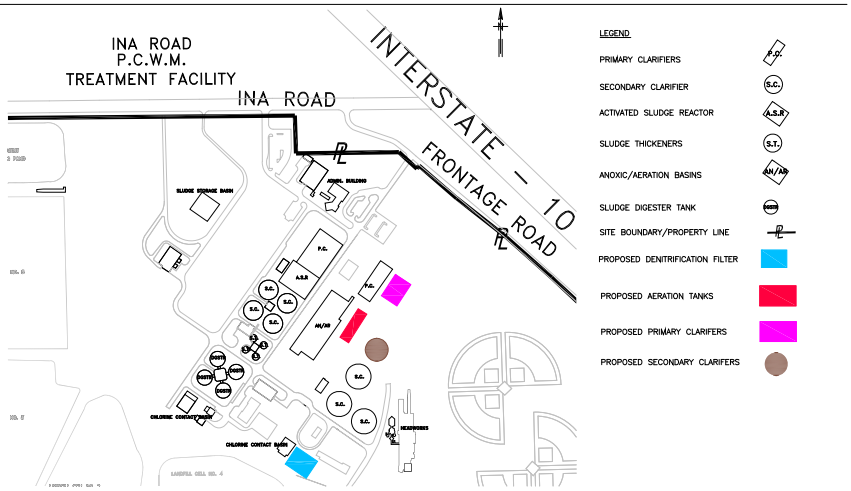
129

Process Type: MLE Nitrification
Plant Capacity: 82 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$69,700
Denitrification Filters	$86,100
Estimated Annual Power Cost	$4,100
Estimated Annual Methanol Cost	$2,700
Present Worth	$222,700

130

Process Type: MLE NdeN
Plant Capacity: 50 MGD



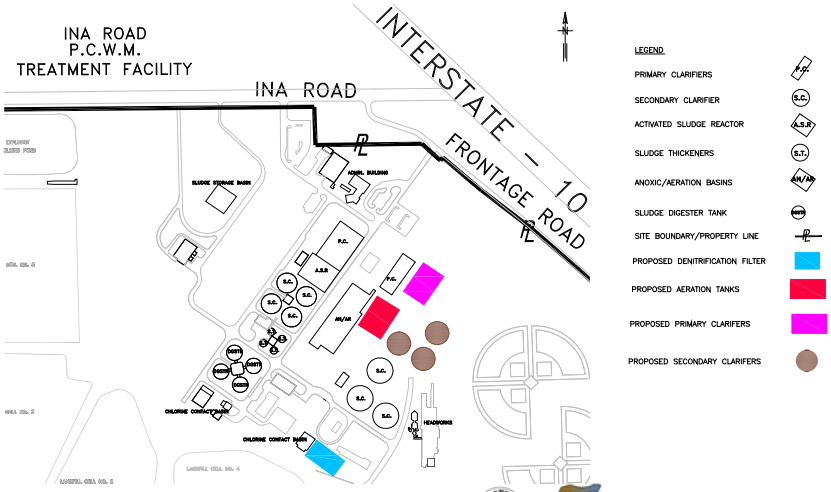
131

Process Type: MLE NdeN
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$38,500
Denitrification Filters	$52,500
Estimated Annual Power Cost	$2,300
Estimated Annual Methanol Cost	$200
Present Worth	$115,500

132

Process Type: MLE NdeN
Plant Capacity: 62 MGD



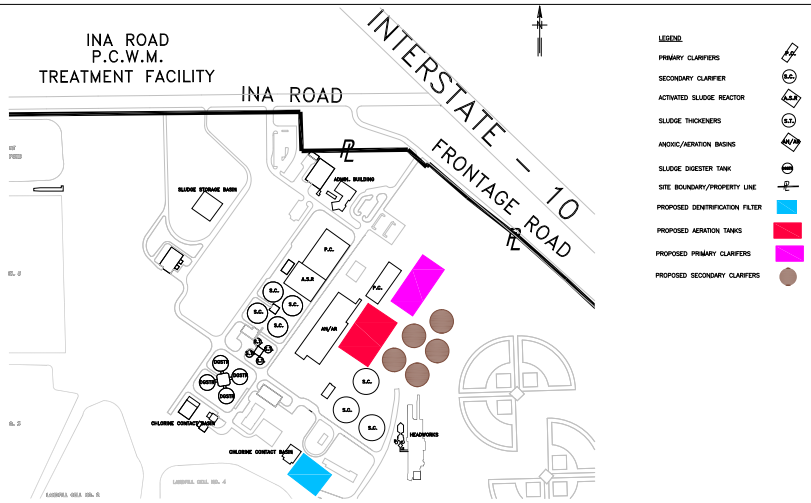
133

Process Type: MLE NdeN
Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$59,900
Denitrification Filters	65,100
Estimated Annual Power Cost	$2,900
Estimated Annual Methanol Cost	$200
Present Worth	$155,400

134

Process Type: MLE NdeN
Plant Capacity: 82 MGD



135

Process Type: MLE NdeN
Plant Capacity: 82 MGD

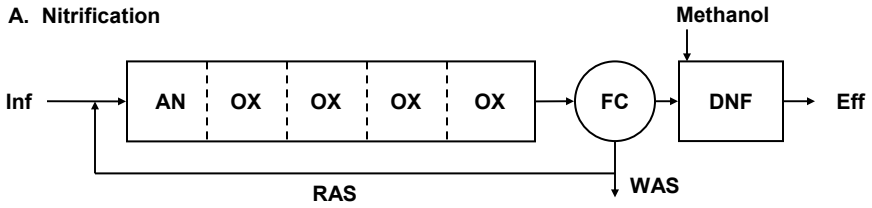
Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$95,600
Denitrification Filters	$86,100
Estimated Annual Power Cost	$3,800
Estimated Annual Methanol Cost	$300
Present Worth	$222,000

136

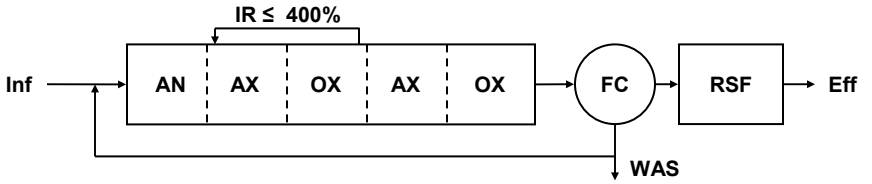
5-Stage Bardenpho

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

A. Nitrification

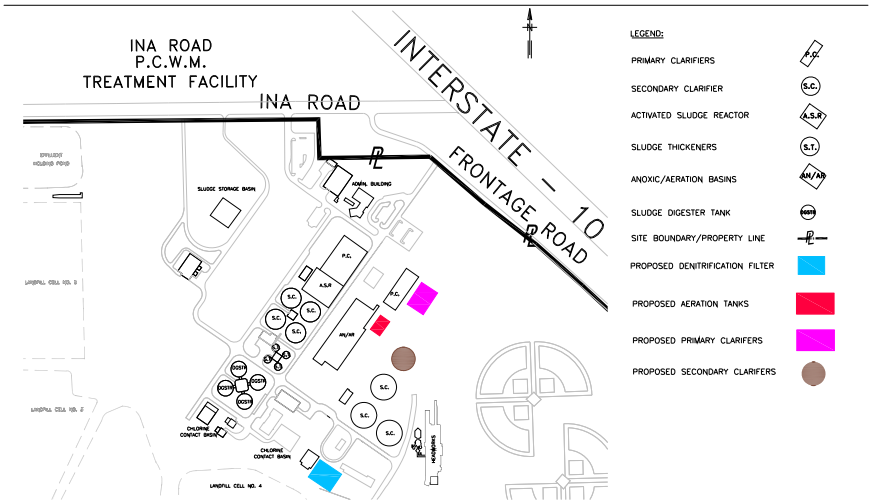


B. Nitrification-Denitrification (NdeN)



137

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 50 MGD



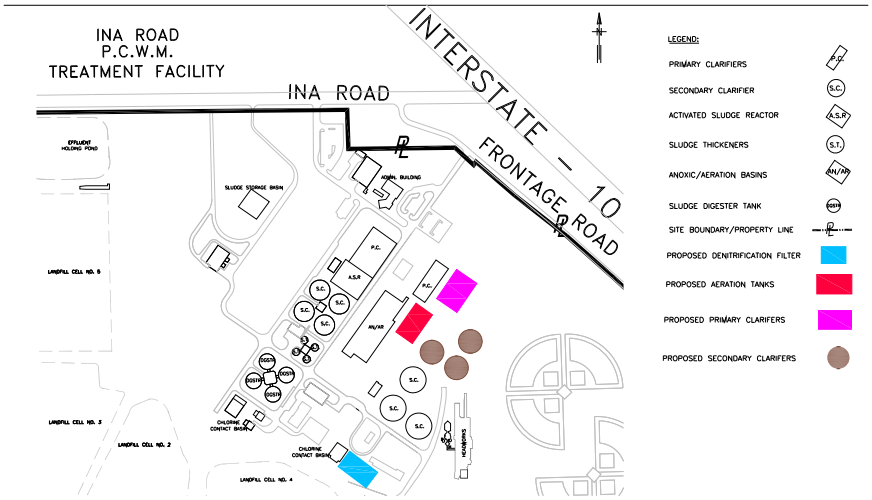
138

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$11,500
Denitrification Filters	$52,500
Estimated Annual Power Cost	$2,500
Estimated Annual Methanol Cost	$1,700
Present Worth	$104,700

139

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 62 MGD



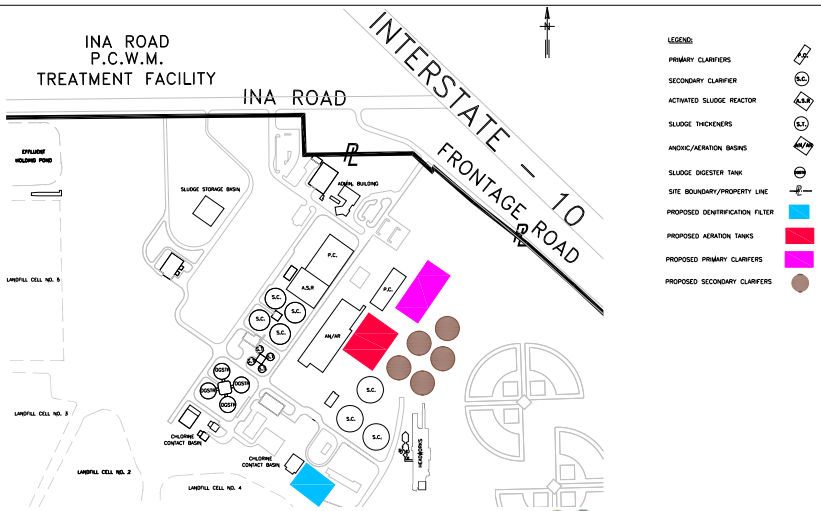
140

Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$27,200
Denitrification Filters	$65,100
Estimated Annual Power Cost	$3,100
Estimated Annual Methanol Cost	$2,000
Present Worth	$142,900

141

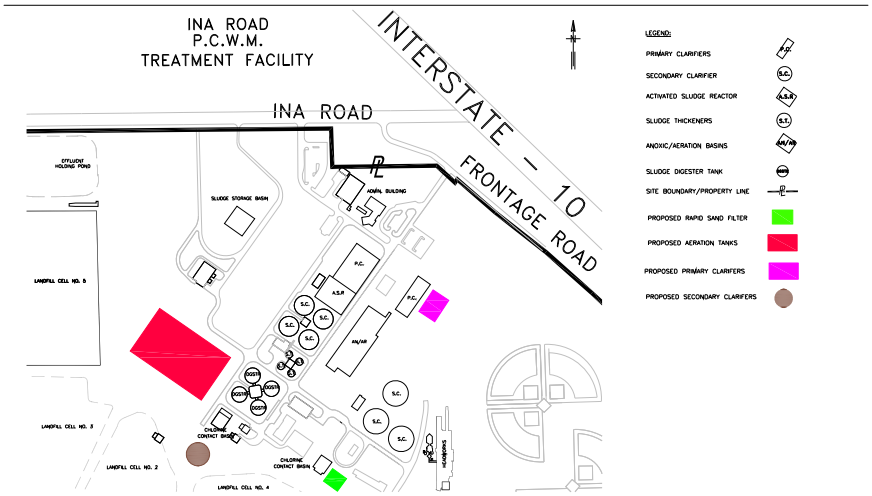
Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 82 MGD



Process Type: 5-Stage Bardenpho Nitrification – Plant Capacity: 82 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$69,700
Denitrification Filters	$86,100
Estimated Annual Power Cost	$4,100
Estimated Annual Methanol Cost	$2,700
Present Worth	$222,700

Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 50 MGD



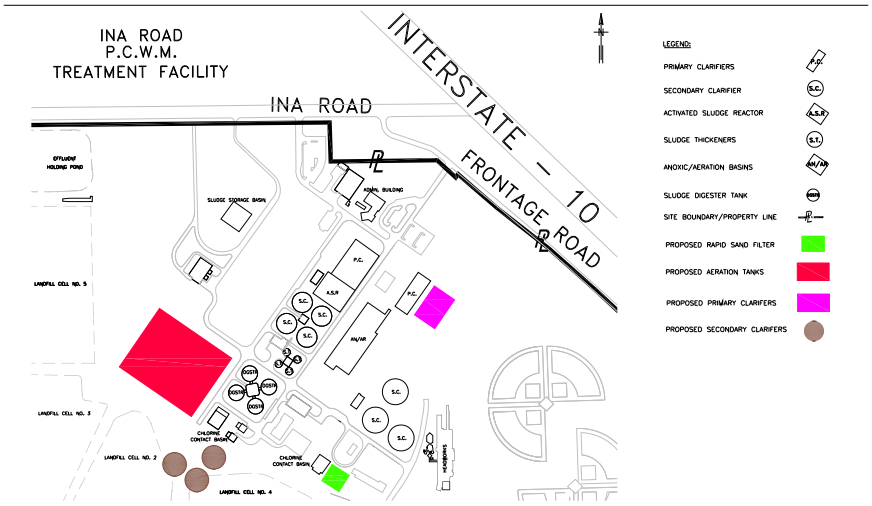
144

Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$45,400
Rapid Sand Filters	$20,100
Estimated Annual Power Cost	$2,300
Estimated Annual Methanol Cost	$0
Present Worth	$88,100

145

Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 62 MGD



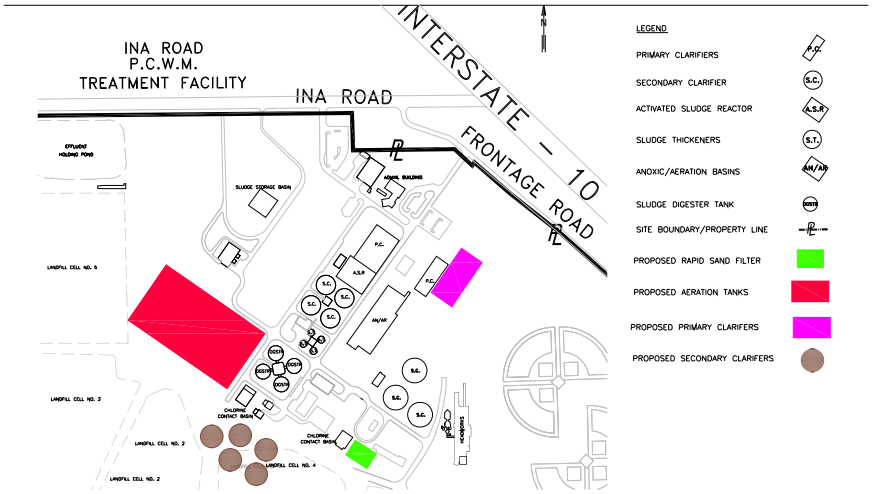
146

Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$68,400
Rapid Sand Filters	$25,000
Estimated Annual Power Cost	$2,900
Estimated Annual Methanol Cost	$0
Present Worth	$121,900

147

Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 82 MGD



148

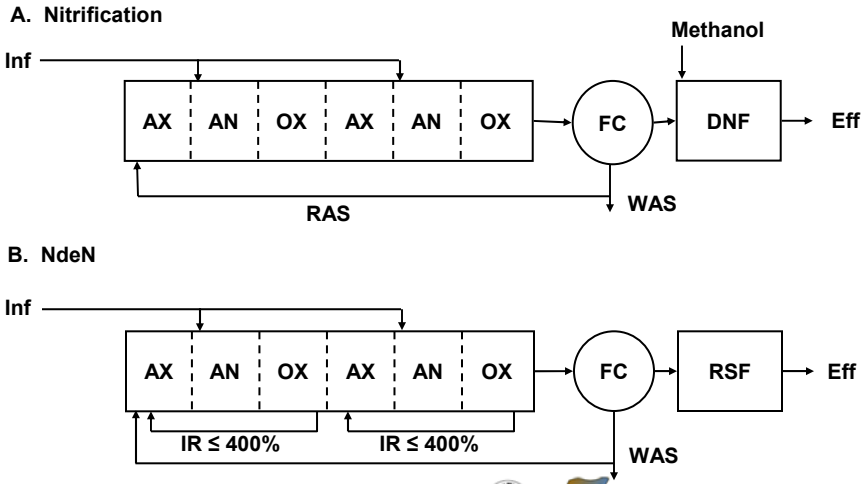
Process Type: 5-Stage Bardenpho NdeN
Plant Capacity: 82 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$106,900
Rapid Sand Filters	$33,000
Estimated Annual Power Cost	$3,800
Estimated Annual Methanol Cost	$0
Present Worth	$177,200

149

Step Feed

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter



150

Step Feed

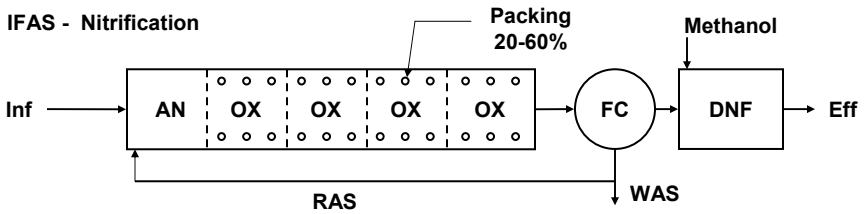
- Step Feed dropped for further consideration:
  - Same reasons as stated for Roger Road WWTP

151

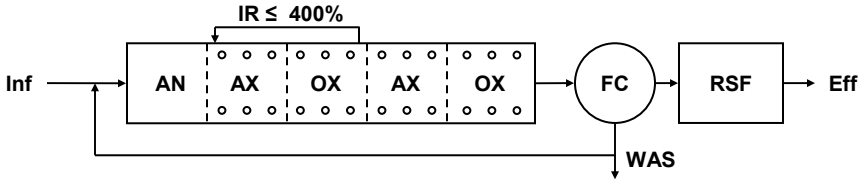
IFAS

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

IFAS - Nitrification

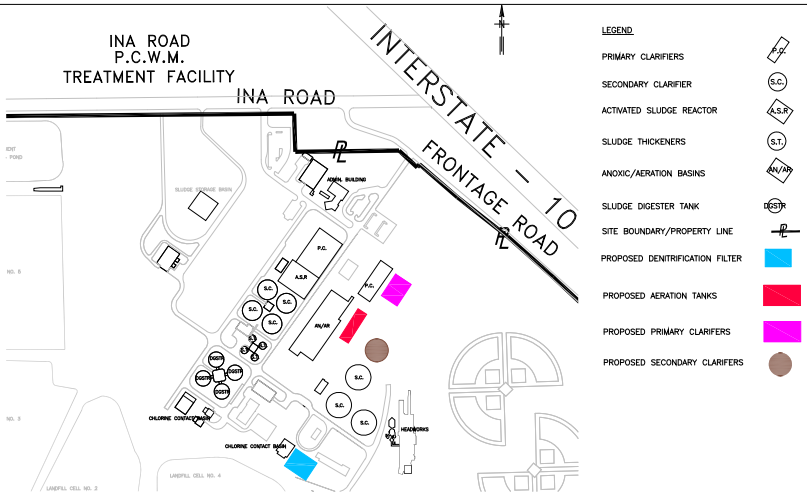


IFAS - NdeN



152

Process Type: IFAS Nitrification
Plant Capacity: 50 MGD



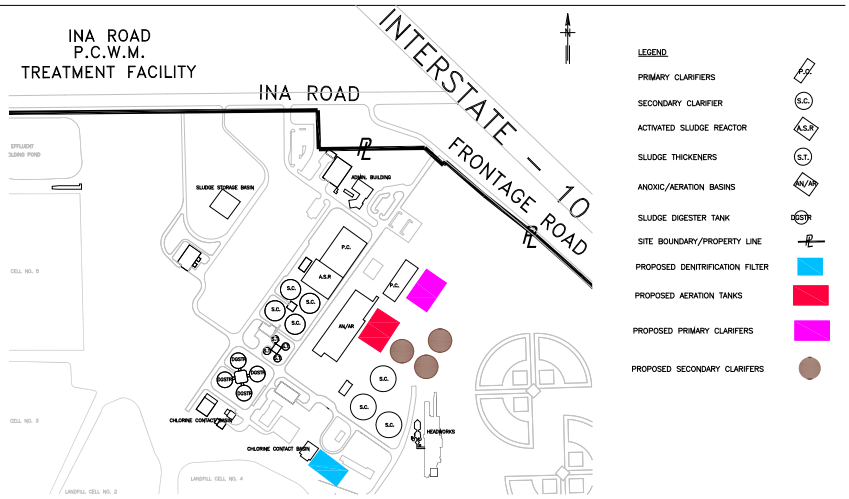
153

Process Type: IFAS Nitrification
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$39,700
Denitrification Filters	$52,500
Estimated Annual Power Cost	$3,900
Estimated Annual Methanol Cost	$1,500
Present Worth	$134,100

154

Process Type: IFAS Nitrification
Plant Capacity: 62 MGD



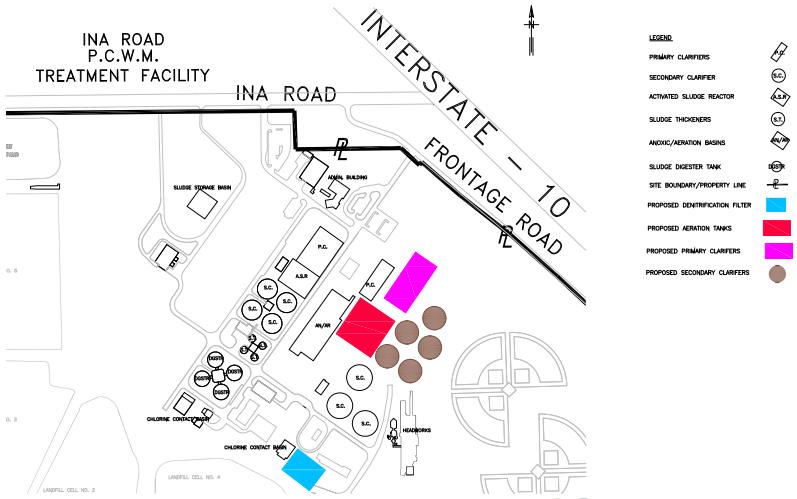
155

Process Type: IFAS Nitrification
Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$50,300
Denitrification Filters	$65,100
Estimated Annual Power Cost	$4,800
Estimated Annual Methanol Cost	$1,800
Present Worth	$180,200

156

Process Type: IFAS Nitrification
Plant Capacity: 82 MGD



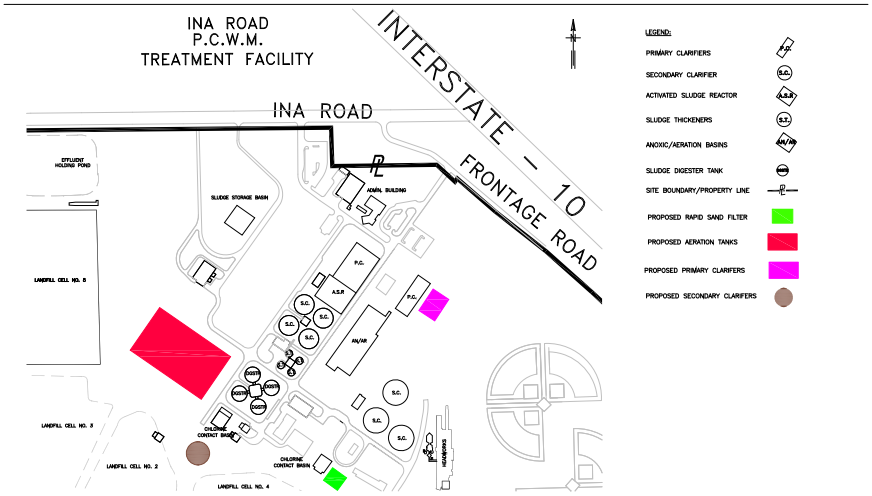
157

Process Type: IFAS Nitrification
Plant Capacity: 82 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$91,100
Denitrification Filters	$86,100
Estimated Annual Power Cost	$6,400
Estimated Annual Methanol Cost	$2,400
Present Worth	$263,300

158

Process Type: IFAS NdeN
Plant Capacity: 50 MGD



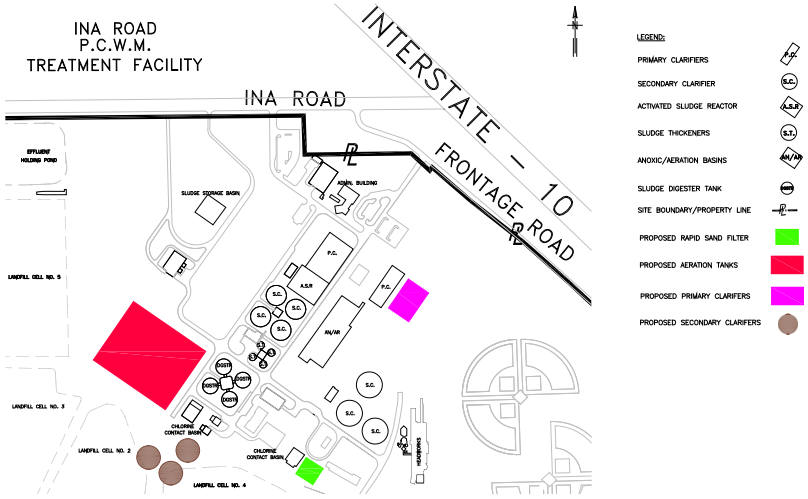
159

Process Type: IFAS NdeN
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$67,400
Rapid Sand Filters	$20,100
Estimated Annual Power Cost	$3,900
Estimated Annual Methanol Cost	$0
Present Worth	$125,800

160

Process Type: IFAS NdeN
Plant Capacity: 62 MGD



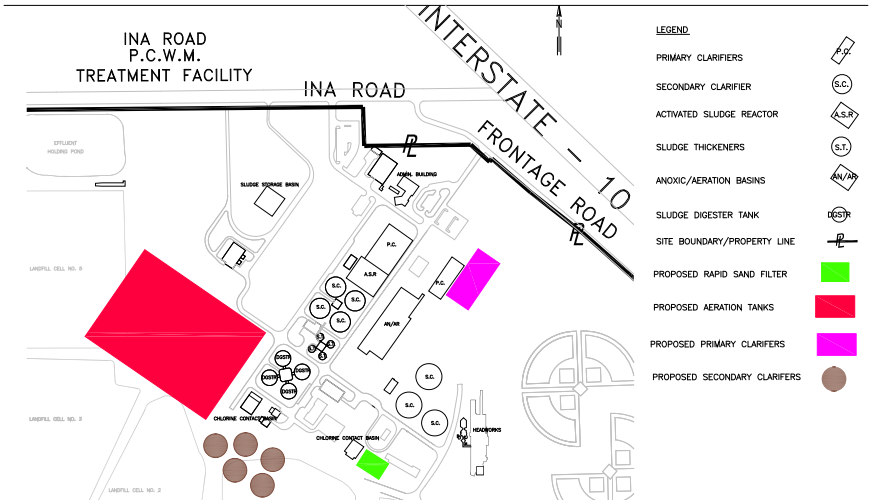
161

Process Type: IFAS NdeN
Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$86,800
Rapid Sand Filters	$25,000
Estimated Annual Power Cost	$4,800
Estimated Annual Methanol Cost	$0
Present Worth	$159,900

162

Process Type: IFAS NdeN
Plant Capacity: 82 MGD



163

Process Type: IFAS NdeN
Plant Capacity: 82 MGD

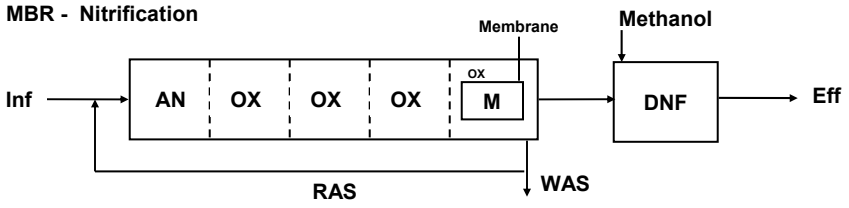
Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$123,300
Rapid Sand Filters	$33,000
Estimated Annual Power Cost	$6,400
Estimated Annual Methanol Cost	$0
Present Worth	$219,100

164

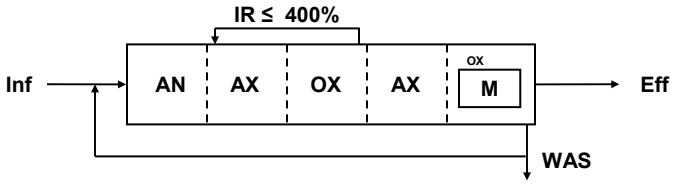
MBR

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

MBR - Nitrification

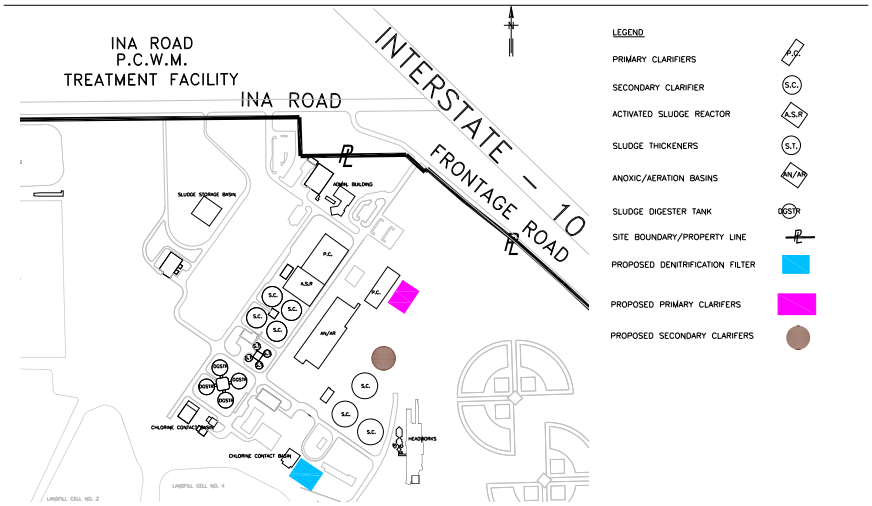


MBR - NdeN



165

Process Type: MBR Nitrification
Plant Capacity: 50 MGD



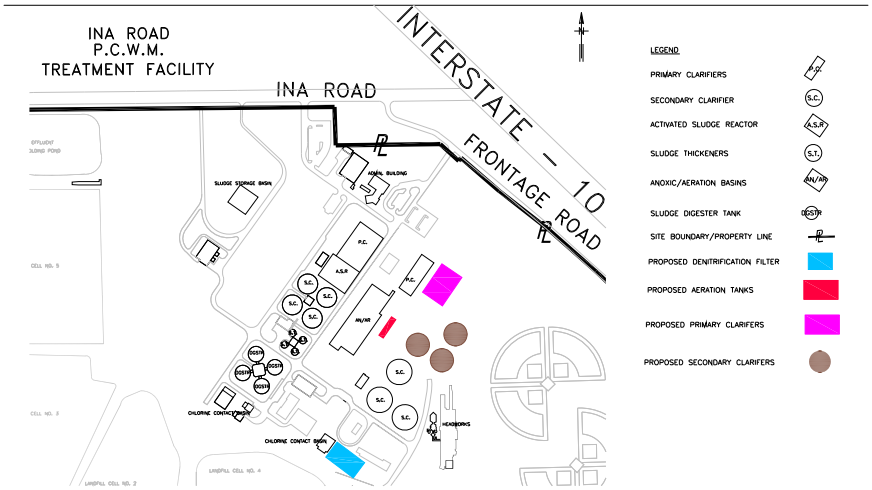
166

Process Type: MBR Nitrification
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks (Addition of Membranes to Existing Aeration Tanks) and Secondary Clarifiers	$188,800
Denitrification Filters	$52,500
Estimated Annual Power Cost	$6,500
Estimated Annual Methanol Cost	$1,200
Present Worth	$317,300

167

Process Type: MBR Nitrification. Plant Capacity: 62 MGD



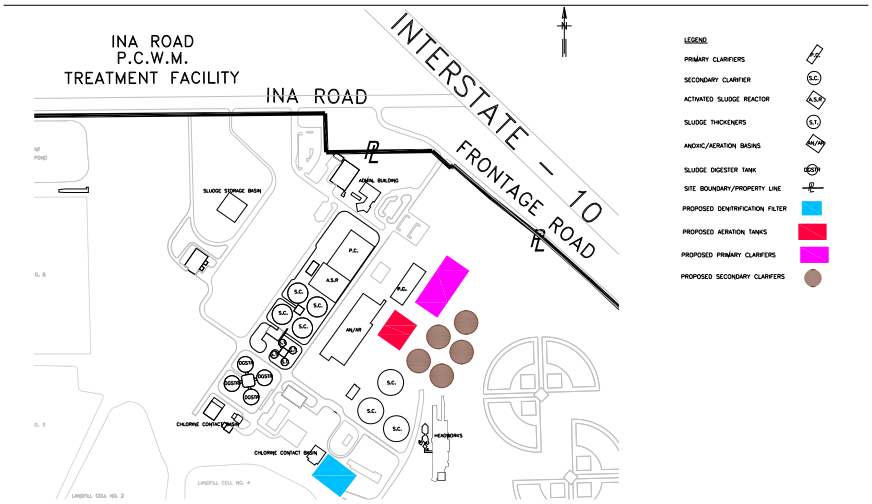
168

Process Type: MBR Nitrification. Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$243,800
Denitrification Filters	$65,100
Estimated Annual Power Cost	$8,000
Estimated Annual Methanol Cost	$1,500
Present Worth	$402,500

169

Process Type: MBR Nitrification. Plant Capacity: 82 MGD



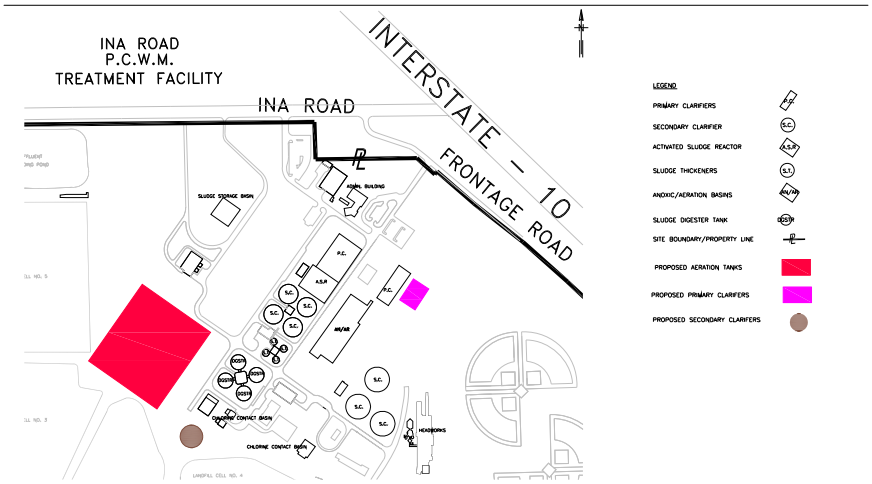
170

Process Type: MBR Nitrification. Plant Capacity: 82 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$339,900
Denitrification Filters	$86,100
Estimated Annual Power Cost	$10,600
Estimated Annual Methanol Cost	$2,000
Present Worth	$550,000

171

Process Type: MBR NdeN
Plant Capacity: 50 MGD



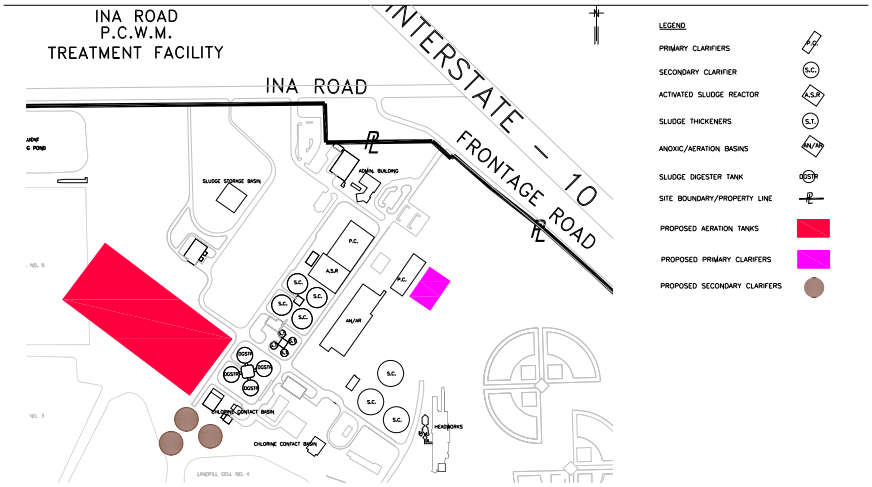
172

Process Type: MBR NdeN
Plant Capacity: 50 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$231,600
Rapid Sand Filters	$0
Estimated Annual Power Cost	$6,500
Estimated Annual Methanol Cost	$0
Present Worth	$305,400

173

Process Type: MBR NdeN
Plant Capacity: 62 MGD



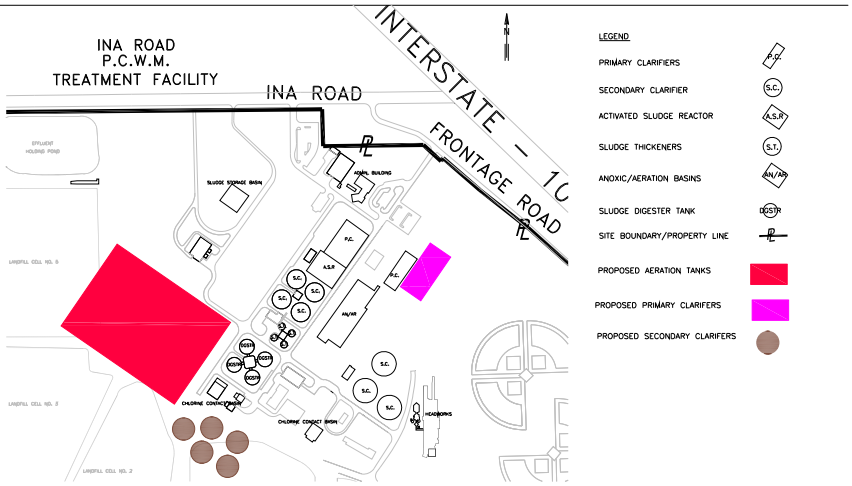
174

Process Type: MBR NdeN
Plant Capacity: 62 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$308,400
Rapid Sand Filters	$0
Estimated Annual Power Cost	$8,000
Estimated Annual Methanol Cost	$0
Present Worth	$386,900

175

Process Type: MBR NdeN
Plant Capacity: 82 MGD



176

Process Type: MBR NdeN
Plant Capacity: 82 MGD

Item	*Cost ($1000's)*
Primary Clarifiers, Aeration Tanks and Secondary Clarifiers	$419,700
Rapid Sand Filters	$0
Estimated Annual Power Cost	$10,600
Estimated Annual Methanol Cost	$0
Present Worth	$523,800

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50-mgd Capacity – Nitrification vs. NdeN

Process	*Nitrification* *Present Worth ($1000's)*	*NdeN* *Present Worth ($1000's)*
MLE	$116,000	$115,500
5-Stage Bardenpho	$104,700	$88,100
IFAS	$134,100	$125,800
MBR	$317,300	$305,400

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62-mgd Capacity – Nitrification vs. NdeN

Process	*Nitrification* *Present Worth ($1000's)*	*NdeN* *Present Worth ($1000's)*
MLE	$156,000	$155,400
5-Stage Bardenpho	$142,900	$121,900
IFAS	$180,200	$159,900
MBR	$402,500	$386,900

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82-mgd Capacity – Nitrification vs. NdeN

Process	*Nitrification* *Present Worth ($1000's)*	*NdeN* *Present Worth ($1000's)*
MLE	$222,700	$222,000
5-Stage Bardenpho	$222,700	$177,200
IFAS	$263,300	$219,100
MBR	$550,000	$523,800

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Present Worth Comparison of Existing Plan, Transfer Some and Transfer All – $1000's

Process *Nitrification*	*Existing* *RR = 32 MGD* *IR = 50 MGD*	*Transfer Some* *RR = 20 MGD* *IR = 62 MGD*	*Transfer All* *RR = 0 MGD* *IR = 82 MGD*
MLE	$181,800	$194,100	$222,700
5-Stage Bardenpho	$172,500	$182,000	$227,900
IFAS	$210,900	$221,800	$263,300
MBR	$519,200	$528,400	$550,000

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Present Worth Comparison of Existing Plan, Transfer Some and Transfer All – $1000's

Process *NdeN*	*Existing* *RR = 32 MGD* *IR = 50 MGD*	*Transfer Some* *RR = 20 MGD* *IR = 62 MGD*	*Transfer All* *RR = 0 MGD* *IR = 82 MGD*
MLE	$183,300	$193,200	$222,000
5-Stage Bardenpho	$139,000	$150,200	$177,200
IFAS	$184,200	$192,900	$219,100
MBR	$498,600	$494,300	$523,800

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Pima County Wastewater Management Department

GREELEY AND HANSEN

Matrix Evaluation

Gordon Culp

Matrix Evaluation

ROGER ROAD	*MLE NIT*	*MLE NdeN*	*Bardenpho NIT*	*Bardenpho NdeN*	*IFAS NIT*	*IFAS NdeN*	*MBR NIT*	*MBR NdeN*
Operability	+	0	+	0	+	0	-	-
Proven Process	+	+	+	+	0	0	-	-
Present Worth Cost, Capital + O&M								
Site Compatibility								
Resource Consumption								
Ease of Maintaining Treatment Capacity during Construction								
Recommended Process								

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Matrix Evaluation

INA ROAD	*MLE NIT*	*MLE NdeN*	*Bardenpho NIT*	*Bardenpho NdeN*	*IFAS NIT*	*IFAS NdeN*	*MBR NIT*	*MBR NdeN*
Operability	+	0	+	0	+	0	-	-
Proven Process	+	+	+	+	0	0	-	-
Present Worth Cost, Capital + O&M								
Site Compatibility								
Resource Consumption								
Ease of Maintaining Treatment Capacity during Construction								
Recommended Process								

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Matrix Evaluation

ROGER ROAD	*MLE NIT*	*MLE NdeN*	*Bardenpho NIT*	*Bardenpho NdeN*	*IFAS NIT*	*IFAS NdeN*	*MBR NIT*	*MBR NdeN*
Operability		0		0		0		-
Proven Process		+		+		0		-
Present Worth Cost, Capital + O&M		-		+		-		-
Site Compatibility		0		0		0		0
Resource Consumption		-		+		+		-
Ease of Maintaining Treatment Capacity during Construction		-		-		-		-
Recommended Process								

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Matrix Evaluation

INA ROAD	*MLE NIT*	*MLE NdeN*	*Bardenpho NIT*	*Bardenpho NdeN*	*IFAS NIT*	*IFAS NdeN*	*MBR NIT*	*MBR NdeN*
Operability		0		0		0		-
Proven Process		+		+		0		-
Present Worth Cost, Capital + O&M		-		+		-		-
Site Compatibility		-		+		+		+
Resource Consumption		-		+		-		-
Ease of Maintaining Treatment Capacity during Construction		+		+		+		+
Recommended Process								

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Summary

Anne Smith

Workshop #7 Meeting Notes
Biosolids

1. The Biosolids Workshop for Pima County Regional Optimization Master Plan was held on July 19, 2006. The workshop agenda is attached. Attendance included:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Jackson Jenkins
Mike Bunch
PCWMD Staff
David Bartos
Tom Berry
James Doyle
Houssam Eljerdi
Dennis Froehlich
Frank Gall
Mary Hamilton
Michael Kostrzewski
Frank Luiz
Jing Luo
Byron McMillan
John Munden
Steve Munsell
Jeff Prevatt
Prakash Rao
Helen Rhudy

PCWMD Staff (cont.)
Bill Richardson
Ron Riska, Project Manager
John Sherlock
Jack Van Riper
John Warner
Ken Weber
TUCSON WATER
Tucson Water Staff
Melodee Loyer
Mark Seamans

PEER GROUP
Gary Newman, B&C
Denny Parker, B&C

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Gordon Culp
Carl Koch
Andy Richardson
Steve Sticklen
Beth Vogt

2. Major topics of the workshop were:

- Workshop #7: Biosolids
  - ► Summary of Previous Studies/Condition Assessment
  - ► Current Biosolids Handling at Roger Road and Ina Road Plants
  - ► Current Disposal Options in Pima County
  - ► Future Disposal Options
  - ► Future Biosolids Handling Issues
  - ► Class A Drivers and Status for Pima County
  - ► Class A Options
  - ► Screening of Class A Options
  - ► Development of Most Likely Class A Alternatives
  - ► Next Steps in Biosolids Analysis

A set of handouts were provided to each attendee of the presentation slides used during the workshop.

Throughout the workshop, notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Andy Richardson provided a few opening remarks and defined his role as the facilitator. The group reviewed the meeting goals and provided additional comments on goals for the workshop. Workshop goals included:

- Review of biosolids regulatory requirements,
- Shortlist biosolids alternatives,
- Consider impacts of biosolids on plant operations,
- Relate biosolids options to the plant liquid stream options,
- Discuss timing of Class A conversion, and
- Discuss biosolids plan for the satellite facilities.

Agenda, ground rules and objectives/goals of the workshop were presented and covered on pages 1 through 4 of the handout.

4. Beth Vogt identified and summarized previous study results as they relate to biosolids processing and disposal. Discussions on the previous studies included: one gravity belt thickener (GBT) is on order for Roger Road WWTP to increase solids concentration to the digesters, dissolved air flotation thickeners have been returned to service at Roger Road WWTP, Operations is looking at converting Digester 5 at Roger Road WWTP into a primary digester, and Pima County does not have any acreage registered for land application (all land is registered by the private contractor). In addition, Mike Gritzuk indicated that the project team needs to look at making money from Class A biosolids products, if possible.

Summary of the previous studies were covered on pages 4 through 6 of the handout.

5. Beth Vogt provided a summary of the condition assessments for both Ina Road WPCF and Roger Road WWTP with respect to solids handling facilities. The most significant issue discussed was the unknown structural condition of Digester 3 at Roger Road WWTP. Digester 3 is the oldest digester, from the 1950's, with a flat concrete roof. There are known leaks at the gas box atop the digester. As the digester has not been inspected inside for some time, there is concern about the stability of this digester. The County can not currently take a digester offline for cleaning and maintenance or they will be unable to meet Class B processing requirements.

John Sherlock indicated that contingency plans have been developed to deal with the unknown condition of Digester 3. They include: addition of the GBT to thicken sludge to the digesters to 5%, conversion of Digester 5 to a primary, or pumping waste activated sludge (WAS) from Roger Road WWTP to Ina Road WPCF for digestion.

Other current sludge processing issues discussed included:

- Only one (20+ year old) bladder at Ina Road WPCF -- no redundancy (John Munden),
- Truck loading facilities need improvements (John Munden),
- Centrifuge facility is marginally capable of handling current sludge quantities (Jackson Jenkins),
- Ina Road WPCF can now produce and pump cake from dewatering, but it is not desirable to the land applicator (land owner wants the water in the sludge),
- By contract the current disposal plan using a private contractor is good for next 8 years
- Pinal County disposal sites are of concern due to potential road damage, and
- County is rebuilding vaults and valving on the sludge transfer line between Roger Road WPCF and Ina Road WPCF.

Review of the condition assessment of the solids handling facilities was covered on pages 6 and 7 of the handout.

6. Beth Vogt presented a summary of the information currently received by the project team on existing biosolids handling at Roger Road WWTP, Ina Road WPCF, and outlying facilities. The project team has requested additional solids processing data from each facility, such as sludge flows. Future sludge quantities were developed for the three system options, as well as, the future outlying facilities. Over time there will be substantially more sludge generated in the outlying facilities.

At this time Randolph Park WRP sludge is processed at Ina Road WPCF. It was noted that current treatment plants are relatively high rate processes that generate more sludge than most nitrification/denitrification facilities. So values used in the screening analysis are high compared to probable future sludge generation. However, competing issues, such as phosphorus removal requiring chemicals will increase sludge quantities. Denny Parker indicated that P removal, if ever required, may be lower than 1.0 mg/L assumed in the process evaluation. The standard may be as low as 0.2 mg/L or 0.1 mg/L. From the discussion it was agreed that for screening purposes, the sludge quantities presented were acceptable.

Frank Gall noted that Avra Valley WWTP sludge goes to Roger Road WWTP not Ina Road WPCF, and currently Corona de Tucson WWTP sludge is thickened and goes directly to landfill. Trucking costs for transporting sludge from the outlying plants are considerable and the County would like this to be addressed in the long term planning of these facilities. Currently, plants of about 1 MGD require 5 to 6 tanker trucks per day and the sludge is transported to the nearest manhole, which may be 20 miles away. Also, there is no overall biosolids handling strategy in place for the outlying areas, although Dennis Froehlich indicated that one is underway. Mike Gritzuk asked how the solids at the Tucson Water Sweetwater wetland facilities were handled. Residual solids are periodically dredged and dispose of in a landfill.

It was suggested that at a minimum that each of the outlying areas have the capacity to dewater and haul. In all cases, centrate recycle and tanker truck discharges of sludge must be considered as an impact for alternative(s) selected for the plan.

The existing biosolids handling operations were summarized on pages 8 through 10 of the handout.

7. Beth Vogt summarized current disposal options available to the County. Most sludge is taken to land application at about 2% to 3% solids. Land owners like the water content of the sludge. There is one owner of the majority, if not all, of the land available for sludge disposal. Currently the haul distance is less than 25 miles, but as growth continues, hauls to Pinal County and elsewhere will require a haul distance of approximately 40 miles over the next 5 years. Paul Bennett indicated that landfilling is available, but the currently utilized landfill (Tangerine) is going to close soon and the remaining landfill is owned by the County, which is farther away. Landfilling should continue to be a backup option, as having a multiple outlet approach for sludge disposal is essential.

   Green Valley WWTP sludge is dried and hauled for mine reclamation through the University of Arizona demonstration project. Frank Gall believes that the Green Valley WWTP demonstration program is good for 5 to 10 years. Mine disposal is a good option for the mines will continue with closure mitigation programs, but most likely will not be a stable enough market for all sludge generated at the County wastewater facilities.

   Future Class A disposal options include all of the existing disposal outlets plus non-traditional markets such as, landscapers, golf courses, DOT, forest fire reclamation areas and direct sales to customers depending on the type of end-product. All non-traditional markets require a market analysis prior to investing in a process to support them. A step-by-step approach would be required to enter into these other markets. Each analysis will need to consider the labor required to handle the solids for these other market products.

   John Warner asked if co-generation with sludge, as a fuel source, is viable. It was noted that co-generation has been considered elsewhere (Baltimore, MD and Stamford, CT), but high solids concentration (80% to 90% solids) is required. It was further noted by Houssam Eljerdi that Arizona prohibits incineration.

   Current and future potential biosolids disposal options were covered on pages 10 through 12 of the handout.

8. Carl Koch presented information on future biosolids handling issues to be considered in the master plan. These include:

   - Class A anaerobic digester conversion and future status of anaerobic digestion as Class A,
   - Central processing of solids versus continued processing at each plant (Roger Road WWTP and Ina Road WPCF), and
   - Contract processing of biosolids.

   Producing Class B biosolids advantages are less expensive operations, simpler to operate and is consistent with the County's current disposal method. Class A biosolids has less restrictive management and monitoring requirements, lower odor potential from the biosolids, and is perceived by the public to be superior. Thus, Class A may open up more disposal options.

Centralizing processing provides economy of scale and consolidates labor. On the other hand, centralizing facilities will concentrate and increase recycle loads on the wastewater treatment at that location.

Contract processing is a current trend with utilities, particularly with providing dry Class A products. In these applications the digester gas is used as a fuel to dry the sludge. It is important to realize that contract operations do not completely transfer the responsibility for the biosolids disposal to others.

Major Class A drivers for Pima County seem more likely to be public/political or from involvement with public through EMS program than regulatory driven. Paul Bennett indicated that Pima County has applied to be part of the EMS program. There was discussion on whether this would drive the County to Class A. The group discussed that a move toward Class A makes sense for them.

Future biosolids issues and Class A drivers were covered on pages 12 through 16 of the handout.

9. Carl Koch presented descriptions of major Class A processes: digestion, alkaline stabilization, composting, heat drying, and advanced air drying. An example from each process category of an alternative considered appropriate for the County was outlined. Advantages and disadvantages of the alternatives were provided along with a qualitative cost comparison. This information was utilized in the screening of Class A options that followed.

Major issues and concerns of the options included the following. There was a desire by the County for an analysis of the Cambi process, a predigestion thermohydrolysis process. The County has a proposal for the Cambi process that will be forwarded to the project team. The methane gas from anaerobic digestion could be used in heat drying or Cambi. Dennis Froehlich asked if there was any advantage to the separation of sludges prior to processing. Gary Newman indicated that products from heat drying have less odor if the sludge is first digested.

It was noted that anaerobic digestion may not be a good fit for outlying facilities since they employ extended aeration treatment systems and the volatile solids content of the sludge is partially destroyed.

John Sherlock suggested that disposal of the alkaline stabilized biosolids is not viable in Arizona as the soils are alkaline and there is no market for land application of the product.

It was suggested that flow-through thermophilic digestion should be considered for the advanced digestion process. It was noted that this process would require process review and data to be provided to prove Class A compliance.

It is currently unclear how much of a market there will be for a dry product. Land applicators like the water in the biosolids. A market assessment study would be required before this would be implemented in the County.

A proposal for accelerated air drying has been provided to the County for the Green Valley WWTP. Two structures would be required to process the sludge to Class A. The County will provide the project team with a copy of the proposal.

It was noted that Marana does not allow composting. This has a direct impact on Ina Road WPCF which is in Marana.

Dennis Froehlich asked about separating the primary and waste activated sludge and using aerobic digestion. This has been done elsewhere with mixed success. Tampa, Florida, had applied aerobic digestion to its waste activated sludge but discontinued it because of high operating costs and the achievement of less than 40% volatile suspended solids (VSS) destruction. Primary sludge was anaerobically digested. Eventually Tampa converted their aerobic digesters to anaerobic to produce more methane for electrical power generation.

It was agreed that the County is committed to anaerobic digestion for the Ina Road WPCF and Roger Road WWTP sludges as a part of any Class A alternative.

Class A biosolids alternatives were covered on pages 17 through 23 of the handout.

10. Gordon Culp led the group through a screening of Class A options. Each criterion for the screening was defined. It was suggested that a criterion for the acceptability of the final product to the public should be added. An evaluation matrix for the alternatives which was filled in by the project team prior to the workshop was presented. Through discussion with the group some of the -, 0, and + values were modified. Results of the screening evaluation matrix analysis follow.

Matrix Evaluation

	Stages Anaerobic Digestion	*Alkaline Stabilization*	*Composting*	*Heat Drying*	*Advanced Air Drying*
Operability	+	–	–	–	0
Proven Process	+	+	+	+	–
Present Worth Cost, Capital + O&M	+	0	–	–	–
Marketability	–	–	+	+	–
Resource Consumption	+	–	–	–	+
Ease of Maintaining Treatment Capacity during Construction	0	+	0	+	0
Recycle Impacts	0	0	0	0	0
Recommended Process					

The screening evaluation for biosolids handling at Roger Road WWTP and Ina Road WPCF eliminated alkaline stabilization, composting and advanced air drying. The remaining options for Ina Road WPCF and Roger Road WWTP sludges were: anaerobic digestion (phased or flow through), Cambi, and heat drying. Other processes, such as advanced air drying and composting, may be appropriate for some of the outlying facilities.

The evaluation criteria and screening matrix analysis were covered on pages 24 through 27 of the handout.

11. Beth Vogt discussed development of the most likely biosolids handling options. Staying with Class B (mesophilic digestion) land application is the most cost effective approach (while land is available) and should continue until public/political/regulatory pressure requires otherwise.

    Layouts for staged anaerobic digestion facilities for both Ina Road WPCF and Roger Road WWTP facilities to achieve Class A were presented to show space requirements. In addition, a layout of heat drying facilities with sludge digestion at Ina Road WPCF was shown for space requirements.

    It was noted that Tucson Water needs 10 acres at Ina Road WPCF for their future use.

    Other biosolids processing issues for consideration include: recycle streams, odors, and methane utilization.

    The most likely biosolids treatment layouts and other issues of concern were covered on pages 28 through 33 of the handout.

12. Andy Richardson wrapped up the workshop by summarizing the next steps. These include: defining intermediate processing requirements for alternatives, coordinating biosolids layouts with liquid processes, determining recycle load processing requirements and adjusting influents for recycle loads for the options.

Agenda
Workshop #7 – Biosolids
July 19, 2006

Time	Topic	Presenter
8:00 am	*Continental Breakfast – Pima County Parks and Recreation Facility* *3500 West River Road, Tucson, AZ*	
8:15 am	Opening Session • Welcoming Remarks • Review Agenda • Workshop Goals	 Mike Gritzuk Andy Richardson
8:30 am	Previous Biosolids Studies	Beth Vogt
8:45 am	Biosolids Handling at Roger Road WWTP and Ina Road WPCF • Digestion • Solids Handling • Methane Handling/Use • Odors	Beth Vogt
9:15 am	Current Disposal Options in Pima County	Beth Vogt
9:30 am	Future Biosolids Handling Issues	Carl Koch
9:45 am	Class A Drivers and Status for Pima County	Carl Koch
10:00 am	Break	
10:15 am	Class A Options	Carl Koch
10:45 am	Screening of Class A Options	Gordon Culp
11:15 am	Development of Most Likely Class A Alternative(s)	Beth Vogt
11:30 am	Other Issues	Beth Vogt
1145 am	Summary Wrap-Up • Comments by Group • Closing Remarks	Andy Richardson Mike Gritzuk
12:15 pm	Adjourn / Lunch	

Flip Chart Notes – July 19, 2006

Objectives

- Are we sure we need to go to Class A?
- Is there money to be made by selling a Class A product?
- Disposal of screenings and grit was not considered for this workshop.
- Status of private solids disposal contractor
- What are Class A disposal options
- Land registration for biosolids disposal only in Contractor's name?
- Continue with land applications
- Have we overlooked "co-generation"?

Previous Studies

- Precipitation of struvite will impact sludge quantities
- They are looking at conversion of Digester 5 to a primary digester at Roger Road
- Pumping to Ina from Roger Road is 200,000 gal/day at 2100 mg/L
- Structural condition of Digester 3 is ?; grout joint at gas box leaking
- Cannot take digester off line at Roger Road
- Improving pumping system from bladder that loads trucks – change out pumps – bladder is an Air Force fuel tank surplus - 25 years old.
- Ina Road only has one bladder
- Gravity belt thickener on order
- CIP project awarded for sludge force main rehab of valves and structures
- Contractor not able to handle cake (only liquid) from Ina Road
- One Schwing pump at Ina Road to pump cake
- Ina Road – 8 percent sludge able to be pumped, have pumped up to 24 percent with Schwing pump
- Loading facility needs improvements
- Ina Road centrifuge system marginal; needs upgrade
- Get copy of material on Class A evaluation
- Acceptability of land application in future is ?
- Beholding to only one guy; some land used for disposal is in Pinal County. Concern of the future possibility to dispose.

Biosolids Handling

- Make sure we consider ***centrate*** handling as we determine biosolids solutions
- Piloting of high anaerobic process – look at energy generation
- Roger Road volatile solids destruction is 65 percent
- Corona is like Avra Valley outlying areas
- Avra Valley biosolids goes to Roger Road
- Green Valley and look at capacity

- Outlying facilities achieve Class A on site to avoid hauling
- Regional site to handle, compost
- Need step-by-step approach; leading indicators

Current Disposal Options

- What is the regional plan on solid waste?
- Tangerine landfill is going to close – current landfill site for sludge
- Remaining landfill is County owned which is farther away
- Forest fire burn area reclamation
- What other options are available?
- Is there a contract anywhere in nation to develop biosolids as an alternative fuel source?

Class A Options

- Not sure alkaline stabilization is good for this location; existing alkaline soils
- Add Cambi Process to the alternatives
- Consider primary vs. secondary sludge handling separately
- Heat drying may need digestion to improve product results
- Is there a market in Arizona for a "dry" product?
- Accelerated air drying – may be good for a transition process – Pima County has had some experience and success
- Staged as opposed to batch digestion options

Evaluation Criteria

- Include public acceptance – of both product and facility
- Get biosolids study from Houssam
- O&M cost on hauling is major consideration
- Alkaline stabilization is out
- Continue to digest – has an impact on recycle
- Need to consider what is the long-term Class "B" program; projected farm land availability
- On heat drying and air drying, what are the air quality issues?
- Do not want to be hauling limited
- Need to get agreement on design assumptions

Shortlist

- Staged anaerobic digestion
- Cambi process
- Heat drying
- Continue to look at Class B – what factors would require change

Pima County
Regional Optimization
Master Plan

Workshop #7
Biosolids

July 19, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
Beth Vogt	Biosolids Handling
Carl Koch	Biosolids Handling Options
Gordon Culp	Alternative Technologies Evaluation

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop objectives
- Summary of biosolids studies
- Existing facilities
- Future disposal options
- Evaluation of alternatives
- Timing of Class A

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

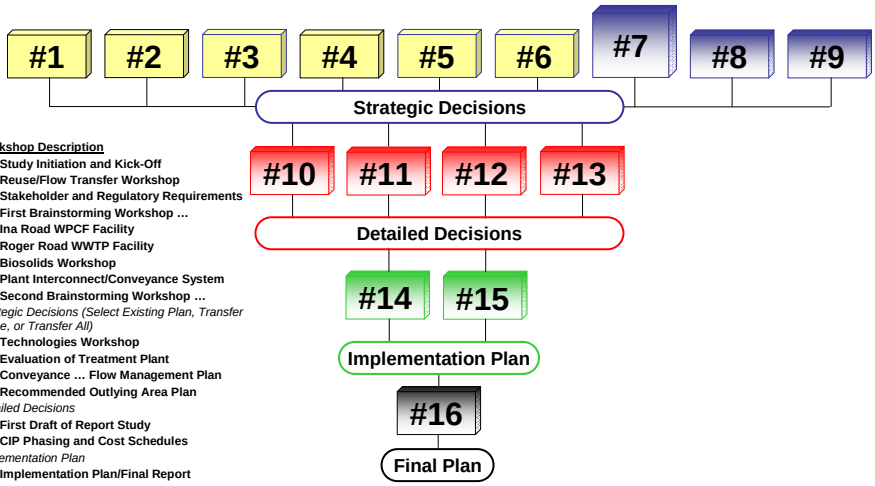
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Workshop Objectives

- Review biosolids regulatory requirements
- Review biosolids state-of-the-art technologies/operation considerations
- Shortlist biosolids alternatives
- Impacts of biosolids on plant operations
- Relate biosolids options to transfer options
- Timing of Class A conversion
- Biosolids plan for satellite facilities

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Previous Biosolids Studies

Beth Vogt

Summary of Previous Studies

- 2002 biosolids management system evaluation
- 2005 facility plan update
- 2006 Roger Road thickening facility PDR
- 2006 Roger Road digester contingency planning

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Previous Study Conclusions

- 2002 biosolids management system evaluation
  - Cavitation issues with Roger Road transfer pumps during line flushing
  - Possible corrosion issues in transfer forcemain
  - Ina Road centrifuge maintenance schedule issues
  - Inability to pump 20-30% cake from centrifuge building
  - Centrate line struvite build up
  - Significant sludge storage and transfer station problems

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Previous Study Conclusions

- 2005 facility plan update
  - Process all solids at Ina Road (decommission Roger Road digesters as sludge storage)
  - Add digester capacity at Ina Road and upgrade digesters to be able to produce Class A
  - Upgrade Ina Road dewatering facilities to produce higher % solids
  - Upgrade Ina Road treatment process to handle additional centrate (if necessary)
  - Upgrade Ina Road co-generation facilities to handle increased gas

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Previous Study Conclusions

- 2006 Roger Road thickening facility PDR
  - Separate WAS thickening in GBTs
  - 2, 3.0 meter, covered GBTs
  - Operating at 1,200 gpm each
  - Thickened WAS: 5.5-6.0% solids

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Previous Study Conclusions

- 2006 Roger Road digester contingency planning
  - Sludge production is increasing
  - If GBT is operating for total sludge = 5% to digesters, 3 digesters would provide 15 day HRT
  - Pump some WAS from Roger Road to Ina Road for digestion
  - Truck thickened sludge from Roger Road to Ina Road for digestion (up to 30%)
  - Modify Digester 5 as secondary or primary

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Summary of Condition Assessment – Roger Road

- Gravity thickeners
  - Possible structural stability issues
  - Corrosion issues
- Digesters
  - No. 3 roof leakage
  - Unknown condition inside all digesters
  - Likely solids deposition reducing active volume
  - No. 6 mixing maintenance issues

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Summary of Condition Assessment – Roger Road

- Sludge transfer station/forcemain
  - Cavitation issues with pumps during line flushing
  - Possible corrosion issues in forcemain
  - Single element – no redundancy

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Summary of Condition Assessment – Ina Road

- Thickeners
  - Wear on support facilities (corrosion)
- Digesters – no major issues
- Thickening/dewatering facility
  - Centrate return capacity and struvite build up issues
  - Lack of sludge cake pumping equipment
  - Odors
- Sludge storage
  - Aging and inadequate storage

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Summary of Condition Assessment – Ina Road

- Sludge transfer facilities
  - Odor issues
  - Electrical system issues
  - Safety issues

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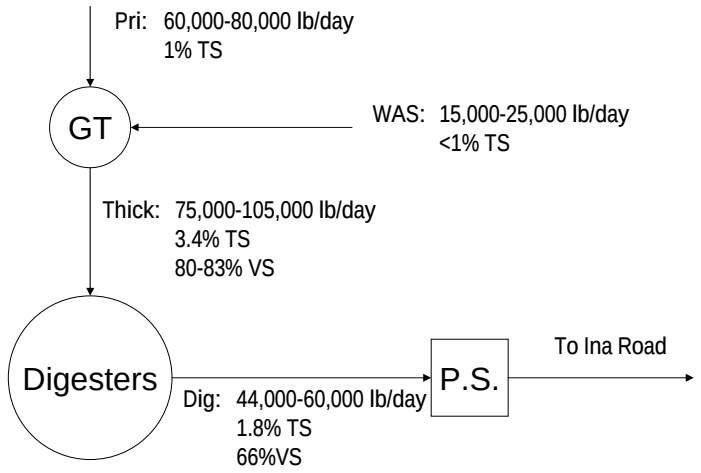
Biosolids Handling at Roger Road WWTP and Ina Road WPCF

Beth Vogt

Current Biosolids Handling – Roger Road (Infl. Flow = 38.3 mgd)



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Current Biosolids Handling – Roger Road (Infl. Flow = 38.3 mgd)

- Data yields:
  - Raw: 2000-2700 lbs/day/mgd
  - Digested: 1150-1600 lbs/day/mgd
- Will be impacted by future methanol and possible phosphorus removal
- For screening assessment use: 2800 lbs/day/mgd raw sludge and 1700 lb/day/digested

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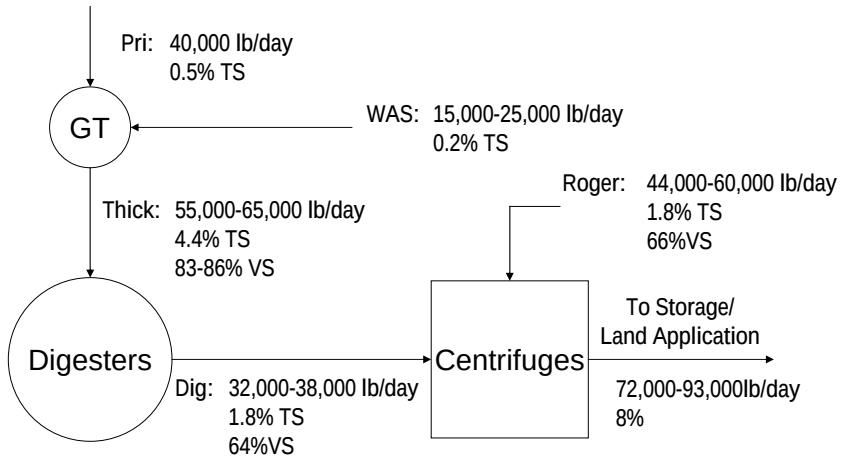
Current Biosolids Handling – Ina Road (Infl. Flow 23.4 = mgd)



25

Current Biosolids Handling – Ina Road (Infl. Flow = 23.4 mgd)

- Data yields:
  - Raw: 2300-2800 lbs/day/mgd
  - Digested: 1400-1600 lbs/day/mgd
- Will be impacted by future methanol and possible phosphorus removal
- For screening assessment use: 2800 lbs/day/mgd raw sludge and 1700 lb/day/digested

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Sludge Quantities for Screening

Alternative	*Roger Road Sludge*	*Ina Road Sludge*
1 – Roger 32 mgd Ina 50 mgd	Raw: 90,000 lb/day Dig: 55,000 lb/day @2% = 330,000 gpd	Raw: 140,000 lb/day Dig: 85,000 lb/day @2% = 510,000 gpd
2 – Roger 20 mgd Ina 62 mgd	Raw: 56,000 lb/day Dig: 34,000 lb/day @2% = 204,000 gpd	Raw: 174,000 lb/day Dig: 105,000 lb/day @2% = 630,000 gpd
3 – Roger 0 mgd Ina 82 mgd	Raw: 0 lb/day Dig: 0 lb/day	Raw: 230,000 lb/day Dig: 140,000 lb/day @2% = 840,000 gpd

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Outlying Facilities Biosolids

Location	*Current, tpd(1)*	*Future, tpd(1)*	*Processing, Disposal*
Marana	0.28	6.16	storage, hauled ⇒ Ina
Rillito Vista	0.014	0.00	---
Avra Valley	2.2	4.13	storage, hauled ⇒ Ina
Green Valley	5.7	8.5	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Arivaca Junction	0.09	0.000	---
Corona de Tucson	0.16	3.7	Evaporation
Pima Co. Fairgrounds	0.004	0.004	Evaporation
Mt. Lemmon	0.018	0.018	storage, hauled ⇒ Ina
Southlands	0.0	19.2	None
Total	8.466	41.712	

(1) Based on 2,800 dry lb/d raw biosolids produced/mgd flow treated

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Outlying Facilities Impacts

- Total future outlying plant sludge = 40 ton/day dry
- Future Roger and Ina Road = 115 ton/day dry
- Outlying plant sludge = 26% future total production
- Must be considered in sizing Ina and Roger biosolids handling facilities if continuing with current approach

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Current Disposal Options in Pima County

Beth Vogt

Current Disposal Options

- Land application
  - Digested Class B, liquid (8%)
  - < 25 miles round trip now, expecting 40 miles in the future
- Landfill
  - Need higher % solids, dewatering to 12-15%
  - No stabilization required
  - No methane gas for energy if digesters unused
  - Landfill space is available in Arizona
  - Could be a short-term backup plan

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Current Disposal Options

- Mine tailings
  - Green Valley/University of Arizona project
  - Requires dewatered/dried product
  - Availability depends on market conditions/may not be stable enough as primary outlet

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Future Disposal Options

- All of the existing options
- If Class A:
  - Sale as natural fertilizer
  - DOT
  - Golf courses
  - Landscaping
- All non-traditional options will require market analysis
  - Could be DBO for Class A disposal

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Future Biosolids Handling Issues

Carl Koch

Future Biosolids Handling Issues

- Class A conversion
- Anaerobic digestion
- Central processing versus each plant treats its own
- Contract handling

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Why Continue with Class B?

- Less expensive
- Simpler to operate
- Satisfies EPA regulations
  - Acceptable risk
- Consistent with current market conditions

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Why Consider Class A Process?

- Less restrictive management and monitoring requirements
- Lower level of pathogens
- Lower odor potential
- Perceived superior product
- More utilization options
- Public pressure

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Class A Drivers and Status for Pima County

Carl Koch

Class A Pressures

- Public reaction
- Political pressures
- Regulatory pressure
- National biosolids partnership EMS program

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National Biosolids Partnership

- Advance environmentally sound and accepted management practices
- Comprehensive environmental management system (EMS)
- Demonstration of commitment to community
- Involving community in defining performance improvements

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National Biosolids Partnership

- Pima County committed to EMS certification
- NBP goals to be considered in Master Plan Biosolids Assessment
- Community involvement from NBP goals – could be the trigger/gage for Class A timing?

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Recycle Streams

- Ammonia-laden recycle can impact plant treatment
- Particularly an issue in plants that handle biosolids from other facilities (imbalance of recycle to influent, increased % of load)
- If recycle stream part of selected biosolids alternative – must evaluate
  - Handle in main plant process
  - Provide flow equalization prior to return to main process
  - Sidestream treatment process

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Odor Issues

- Significant complaints at Roger Road
- Increasing complaints at Ina Road as neighbors get closer
- Outlying Green Valley facility experiencing continued growth closing in on site
- General interest in "good neighbor" practices
- Odor control project to address current needs
- Odor generation considered with biosolids alternatives

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Methane Gas Utilization

- Not currently used at Roger Road
- Currently used at Ina Road
- Some options would eliminate methane gas
- Is gas utilization cost effective?
- Is gas utilization a "green" procedure important to continue whether or not cost effective?
- Will siloxanes become a maintenance issue that make methane use less desirable?

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Digestion Issue - WERF Fecal Coliform Re-Growth Research

- Digestion followed by centrifuges
- Evidence of re-growth after dewatering (several orders of magnitude)
- More pronounced with Class A
- Confirmed with DNA testing
- Possible explanations
  - Digestion inhibits culturing/hibernation (VBNC)
  - Centrifuge Shear creates growth medium
- More research needed?
- Could affect future certification of digestion as Class A process

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Central versus Individual Plant Processing

- Centralization consolidates processing/ economy of scale
- Centralization concentrates recycle streams
- Centralization makes sense for outlying plant
- Requires transport of solids from Roger Road to Ina Road

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Contract Processing

- Current trend to let other handle biosolids
- Places responsibility in specialized hands
- Results in reliance on other and loss of control
- Does not completely transfer responsibility

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Class A Options

Carl Koch

Major Types of Class A Processes

- Digestion
- Alkaline stabilization
- Composting
- Heat drying
- Advanced air drying

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Digestion Prescreening

- Thermophilc aerobic
- Thermophilc anaerobic
- Phased anaerobic digestion

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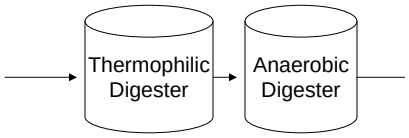
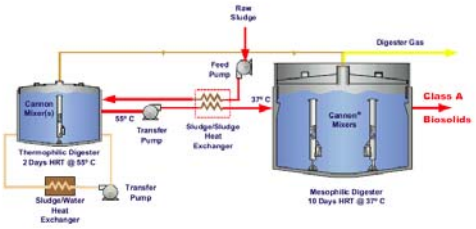
Staged Thermophilc Digestion

- Produce Class A Product
- Gas Production





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Alkaline Stabilization

Process	*Additive*	*Source of Heat*	*Number Installations*
N – Viro	Lime/Kiln Dust	Hydration	> 50
Biofix	Lime	Hydration	<10
Leopold	Lime	Hydration	<10
Envessel	Lime	Hydration + Electric	<10
Chemfix	Lime/Cement Silicate	Hydration	<10
Bioset	Lime/Acid	Hydration/Acid Reaction	<5

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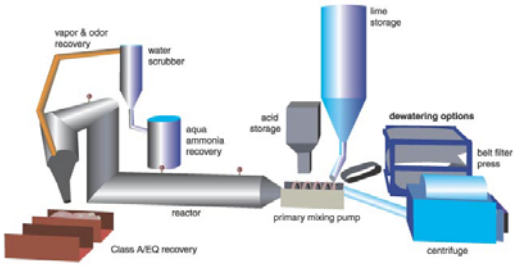
Bioset

- Requires dewatering to >15%
- Does not require digestion
- Portable/compact
- Acid + lime stabilization
- Class A granular product

Bioset Process



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Types of Composting Systems

- Windrow
- Extended pile
- In-vessel

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Silo In-Vessel (Taulman)

- Requires dewatering to >15%
- Does not require digestion
- Quality product
- Requires bulking agent
- Significant material handling

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Types of Heat Drying Systems

- Direct – sludge in immediate contact with drying fluid
- In-Direct – uses intermediate exchange surface
- Direct/In-Direct combination

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In-Direct Dryers

- Typically use oil or steam as transfer media
- Screw/paddle dryers
  - Stortz-Bartz
  - Komline Sanderson
  - Bethlehem
  - Fenton
- Katy-Seghers (multiple hearth trays)
- U.S. Filter
- Carver-Greenfield (multiple effect evaporation)

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Direct Dryers

- Flash dryers (CE Reynolds)
- Fluid bed dryers (Sulzer Escher Wyss)
- Ball mill dryers
- Rotary drum dryers
  - Largest number of installations

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Rotary Drum Dryers

- Has evolved as the most prominent technology
  - Can form pellets in the process
  - Largest number of US installations (large installations)
  - Largest number of foreign installations
  - Enclosed/controlled emissions
  - Relatively simple technology/system suppliers
  - Has evolved from once through to recirculating gas to save energy

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Rotary Dryers

- Synagro (Acquired Enviro-Gro)
- Andritz
- New England Fertilizer (Baker Rullman)
- Vandenbrock
- Swiss-Combi (Berlie)
- MEC/FEECO
- BER/Harmony (commercial fertilizer manufacturer)

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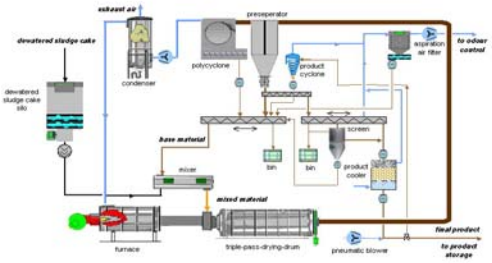
Heat Drying

- Produce Class A product
- 90% solids
- Requires dewatering to >15%
- Does not require digestion



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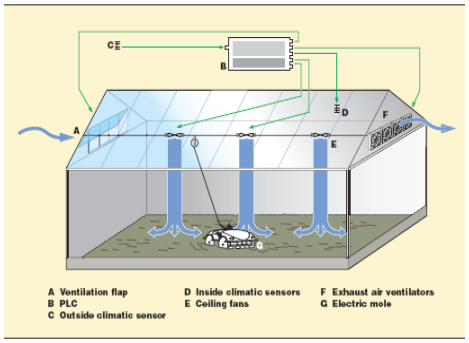
Accelerated Air Drying

- Enclosed solar drying
- Robot turning machine speeds up drying
- Low chemical/energy requirements
- Class A product
- 75% TSS



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Anaerobic Phase Thermophilic Digestion

- Advantages
  - Process familiarity
  - Produces gas for fuel
  - Reduces volume of solids
  - Can generate liquid or cake
  - Reduce product odor
- Disadvantages
  - Potential re-growth could jeopardize future Class A status
  - Generates both ammonia and phosphorus recycle
  - Methane handling potential safety issues

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Alkaline Stabilization

- Advantages
  - Small footprint
  - Fully enclosed/moderate system complexity
  - Can process raw of digested biosolids
- Disadvantages
  - Increase volume of solids
  - Consumes chemicals
  - Odor potential
  - Could generate ammonia recycle from odor scrubber

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Composting

- Advantages
  - Generate well accepted quality product
  - Considered “green” process
  - Can process raw or digested sludge
- Disadvantages
  - Odor potential
  - Complex and significant material handling
  - Fire potential issue

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Heat Drying

- Advantages
  - Small footprint
  - Largest volume reduction
  - Produces high quality multiple use product
  - Product can be used as low grade fuel
  - No nutrient significant recycle to wastewater treatment process
  - Can process raw or digested biosolids
- Disadvantages
  - Large energy consumption
  - Complex equipment
  - Fire and explosion safety issues

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Advanced Air Drying

- Advantages
  - Lowest energy consumption
  - Lowest nutrient recycle
  - No nutrient significant recycle to wastewater treatment process
  - Can process raw or digested biosolids
- Disadvantages
  - Largest footprint
  - Need to establish Class A performance
  - Limit experience (require piloting)

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Qualitative Cost Comparison

Process	*Cost per Dry Ton Processed*
Staged Digestion	$300
Alkaline Stabilization	$350
Composting	$450
Heat Drying	$470
Advanced Air Drying	??

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Screening of Class A Options

Gordon Culp

Class A Screening Analysis Criteria

- Operability
- Proven process
- Present worth cost, capital + O&M
- Marketability
- Resource consumption
- Ease of maintaining treatment capacity during construction
- Recycle impacts

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Evaluation Criteria

- Operability
  - Readily operable = (+)
  - Some operational concerns = (0)
  - Significant operational concerns = (-)

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Evaluation Criteria

- Proven process
  - Process successfully used in a large number of similar capacity facilities meeting similar effluent quality requirements, costs well documented = (+)
  - Process successfully used in only a few similar capacity facilities = (0)
  - Process successfully used in only significantly smaller capacity facilities = (-)

72

Evaluation Criteria

- Present worth costs
  - Lowest cost and costs within 10% of lowest cost = (+)
  - Costs within 20% of lowest cost = (0)
  - Costs more than 20% greater than lowest cost = (-)

    (Costs are for added equipment, structures, conveyance systems, mixing system, chemical and bulking agent addition and storage, product storage, and air emission and odor control)

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Evaluation Criteria

- Marketability
  - High quality product with wide range of markets = (+)
  - Quality product with more than one market for product = (0)
  - Product market limited to land application = (-)

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Evaluation Criteria

- Resource consumption
  - Lowest resource consumption and consumption within 10% of lowest consumption = (+)
  - Consumption within 20% of lowest consumption = (0)
  - Consumption more than 20% greater than lowest consumption = (-)

    (Annual resource consumption includes fuel, power, chemical, bulking agents and other)

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Evaluation Criteria

- Ease of maintaining treatment capacity during construction
  - Construction of new units has little or no impact on operating units = (+)
  - Construction of new units has some temporary impact on operating units = (0)
  - Construction of new units requires that operating units be concurrently demolished = (-)

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Evaluation Criteria

- Recycle Impacts
  - Process results in limited recycle impacts on wastewater treatment process = (+)
  - Process results in ammonia recycle impacts on wastewater treatment process = (0)
  - Process results in both ammonia and phosphorus recycle impacts on wastewater treatment = (-)

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Evaluation Criteria

- Ease of maintaining treatment capacity during construction
  - Construction of new units has little or no impact on operating units = (+)
  - Construction of new units has some temporary impact on operating units = (0)
  - Construction of new units requires that operating units be concurrently demolished = (-)

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Matrix Evaluation

	Stages Anaerobic Digestion	*Alkaline Stabilization*	*Composting*	*Heat Drying*	*Advanced Air Drying*
Operability					
Proven Process					
Present Worth Cost, Capital + O&M					
Marketability					
Resource Consumption					
Ease of Maintaining Treatment Capacity during Construction					
Recycle Impacts					
Recommended Process					

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Matrix Evaluation

	Stages Anaerobic Digestion	*Alkaline Stabilization*	*Composting*	*Heat Drying*	*Advanced Air Drying*
Operability	+	0	–	–	0
Proven Process	+	+	+	+	–
Present Worth Cost, Capital + O&M	+	0	–	–	–
Marketability	–	0	+	+	–
Resource Consumption	+	–	–	–	+
Ease of Maintaining Treatment Capacity during Construction	–	+	0	+	0
Recycle Impacts	–	0	0	+	+
Recommended Process					

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Development of Most Likely Class A Alternative(s)

Beth Vogt

Most Likely Biosolids Treatment Options

- Digestion Class B
  - Mesophilic digestion (what you are doing now)
- Digestion Class A – liquid processes
  - Staged thermophilic digestion
  - Accelerated air drying
- Dewatering sludge Class A – processes
  - Staged thermophilic digestion
  - Heat drying
  - Bioset

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Biosolids and Treatment Options

- Transfer biosolids to Ina Road
  - No biosolids processing at Roger Road
  - Could be done even with flow treatment at Roger Road
- Separate biosolids processing at Ina Road and Roger Road
  - Applicable to Transfer Some at Ina Road
  - Can still transfer sludge to Ina Road
  - Roger Road
    - Digestion/liquid application?
    - Dewatering?
    - Class A process?

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Solids Generation Assumptions

- Historical data
  - 2,800 lbs/day undigested solids per MGD
  - 1,700 lbs/day digested solids per MGD
- Increase dry tons to account for P removal and methanol feed
- Liquid 8% TSS
- Cake at least 15% TSS

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Solids Processing Rates

Flow (MGD)	*Raw Solids (Dry TPD)*	*Digested Solids (Dry TPD)*
20	28	17
32	45	28
50	70	43
62	87	53
82	115	70

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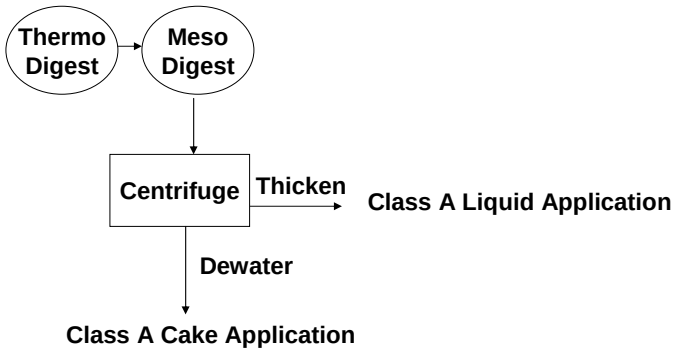
Biosolids Processing – Roger Road Option



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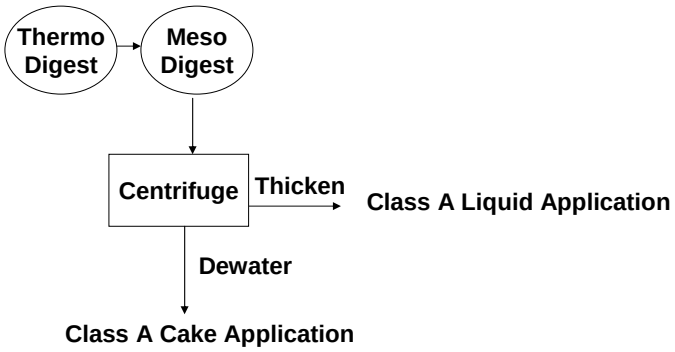
Biosolids Processing – Ina Road Option 1



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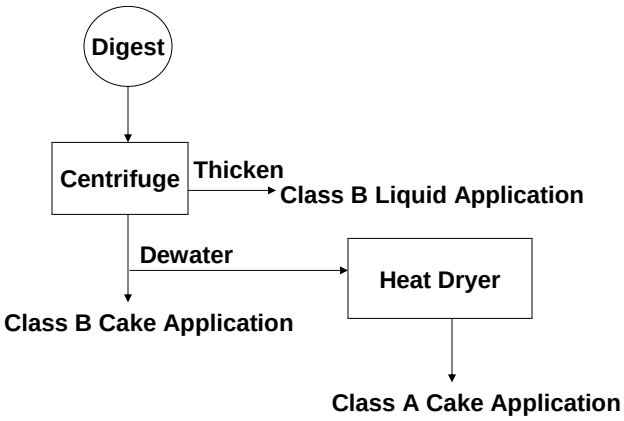
Biosolids Processing – Ina Road Option 2



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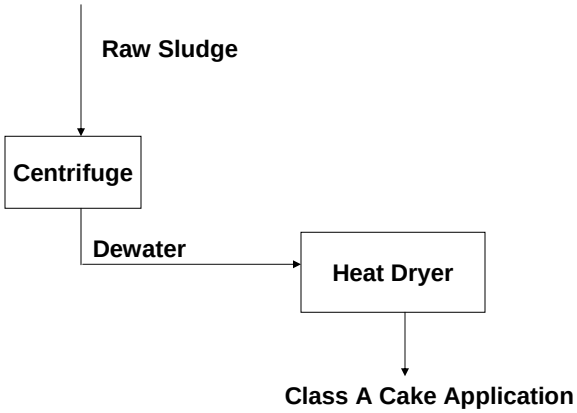
Biosolids Processing – Ina Road Option 3



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Roger Road Site Layout

- Assumed sludge thickening to 5%
- Based on 20 mgd treated
- Class A produced using thermo/meso digestion
- 3 new thermophilic digesters
- Need 2 MG mesophilic capacity (enough available on site)
- Includes centrifuge dewatering/sludge storage

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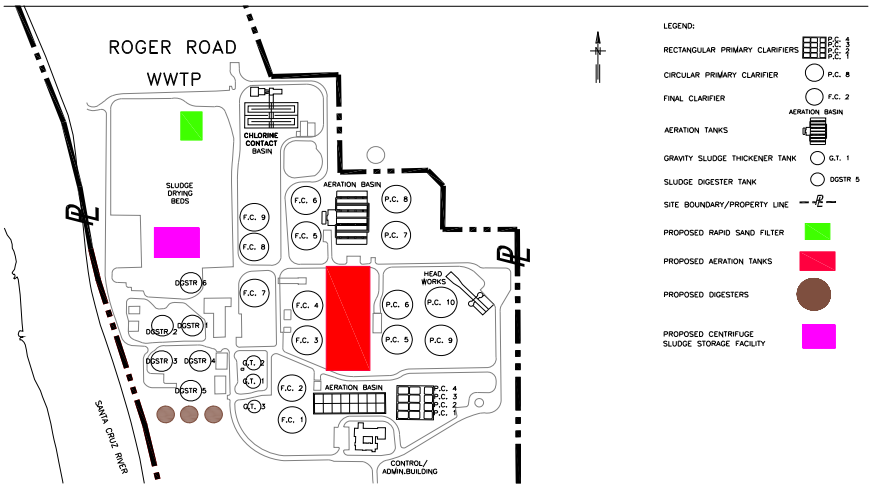
Roger Road Layout



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Ina Road Site Layouts

- Shown with NdeN 62 mgd wastewater site plan
- Assumed sludge thickening to 5%
- All sludge handling at Ina Road
  - Demonstrates 82 mgd treated at Ina Road
  - Demonstrates options with treatment at Roger Road but no solids handling at Roger Road
- Layout for thermo-meso digestion
- Layout for heat drying

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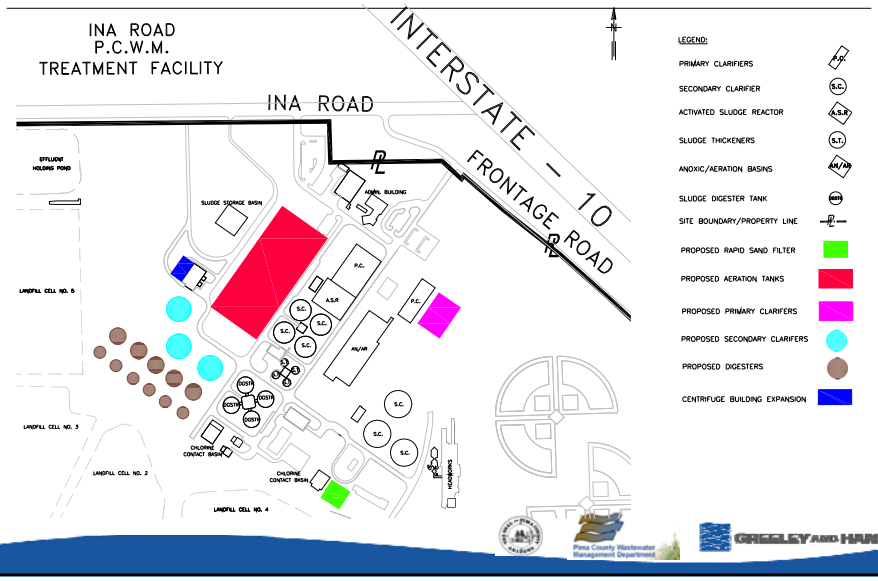
Ina Road Thermo-Meso Layout



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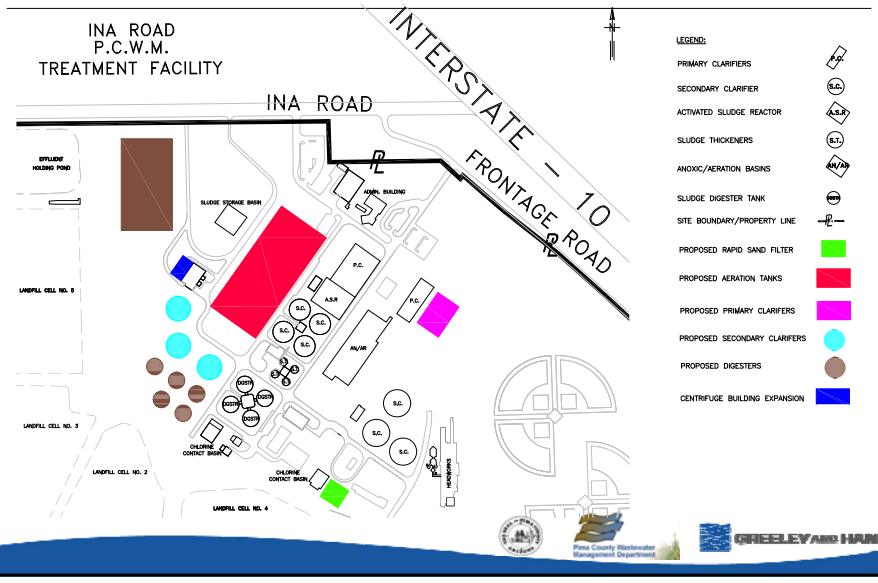
Ina Road Heat Drying Layout



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Decisions Made

- When to Implement Class A?
  - Digest to Class B until Class A required
  - Watch for triggers to Class A
- Selected Class A approach?
  - Phased digestion or heat drying
  - Depending on outcome of re-growth research
- Location for Class A
  - Ina Road

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Other Issues

Beth Vogt

Next Steps

- Define intermediate processing steps
  - Transfer lines
  - Thickening/dewatering
- Coordinate layout with liquid processing
- Determine needed recycle process
- Adjust influent to account for recycles

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Workshop #8 Meeting Notes
Plant Interconnect/Conveyance System

1. The Plant Interconnect/Conveyance System Workshop for Pima County Regional Optimization Master Plan was held on July 19, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
PCWMD Staff
Bob Buecher
Bob Decker
Frank Luiz
Mary Hamilton
Michael Kostrzewski
Byron McMillan
John Munden
Steve Munsell
Bill Richardson
Ron Riska, Project Manager
Robert Shay
John Warner
Legal
Harlan Agnew

TUCSON WATER
Tucson Water Staff
Sandy Elder
Melodee Loyer
Mark Seamans
Tim Thomure
Alan Forrest, CH2M Hill

PEER GROUP
Gary Newman, B&C
Denny Parker, B&C

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Gordon Culp
Andy Richardson
Steve Sticklen

2. Major topics of the workshop were:

- Workshop #8: Plant Interconnect/Conveyance System
  - Existing System Summary
  - Plant Interconnect
  - Operational Considerations
  - Population Growth / Outlying Facilities
  - Recommended Approach
  - Evaluation Criteria
  - Information Transfer Summary

A set of handouts were provided to each attendee which included presentation slides used during the workshop.

Throughout the workshop notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, welcomed the attendees to the workshop and invited all to participate

4. Andy Richardson defined his role as facilitator with the task of moving the group through the agenda and to encourage participation. The purpose of this workshop was to develop an evaluation framework, reach an agreement on the conceptual layout of alternative configurations, and refine the list of monetary and non-monetary criteria to be given consideration during the alternative evaluation process.

   Agenda, ground rules and purpose of the workshop were presented and covered on pages 1 through 4 of the handout

5. Steve Sticklen reviewed of the current issues with the conveyance system. A map was presented that indicated where capacity issues exist or had recently existed as stated in the 2006 Facilities Plan. Those pipes flagged on the map as having capacity issues were based on a q/Q of 85%, which translates into a d/D of 75%. Also, the current plan is to leave 15% of pipe capacity remaining to accommodate wet weather flows. Paul Bennett commented that there have been several sewer rehab projects completed since the 2006 Facilities Plan. For example, bids were opened Monday (07/17/06) for the Santa Cruz Interceptor construction project that is expected to take 2 years to complete. Ron Riska was tasked to provide additional information on updates to conveyance system and furnish the contractor's bids with cost breakdowns for the Santa Cruz Interceptor project.

   Steve Sticklen indicated the capacity of the North Rillito Interceptor (NRI) limits the current maximum diversion rate to approximately 5 mgd. It was indicated that pushing more could potentially blow manhole covers. Bob Buecher thought the NRI could handle flows greater than 5 mgd and indicated that Pete Mulvey had run tests on the flow management structure. Additional information will provided to the project team on the capacity of the NRI. Fixing limitations in the NRI could move up to an additional 6 mgd through the sewer.

   Paul Bennett asked whether the project team for system-wide odor control study will use the conveyance system information developed from this workshop. It was confirmed that the information from this workshop will be used in the conveyance model for that project.

   Tucson Water indicated that by 2030 they would need for reclaimed water distribution 30 mgd at Roger Road WWTP and 20 mgd at Ina Road WPCF. This did not include the water allocated to the Santa Cruz River according to SAWRSA.

   The current conditions of the conveyance system were covered on pages 4 through 7 of the handout.

6. Steve Sticklen summarized the three system interconnect options – Existing Plan, Transfer Some, and Transfer All. On a plan three potential plant interconnect routes currently under consideration were presented. Alternative 1 for the plant interconnect follows the existing sludge pipeline between Roger Road WWTP and Ina Road WPCF. Paul Bennett said that the survey of the existing sludge line easement should be completed within the next month to six weeks and will most likely indicate that approximately 50% of the route is wide enough for a parallel line, the other half may have space limitations.

   A fourth plant interconnect alternative was proposed for consideration and is a combination of alternative 1 and alternative 3.

   Michael Kostrzewski asked when the plant interconnect needed to be completed. Mike Bunch suggested that the critical path for construction of facilities at Roger Road WWTP will be the completion of the plant interconnect to offload existing facilities during construction. Another suggestion was made that perhaps media could be added to the existing aeration systems to increase treatment capacity at Roger Road WWTP to forestall the need of a plant interconnect. Timing of the plant interconnect will remain unknown until the system option is selected.

   Melodee Loyer mentioned that the 24" reclaimed water distribution line from Ina Road WPCF to Roger Road WWTP has the capacity to convey 10 mgd, which could be used to move Class A effluent from Ina Road WPCF to the Sweetwater facilities at Roger Road.

   Mike Bunch said that it might be possible to shave peak flows by storing flow within the system (in-system storage). Michael Gritzuk concurred and said that an equalization basin could also be used to capture wet weather flows.

   Bob Decker said there are spikes in flow in the NRI and Aviation Corridor Interceptor during rainfall events, and that there is some dry weather infiltration in a few areas (foothills). Also, it was noted that mid-size (8" to 12") sewers are the most likely to have capacity issues. Ron Riska stated that the system should have 100% reliability to prevent SSOs. John Warner said the CMOM application permit standard is no surcharging during a 10-year storm.

   Steve Sticklen suggested that the peaking factor curve could be adjusted to account for wet weather flows. A presentation slide indicated how the design capacity of the plant interconnect could be reduced by providing ± 6 million gallons flow equalization at or near Roger Road WWTP. Denny Parker suggested that flow equalization at Roger Road WPCF might be provided after primary treatment and that wet weather flows could be blended.

   Steve Sticklen displayed the hydraulic grade lines for three possible interconnect flows. Bob Buecher mentioned that there is a stub out at Roger Road WWTP from the existing system to accommodate a potential interconnect.

   John Munden mentioned that at Ina Road WPCF that there is an intermediate pump station, before the flow goes to the west train, where raw sewage is lifted again to the east train. Connecting the plant interconnect downstream of the headworks (ahead of the intermediate pump

station) may reduce pumping costs, but would increase pipe size. This is a consideration for the final arrangement.

The plant interconnect routes, schematics and hydraulics were covered on pages 8 through 12 of the handout.

7. Steve Sticklen presented information on unit construction costs for estimating costs of piping alternatives. Costs are based on open cut, do not include right–of-way easements and are in need of adjustment to the Tucson construction market. Recent pipeline construction costs in Tucson will be used to calibrate the costs curves.

   The estimated pipeline cost information was covered on page 13 of the handout.

8. Locations of outlying facilities were presented along with the area topography. It was suggested that the only outlying area for pioneering interceptors (extend sewers to direct location of growth) would be in Marana. Further, at this time the existing sewer system is accommodating the HAMP area.

   The Sonoran Desert Conservation Plan was developed after the outlying treatment plants were constructed. There is no connection between the Plan and planned growth for the outlying facilities.

   John Munden inquired as to who uses the water after treatment. Sandy Elder said Tucson Water is increasingly getting inquiries about reuse in the outlying areas. It was agreed that the locations of the Tucson Water facilities should be added to the map along with the Continental Ranch Pump Station.

   There are three approaches to the outlying facilities. 1) Keep the existing plants and expand as necessary, 2) combine all flows in the south into a subregional facility (maximize reuse potential), and 3) a combination of 1 and 2.

   The outlying areas information was covered on pages 12 and 13 of the handout.

9. Steve Sticklen outlined approach to performing the evaluation for the recommended approach. This would include a review of the existing basin model and the development of a skeletal hydraulic model (model-lite) to evaluate flows and costs of alternatives.

   The recommended evaluation approach was covered on page 14 of the handout.

10. Gordon Culp reviewed and discussed the criteria to be used in evaluation of conveyance alternatives. Mark Seamans mentioned that the peaking factor equations were not displayed properly, and that it should be "$p^{0.231}$", not "p – 0.231". Byron McMillan requested that regulatory deadlines should be added as a criterion. Tim Thomure mentioned that many of the "non-monetary" criteria have cost implications, and requested that water reuse be added to the list. Bob Buecher said that utility conflicts and traffic control have cost implications only, and should not be considered non-monetary. Gary Newman requested that odor control be added to

the list. Frank Luiz suggested consideration be given to conveyance time and hydrogen-sulfide production. Sewers that are 37 miles are too long. Address operations and maintenance, not just maintenance as a criterion. The evaluation criteria will be adjusted based on the comments.

The evaluation criteria were covered on pages 14 and 15 of the handout.

11. Steve Sticklen presented a list of information that had been received and what additional information that the project team had outstanding to be received. Steve Munsell will provide the project team with TAZ and Basin Model data. It was stated that in some areas the total pipe capacity is 200 mgd, far greater than actual flow, indicating opportunities for in-system storage. Also, there is a 2-mile stretch of sewer with internal weirs at all connecting pipes that is particularly challenging to model. The location of the large capacity sewers and information on the 2-mile sewer with weirs will be forwarded to the project team. Mike Gritzuk asked that the existing system be looked at for efficiency in flow conveyance to eliminate problems and use over capacity effectively.

    Information received and outstanding was covered on page 16 of the handout.

12. Andy Richardson wrapped up the workshop with a summary of actions for the project team:

    - Investigate four (4) plant interconnect options
    - Conduct a sensitivity analysis on peaking factor
    - Look for opportunities for in-system storage
    - For subregional plants provide sewers without long detention times
    - Use “model-lite” approach for conveyance system analysis.:

Agenda
Workshop #8 – Plant Interconnect / Conveyance System
July 19, 2006

Time	Topic	Presenter
12:15 pm	*Lunch – Pima County Parks and Recreation Facility* *3500 West River Road, Tucson, AZ*	
1:00 pm	Opening Session • Welcoming Remarks • Review Agenda • Workshop Goals	 Mike Gritzuk Andy Richardson
1:15 pm	Conveyance System Studies • Existing System Summary • Recommended Improvements	Steve Sticklen
1:30 pm	Known Capacity / Condition Issues	Steve Sticklen
2:00 pm	Plant Interconnect • Existing Transfer Option • Transfer Some Flow to Ina Road WPCF • Transfer All Flow to Ina Road WPCF	Steve Sticklen
2:45 pm	Break	
3:00 pm	Population Growth / Outlying Facilities	Steve Sticklen
3:15 pm	Recommended Evaluation Approach	Steve Sticklen
3:30 pm	Evaluation Criteria	Gordon Culp
3:45 pm	Information Transfer Summary	Steve Sticklen
4:00 pm	Summary Wrap-Up • Comments by Group • Closing Remarks	Andy Richardson Mike Gritzuk
4:30 pm	Adjourn	

Flip Chart Notes – July 19, 2006

Water Reuse

- 30 mgd to SAWRSA
- 7 to 14 mgd for Santa Cruz River at Roger Road
- Sweetwater capacity 10 mgd plant and SAT at 10 mgd
- Expansion of SAT in increments from 9,000 AC/ft to future 20,000 AC/ft

Existing Information

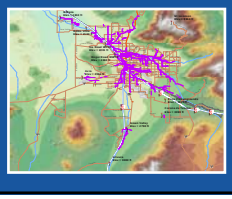
- 3000 manholes identified to be rehabed
- Use collection system data at siphons for odor control study
- Potential to surcharge in certain areas
- Studies on plant interconnect obtain from Ron Riska
- Tucson Water reuse needs dependent on evening flows
- Bids opened Monday on Santa Cruz interceptor – installed in two years
- For analysis, need to look at how flows will increase to 2030
- 10 mgd capacity in 24-inch Tucson Water reclaimed water service from Ina Road to Sweetwater
- 8-inch sludge line is being surveyed; need to get information from PCWMD
- What is the timing of the plant interconnect? What is the trigger?
- Look at what can we do in interim at Roger Road to add capacity and deal with flow increases
- Operational issues and concern for diurnal variations
- Look at flow equalization and economics
- Inflow is an issue; North Rillito is one; aviation area another area
- Foothills is an area with inflow issues
- Look at 5 to 7 mgd of inflow at Roger Road; look at data to verify
- Park Mall area has inflow study underway
- 15 percent ok to handle inflow as design consideration
- Sensitivity analysis on peak factor for smaller lines
- Consider location of equalization basin after primaries at Roger Road
- 60-inch stubout at Roger Road for connection of plant interconnect
- Need to look at location of plant interconnect discharge at Ina Road; connect at intermediate pump station

Plant Interconnect

- Look at a fourth option (combination of 1 & 3)– run portion along sludge pipeline
- At creek crossing could consider stacking pipelines

Outlying Facilities

- Continental Ranch pump station; get rid of
- Marana may be an opportunity for pioneer lines



Pima County
Regional Optimization
Master Plan

Workshop #8
Plant Interconnect / Conveyance System

July 19, 2006

Workshop Presenters

- Mike Gritzuk — Welcome/Closing
- Andy Richardson — Facilitator
- Steve Sticklen — Conveyance
- Gordon Culp — Evaluation

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Existing system summary
  - Capacity issues
  - Condition assessment
- Plant interconnect
  - Existing transfer options
  - Future transfer options
    - Existing Plan
    - Transfer Some
    - Transfer All
- Population growth
- Outlying facilities

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

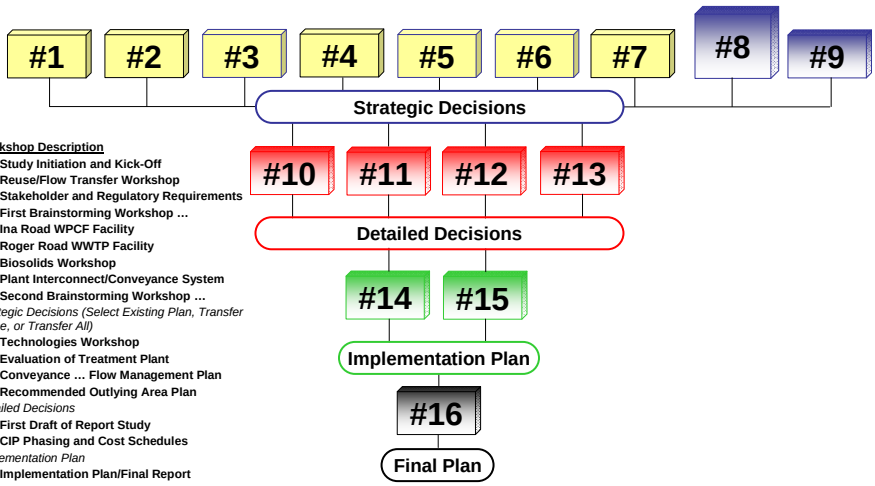
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Workshop Objectives

- Expectations
- Evaluation framework
- Agreement on conceptual layout
- Operational considerations
- Evaluation criteria
  - Monetary
  - Non-monetary

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Pima County Wastewater Management Department

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Conveyance System Studies

Steve Sticklen

Conveyance System Studies

- Existing system summary
- Recommended improvements

13

Pima County Wastewater Management Department

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Pima County Wastewater Management Department

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Known Capacity / Condition Issues

Steve Sticklen

Existing System Summary

- Capacity issues
- Condition assessment
  - Manholes
  - Siphons
  - Pump stations
  - Pipes

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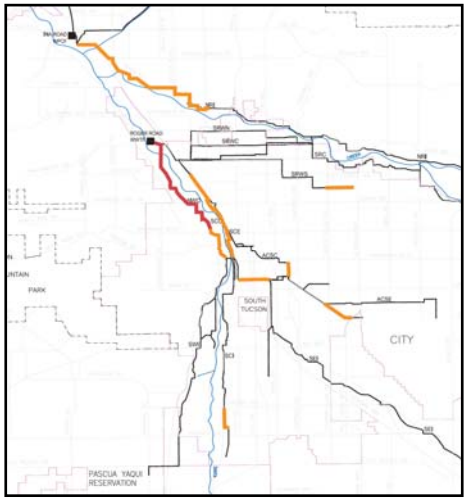
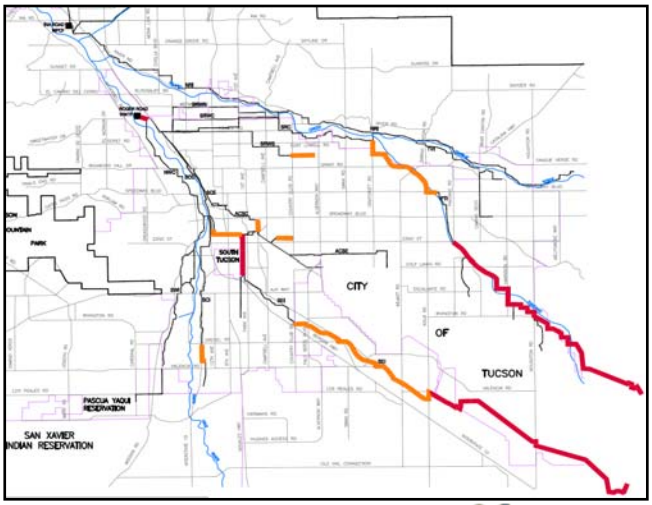
Existing Capacity Issues



16

2030 Capacity Issues



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Condition Assessment Summary

- $4.5M to rehab manholes
- Siphons and pump stations
- $13.5M to rehab pipes in poor condition
- $162M to rehab pipes in fair condition

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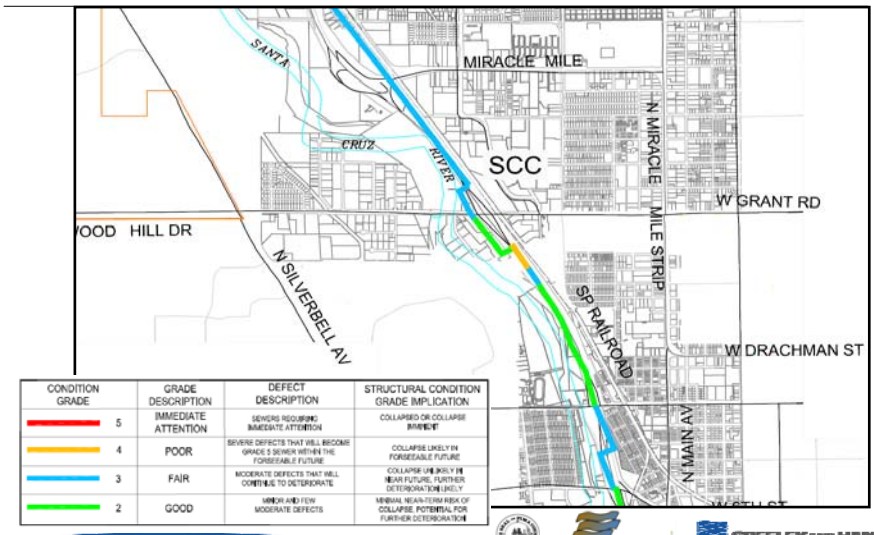
Santa Cruz Central Interceptor



CONDITION GRADE	GRADE DESCRIPTION	DEFECT DESCRIPTION	STRUCTURAL CONDITION GRADE IMPLICATION
5	IMMEDIATE ATTENTION	SEWERS REQUIRING IMMEDIATE ATTENTION	COLLAPSED OR COLLAPSE IMMINENT
4	POOR	SEVERE DEFECTS THAT WILL BECOME GRADE 5 SEWER WITHIN THE FORSEEABLE FUTURE	COLLAPSE LIKELY IN FORSEEABLE FUTURE
3	FAIR	MODERATE DEFECTS THAT WILL CONTINUE TO DETERIORATE	COLLAPSE UNLIKELY IN NEAR FUTURE, FURTHER DETERIORATION LIKELY
2	GOOD	MINOR AND FEW MODERATE DEFECTS	MINIMAL NEAR-TERM RISK OF COLLAPSE, POTENTIAL FOR FURTHER DETERIORATION

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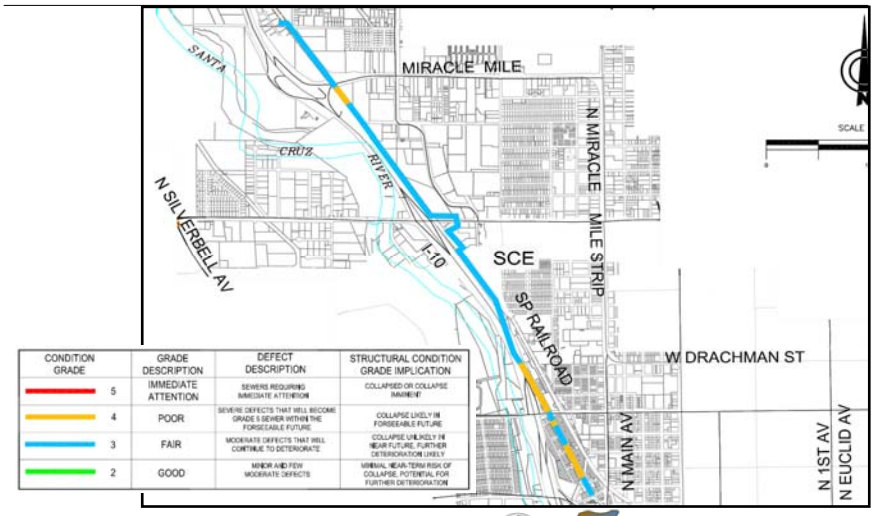
Santa Cruz East Interceptor



CONDITION GRADE	GRADE DESCRIPTION	DEFECT DESCRIPTION	STRUCTURAL CONDITION GRADE IMPLICATION
5	IMMEDIATE ATTENTION	SEWERS REQUIRING IMMEDIATE ATTENTION	COLLAPSED OR COLLAPSE IMMINENT
4	POOR	SEVERE DEFECTS THAT WILL BECOME GRADE 5 SEWER WITHIN THE FORSEEABLE FUTURE	COLLAPSE LIKELY IN FORSEEABLE FUTURE
3	FAIR	MODERATE DEFECTS THAT WILL CONTINUE TO DETERIORATE	COLLAPSE UNLIKELY IN NEAR FUTURE, FURTHER DETERIORATION LIKELY
2	GOOD	MINOR AND FEW MODERATE DEFECTS	MINIMAL NEAR-TERM RISK OF COLLAPSE, POTENTIAL FOR FURTHER DETERIORATION

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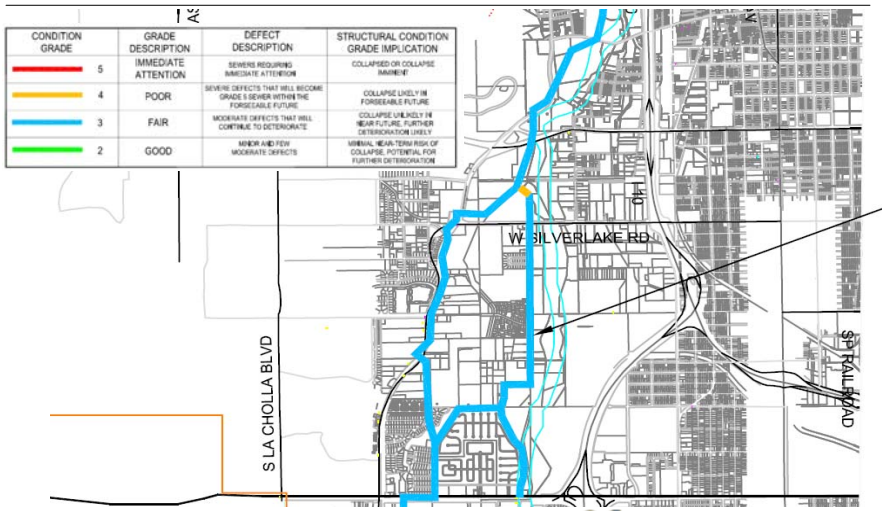
Southwest Interceptor



CONDITION GRADE	GRADE DESCRIPTION	DEFECT DESCRIPTION	STRUCTURAL CONDITION GRADE IMPLICATION
5	IMMEDIATE ATTENTION	SEWERS REQUIRING IMMEDIATE ATTENTION	COLLAPSED OR COLLAPSE IMMINENT
4	POOR	SEVERE DEFECTS THAT WILL BECOME GRADE 5 SEWER WITHIN THE FORSEEABLE FUTURE	COLLAPSE LIKELY IN FORSEEABLE FUTURE
3	FAIR	MODERATE DEFECTS THAT WILL CONTINUE TO DETERIORATE	COLLAPSE UNLIKELY IN NEAR-FUTURE, FURTHER DETERIORATION LIKELY
2	GOOD	MINOR AND FEW MODERATE DEFECTS	MINIMAL NEAR-TERM RISK OF COLLAPSE, POTENTIAL FOR FURTHER DETERIORATION

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Pima County Wastewater Management Department

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Plant Interconnect

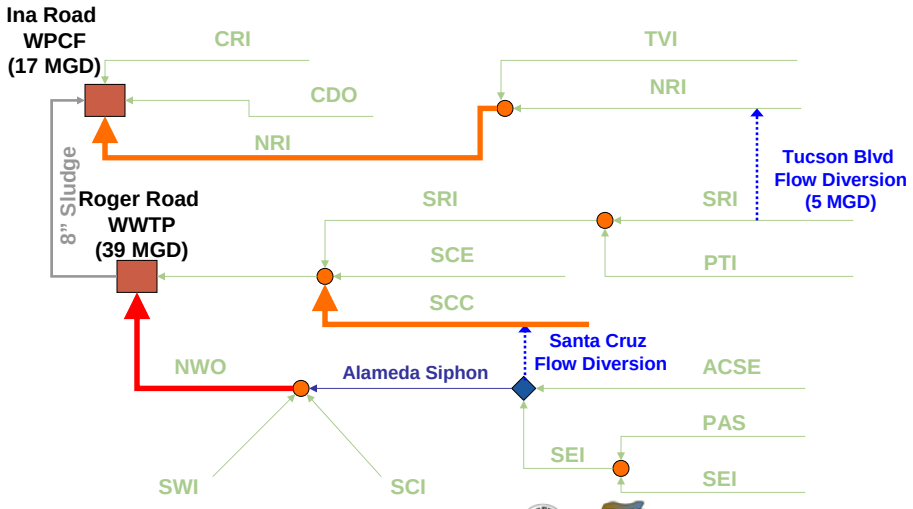
Steve Sticklen

Plant Interconnect

- Current Transfer Options
  - Tucson Blvd and Craycroft Road
  - 8-inch sludge line
- Future Transfer Options
  - Existing Plan
  - Transfer Some
  - Transfer All

23

Mass Balance Schematic
(Existing System Configuration and Flows)



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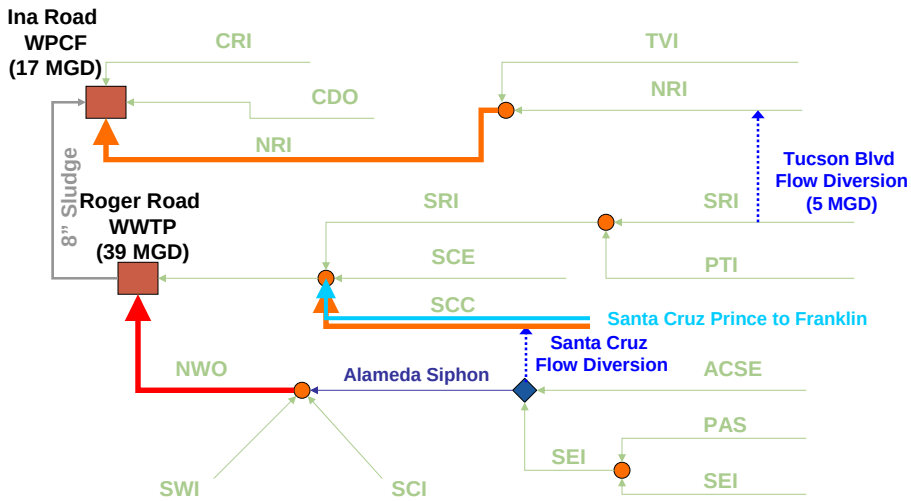
Mass Balance Schematic
(New Santa Cruz Interceptor)



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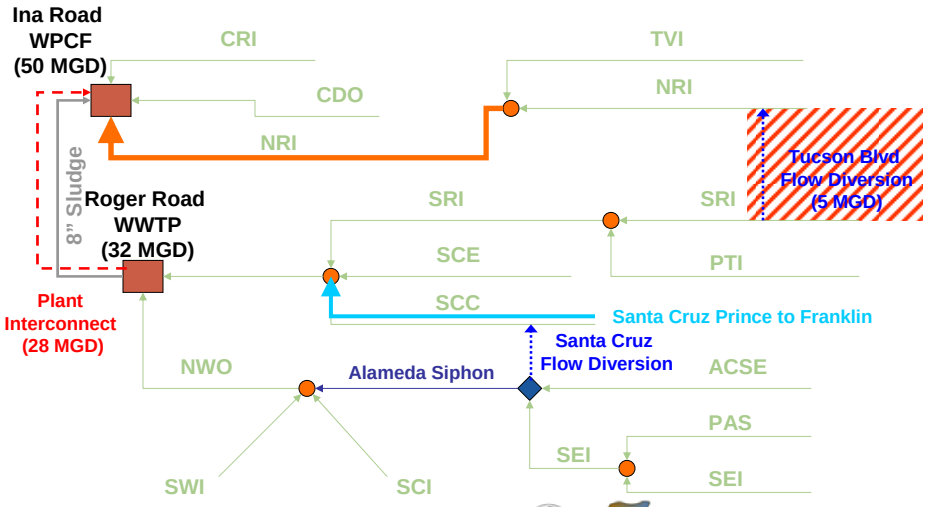
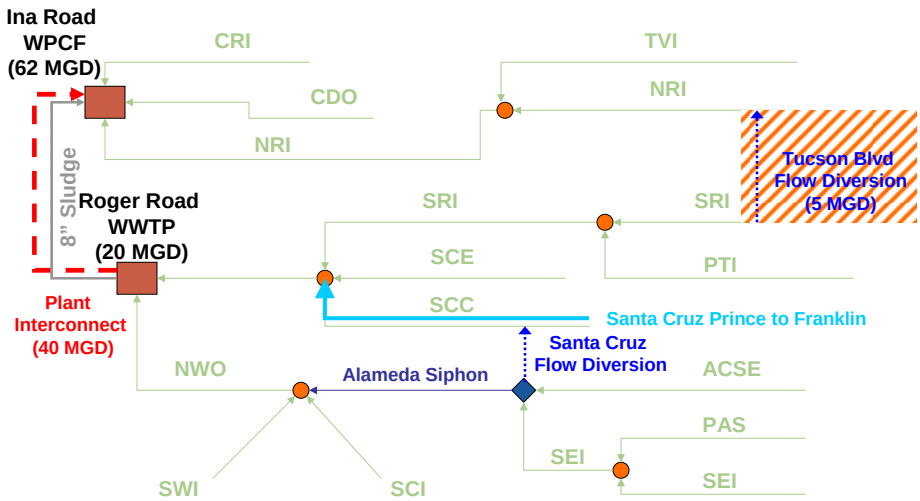
Mass Balance Schematic
(Existing Plan, 2030 Flows)



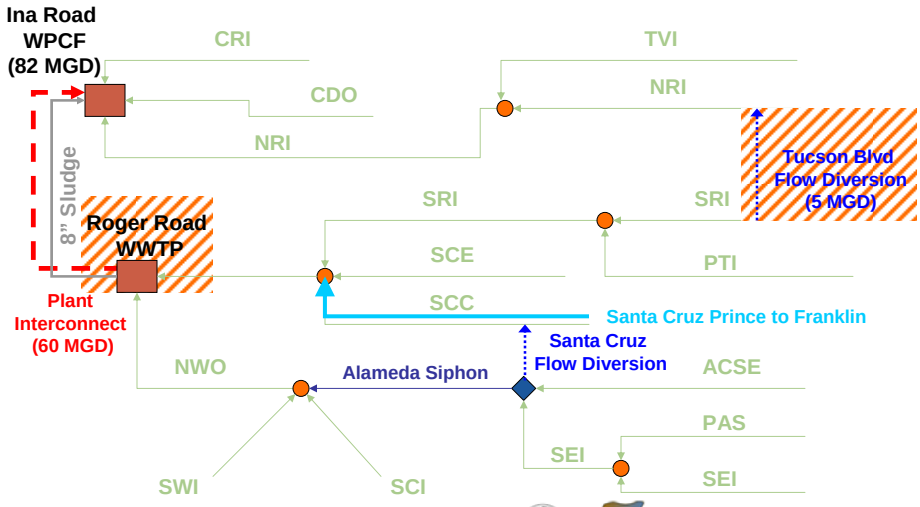
26

Mass Balance Schematic
(Transfer Some)



27

Mass Balance Schematic
(Transfer All)



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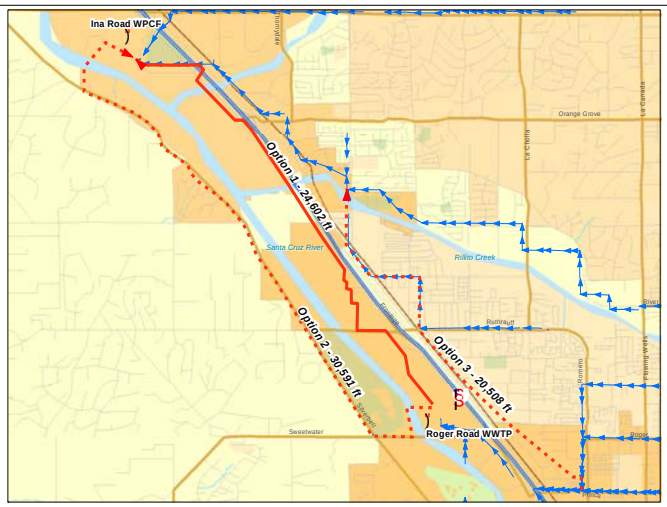
Proposed Interconnect Routes



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Summary of Interconnect Options

Option	*Roger Road (MGD)*	*Transfer (MGD)*	*Ina Road (MGD)*	*Dia (in)*
Existing	32	28	50	42”
Transfer Some	20	40	62	48”
Transfer All	0	60	82	60”

All options presume 6-10 MG of flow equalization at Roger Road site, without which transfer rates would need to be increased by 35 MGD.

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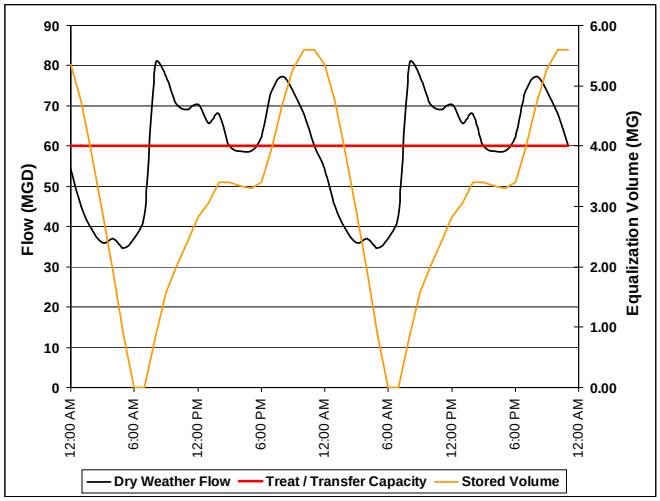
Diurnal Flow Equalization



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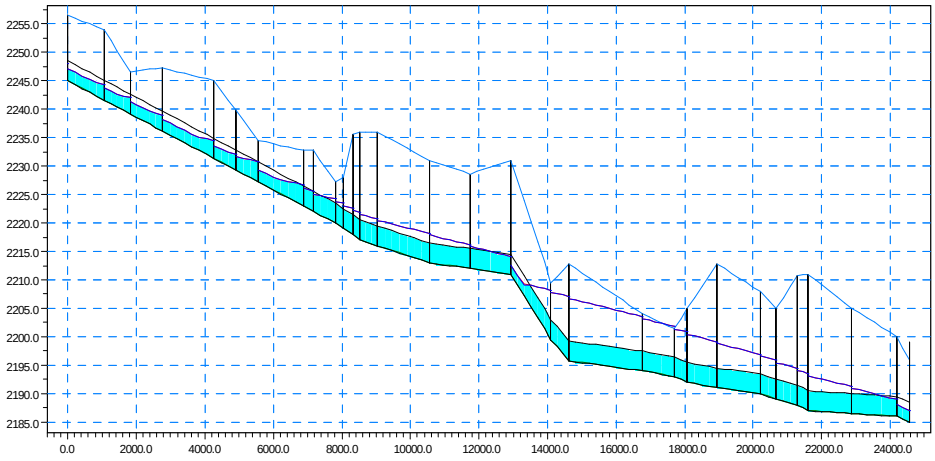
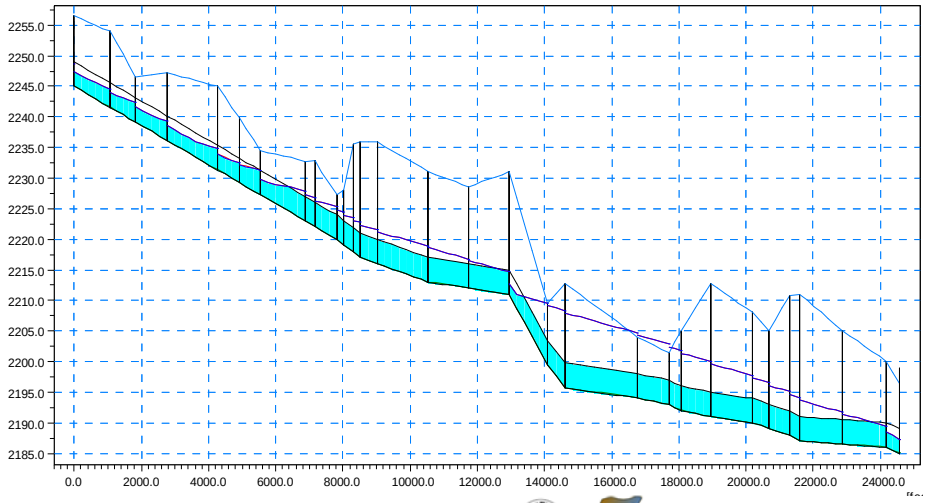
Interconnect Profile – Existing Plan
(42-inch pipe, Q=28 MGD)



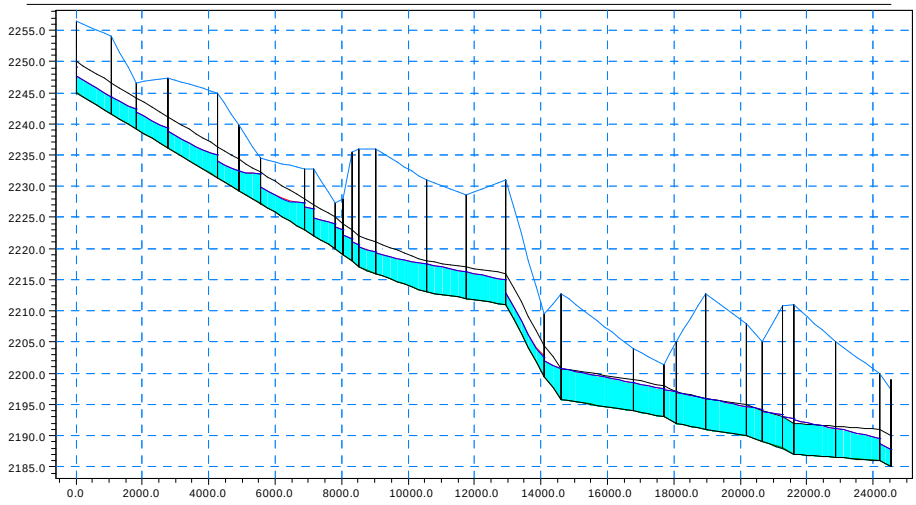
32

Interconnect Profile – Transfer Some
(48-inch pipe, Q=40 MGD)



33

Interconnect Profile – Transfer All
(60-inch pipe, Q=60 MGD)



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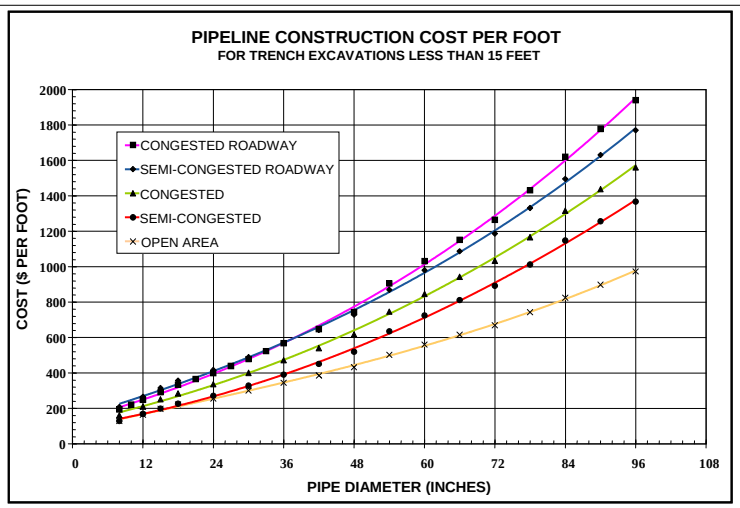
Pipe Unit Costs



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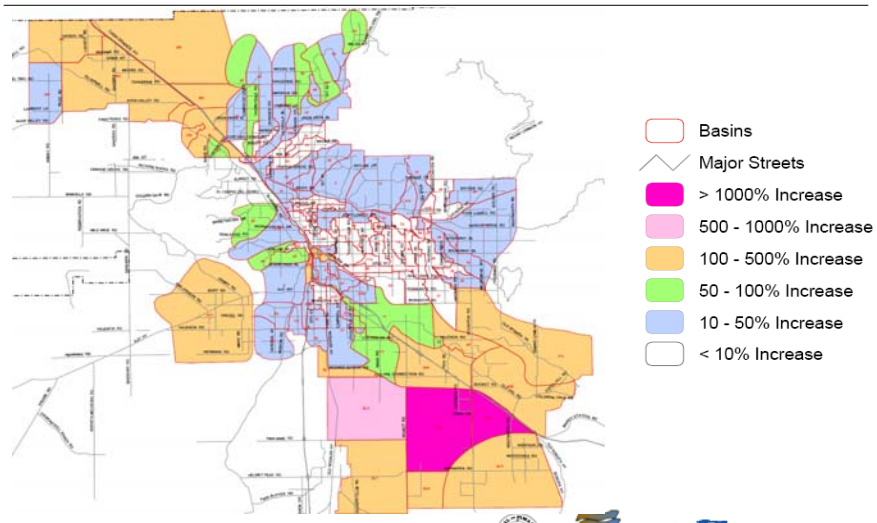
Population Growth Outlying Facilities

Steve Sticklen

Population Growth, 2005 – 2030



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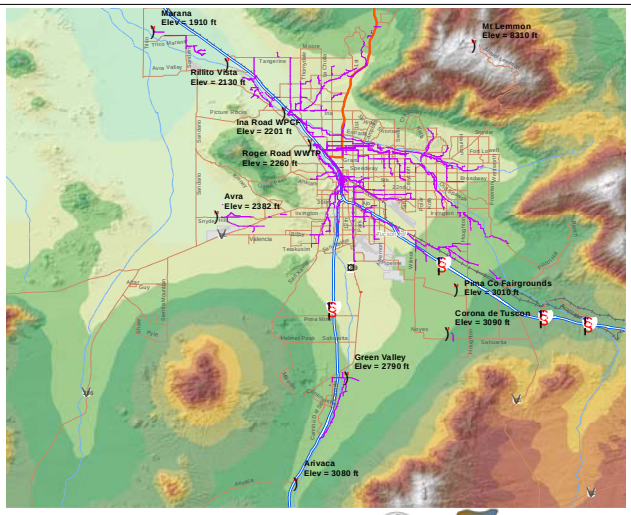
Area Topography



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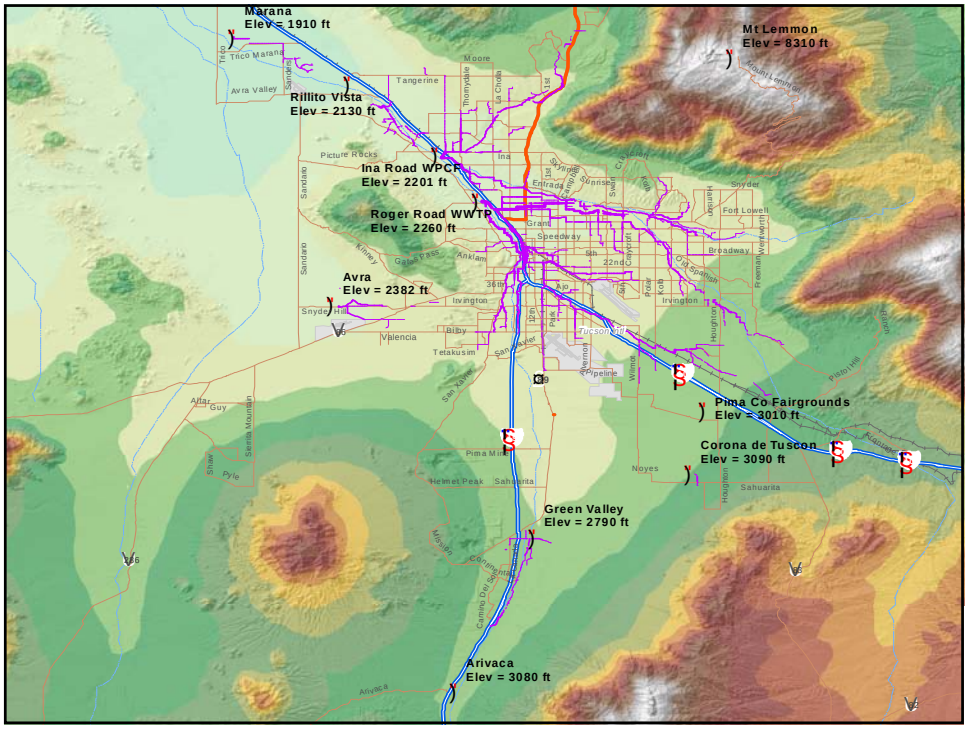

Pima County Wastewater Management Department

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Recommended Evaluation Approach

Steve Sticklen

Recommended Approach

- Review basin model
- Develop skeletal hydraulic model
  - Identify critical conveyance facilities
  - Request manhole rim and inverts
- Develop diurnal patterns
- Develop existing / future loads
- Identify / confirm hydraulic inadequacies
- Alternative analysis
  - System upgrades
  - Plant interconnect
  - Outlying facilities

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Pima County Wastewater Management Department

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Evaluation Criteria

Gordon Culp

Evaluation Criteria

- Present worth cost
- Non-monetary considerations
  - Constructability
  - Long-range planning
  - Safety
  - Public acceptance
  - Maintenance
  - Rights-of-way
  - Pump stations
  - Utility conflicts
  - Traffic control
  - Environmental impacts
  - Business disruption
  - Archeological / historic sites
  - Permitting

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Peaking Factor

Upstream Population	Peaking Factor
1,001 to 10,000	PF = (6.330 x p - 0.231) + 1.094
10,001 to 100,000	PF = (6.177 x p - 0.233) + 1.128
More than 100,000	PF = (4.500 x p - 0.174) + 0.945
PF = Peaking Factor	
p = Upstream Population	

Table 3.4.1 from 2006 Facility Plan

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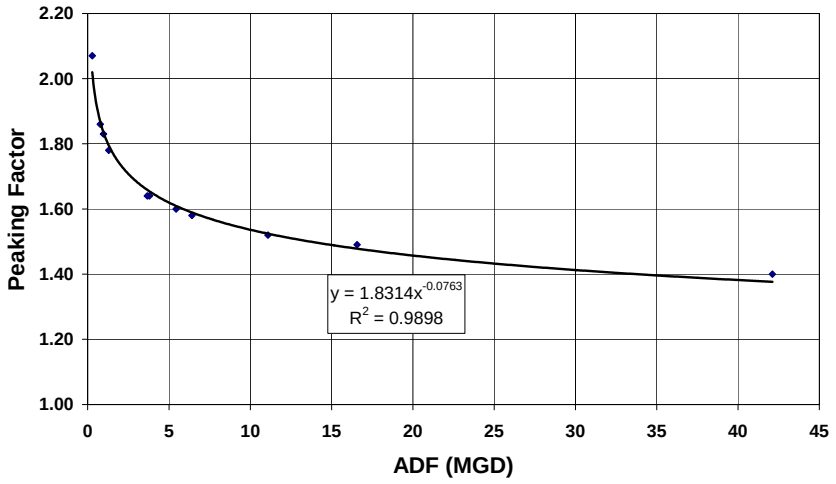
Peaking Factor



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Information Transfer Summary

Steve Sticklen

Information Transfer Summary

- Received
  - Land use
  - Roads, parcels
  - Manhole locations, pipe locations and sizes
  - TAZ data (2000 population)
  - Flow data
- Outstanding
  - Basin model
  - TAZ data (population projections)
  - Manhole rim and invert elevations
  - Flow data

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Workshop #9 Meeting Notes
Second Brainstorming Workshop & Facility Oriented Workshop

1. Workshop #9 - Second Brainstorming Workshop & Facility Oriented Workshop for Pima County Regional Optimization Master Plan was held on August 9, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
PCWMD Staff
James Doyle
Houssam Eljerdi
Dennis Froehlich
Frank Gall
Mary Hamilton
Michael Kostrzewski
Byron McMillan
John Munden
Steve Munsell
Jeff Prevatt
Prakash Rao
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager
John Sherlock
John Warner
Ken Weber
Legal
Harlan Agnew
Chuck Wesselhoft

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Dennis Rule
Mark Seamans
Linda Smith
Tim Thomure
Ken Thompson, CH2M Hill

PCRFCD
Tom Helfrich

PEER GROUP
Joe Husband, MPI
Gary Newman, B&C
Cindy Wallis-Lage, B&V

GREELEY AND HANSEN PROJECT TEAM
Orrie Albertson
Jerry Bish
Gordon Culp
Joe Popeck
Andy Richardson

2. Major topics of the workshop were:

- Workshop #9: Second Brainstorming Workshop & Facility Oriented Workshop
  - Tres Rios del Norte Project
  - Phosphorus Removal
  - Design Influent/Mass Loadings
  - Process Evaluation Matrix Revisited
  - Key Design Criteria

- Process for System Configuration Evaluation
- Procedure for Estimating Costs
- Risks Associated with Reusing Existing Structures and Facilities

A set of handouts were provided to each attendee which included presentation slides used during the workshop.

Throughout the workshop notes were recorded on a series of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. The flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, welcomed the attendees to Workshop #9. All were invited to drill down on the issues of wastewater treatment processes under consideration for Roger Road WWTP and Ina Road WPCF through the brainstorming process, participate in a robust discussion and narrow down the wastewater treatment process selections.

4. Andy Richardson defined his role as facilitator with the task of moving the group through the agenda and to encourage participation. The group was advised that this workshop was a critical point in the master plan process. This was the last strategic decision workshop before moving on to the detailed decisions for the master plan.

   Throughout the previous workshop there were a number of flow alternatives proposed for Roger Road WWTP and Ina Road WPCF. A chart of flows to each plant and the processes for nitrification and denitrification was presented to the group for discussion later in the workshop. The table is provided below.

Q, mgd			Bardenpho	IF/AS	MLE + deN Filter
IR	RR Rehab	RR Greenfield			
22	60	60			
38	44	44			
45	37	37			
50*	32*	32			
62*	20*(1)	20			
82*	0*	--			

IR = Ina Road WPCF
RR = Roger Road WWTP
* = Flows from Workshop #4
(1) Use of Biotower option at RR

Agenda, groundrules and purpose of the workshop were presented and covered on pages 1 through 4 of the handout.

5. Tom Helfrich, District Study Manager for Pima County Regional Flood Control District (PCRFCD), provided an overview of the Tres Rios Del Norte Project Ecosystem Restoration Feasibility Study. The study is being conducted by the Corps of Engineers with support by PCRFCD, City of Tucson and the City of Marana. The study covers 18 miles of the Santa Cruz River from Prince Road to North Sanders Road and encompasses 19,800 acres. Objectives of the study are:

   - Ecosystem restoration
   - Flood damage control
   - Groundwater recharge
   - Recreation
   - Cultural resource preservation

   The plan has not been finalized, but is expected to be completed this fall. Some of the preliminary features, which are subject to change include:

   - Restoration of 3,000 acres of riparian habitat
   - Seven (7) grade control structures (bottom stabilization)
   - Soil bank protection
   - Three (3) pedestrian bridge crossings
   - Off-channel recharge basins (spreading)
   - In-channel T-berms (recharge feature)

   The study area is divided into three reaches:

   1. Prince Road north to Ina Road,
   2. Ina Road north to Avra Valley Road
   3. Avra Valley Road north to North Sanders Road

   Reach 1 covers the Santa Cruz River from the Roger Road WWTP discharge to the Ina Road WPCF discharge. The recommended plan for reach 1 is to develop cottonwood and willow tree habitat (145 acres), mesquite bosque habitat (438 acres) along with other native plant and shrub species (164 acres) at the edges and to create wetland areas (40 acres) in the river bottom. Open channel flow from upstream projects is unlikely. Wetland areas will have water depths of 6 inches to 9 feet.

   The vegetation in the proposed reach 1 plan will require 2,851 acre-feet/year including consumptive and evaporative losses and direct precipitation. This does not include constructed (groundwater) recharge nor channel losses. If channel losses are estimated to be 4.0 acre-feet per mile per day then an additional 6,905 acre-feet/year is required to sustain the ecosystem restoration. For the recommended plan this equates to a total of 9,756 acre-feet/year, or on average approximately 8.71 mgd. A limited restoration plan, or a plan to maintain the existing habitat would reduce the water needs to 8,384 acre-feet/year (average 7.49 mgd) or 7,632 acre-feet/year (average 6.82 mgd), respectively.

   The Tres Rios del Norte project probably cannot proceed without effluent.

6. Mike Gritzuk asked the status of other ecosystem restoration projects considered by the PCRFCD. Tom Helfrich indicated that the Paseo de las Iglesias (1,000 acre) project, which is up the Santa Cruz River (south of Congress) of the Tres Rios del Norte project. The Paseo de las Iglesias project is completed and is first in line for funding. The Tres Rios del Norte project is second for funding (with a preliminary cost of $300 million) and third is a project that covers the Santa Cruz River from Congress to Prince Road. The latter project is not in the planning stage at this time, but is projected to start in two years. Funding sources are to include the County, City of Tucson, City of Marana, Corps of Engineers and private donations.

   Mike Bunch asked if the funds are available for the projects. Funding for all the projects is not committed. It is expected that some elements of the Tres Rios del Norte project will be funded and constructed, while other elements will go unfunded.

7. Dennis Rule indicated that regard to the Tres Rios del Norte project the Tucson Water was keeping their options open regarding water recharge in the Santa Cruz River. Depending on the timing of events Tucson Water could utilize effluent directly or recover water through a river groundwater recharge program. With managed recharge, the plant effluent would be moved one-half mile upstream (south).

8. Harlan Agnew asked if there were any lakes or ponds created by the projects. Tom Helfrich indicated that there will be wetlands and open water features, but none deep enough to be classified as a lake (minimum depth of 9 feet).

   Tres Rios del Norte program is based on 9,000 AC/ft/yr for consumptive use on the Santa Cruz River, approximately 3,000 AC/ft/yr between Roger Road and Ina Road. Another 6,000 AC/ft/yr is planned below Ina Road. This does not consider recharge allocations.

   Ron Riska asked whether the T-berms would survive a storm event. The response was unknown if they would survive. T-berms will be constructed with local funds. Also, with the vegetation planned, what sorts of nutrients are required in the water? Response from Tom Helfrich was that nutrients were not discussed in the Corps of Engineers' study.

9. Orrie Albertson presented the information on wastewater characteristics and flows. There was discussion whether 85 gpcd was a correct assumption for the future with low flow fixtures and interest in gray water use. Paul Bennett suggested a sensitivity analysis for flows as low as 65 gpcd from the 85 gpcd be used in the planning activity.

   Wastewater characteristics and flows were covered on pages 6 through 11 of the handout.

10. Joe Popeck presented the background and regulatory/other drivers for phosphorus removal in the effluent. Phosphorus can lead to algae growth and hypoxia conditions creating aesthetic and odor problems, and negative impacts on aquatic life. Dennis Froehlich suggested that P removal be designed to treat the entire flow at the plant, but only that portion discharged to the river receive phosphorus removal treatment. But according to AZPDES permits, the whole effluent needs to be treated to the highest standard, which would be for P removal.

Based on the fact that master plan is for 25 years in the future, add bio P removal to the treatment system requirements.

Phosphorus removal was covered on pages 5 and 6, and 15 through 18 of the handout.

11. Gordon Culp reviewed the process evaluation matrix. The selected process from the matrix is to determine the system configuration to determine the total integrated costs of the options. After the options are evaluated, a sensitivity analysis will confirm the final process selection. The group agreed to do the system configuration based on Bardenpho, then do sensitivity with other processes - IF/AS, MLE + deN filters and Biotowers (at Roger Road WWTP for 20 mgd only). This will provide the difference in the process costs, as well as the total system costs. This process does not close doors on any process.

    Jim Doyle reminded the group that the process selected must be operable, maintainable, reliable and be "bullet-proof" with regards to meeting permit requirements.

    Process evaluation was covered in pages 11 through 14 of the handout.

12. Joe Popeck presented key design criteria including schedule, costs, risks and value of existing facilities. An example of risk is the creation of an illogical flow path for adding new aeration tanks. Piping arrangements have pipes crossing other pipes and aeration tanks scattered around the site. Melodee Loyer asked if a "green field" plant could be designed and would the public accept higher costs for construction. A "green field" plant is an option for Roger Road WWTP.

    Valuation methodology uses asset approach to determine investment value of assets to remain in service in the future. Asset values are adjusted on condition and functionality for its intended use. Mike Gritzuk agreed with these factors and added a factor to maintain facilities in service during construction and factors for retrofitting existing structures where existing conditions are unknown. John Sherlock supported the idea of increased construction cost risk because of lack of "as-builts". There was concern over double accounting or over derating an asset, so that assigning values will need to be carried out carefully.

    Key design criteria was covered on pages 18 through 27 of the handout.

13. Gordon Culp presented the flow matrix from the beginning of the workshop. There was discussion on the plants to expand Ina Road WPCF to 50 mgd as Roger Road WWTP has 160 acres available for facilities. After review of the alternatives, the group decided the flows discussed at Workshop #4 would remain for the development of the system configuration options. A sensitivity analysis will be conducted to evaluate the other flows under consideration.

14. Mike Gritzuk summarized the workshop as a good session and thanked everyone for attending and participating.

Agenda
Workshop #9 – Second Brainstorming Workshop & Facility Oriented Workshop
August 9, 2006

Time	Topic	Presenter
7:45 am	*Continental Breakfast – Tucson Main Library, Basement Meeting Rm, 101 N. Stone*	
8:15 am	Opening Session	
	• Welcoming Remarks	Mike Gritzuk
	• Review Agenda	Andy Richardson
	• Workshop Goals	
8:30 am	Tres Rios del Norte Project	PCFCD
8:50 am	Phosphorus Removal	Joe Popeck
	• Background	
	• Regulatory/Other Divers	
9:00 am	Design Influent/Mass Loadings	Orrie Albertson
	• Roger Road WWTP	
	• Ina Road WPCF	
10:00 am	Break	
10:15 am	Process Evaluation Matrix Revisited	Gordon Culp
	• Peer Group Responses	
	• Discussion	
	• Develop/Complete Matrix	
11:15 am	Phosphorus Removal – Part 2	Joe Popeck
	• Bio P Impacts	
	• Chemical Addition Impacts	
	• Ultimate Level of P Removal	
12:00 pm	Lunch	
1:00 pm	Key Design Criteria	Joe Popeck
	• Level of Treatment Plant Detail	
	• Basis of Cost Estimates	
	• Design Criteria Used to Size Treatment Processes	
2:00 pm	Process for System Configuration Evaluation	Gordon Culp
3:00 pm	Second Treatment Process (Sensitivity Testing)	Gordon Culp
3:15 pm	Summary Wrap-Up	Andy Richardson
	• Comments by Group	
	• Closing Remarks	Mike Gritzuk
3:30 pm	Adjourn	

Flip Chart Notes – August 9, 2006

Q, mgd			Bardenpho	IF/AS	MLE + deN Filter
IR	RR Rehab	RR Greenfield			
~~22~~	~~60~~	~~60~~			
~~38~~	~~44~~	~~44~~			
~~45~~	~~37~~	~~37~~			
50*	32*	32			
62*	20*(1)	20			
82*	0*	--			

IR = Ina Road WPCF
RR = Roger Road WWTP
* = Flows from Workshop #4
(1) Use of Biotower option at RR

Tres Rios

- Three Corp restoration projects:
  - Project 1: Six miles south of Congress
  - Project 2: Congress to Prince behind by a couple of years
  - Project 3: Tres Rios
- Reach 1 Prince Road to Ina Road
- Water depths 6 inches to less than 9 feet – River bottom
- 40 Acres of wetlands (over 9 feet is considered a lake)
  - 8 AC/ft/AC cottonwoods/willows (145 acres)
  - 6 AC/ft/AC wetlands (40 acres),
  - 3AC/ft/AC mesquite bosque (438 acres)
  - 2 AC/ft/AC desert scrub (164 acres)
- 8,200 AC/ft/year for groundwater recharge

Tres Rios – $300 million

- Tres Rios construction start 2010? Two-year construction 2012?
- 2,800 AC/ft/yr (2.5 mgd) for existing/new habitat
- 8,384 AC/ft/yr (7.5 mgd) wet channel Roger Road to Ina Road
- May or not need in-channel recharge; Tucson Water has to look at timing
- Total demand
  - Total Restore 2,851 AC/ft/yr
  - Total Water Demand 8,195 AC/ft/yr
  - Losses 6,905
  - Total Water 15,100

  17,951 AC/ft

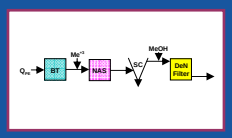
- No lakes or ponds
- River bottom wetlands
- Flowing water feature
- Open body water
- Several elements will go forward, maybe?

Phosphorus

- Need present worth on Bio P added at after construction of original facility

Process

- Use Bardenpho for system configuration with other processes for sensitivity analysis



Pima County Regional Optimization Master Plan

Workshop #9
Second Brainstorming Workshop & Facility Oriented Workshop

August 9, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
PCFCD	Tres Rios del Norte Project
Joe Popeck	Phosphorus Removal / Key Design Criteria
Orrie Albertson	Design Influent / Mass Loadings
Gordon Culp	Process Evaluations

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop objectives
- Tres Rios del Norte Project
- Phosphorus removal
- Design influent/mass loadings
- Process evaluation matrix revisited
- Key design criteria
- Process for system configuration evaluation
- Second treatment process (sensitivity testing)
- Summary wrap-up

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Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

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Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

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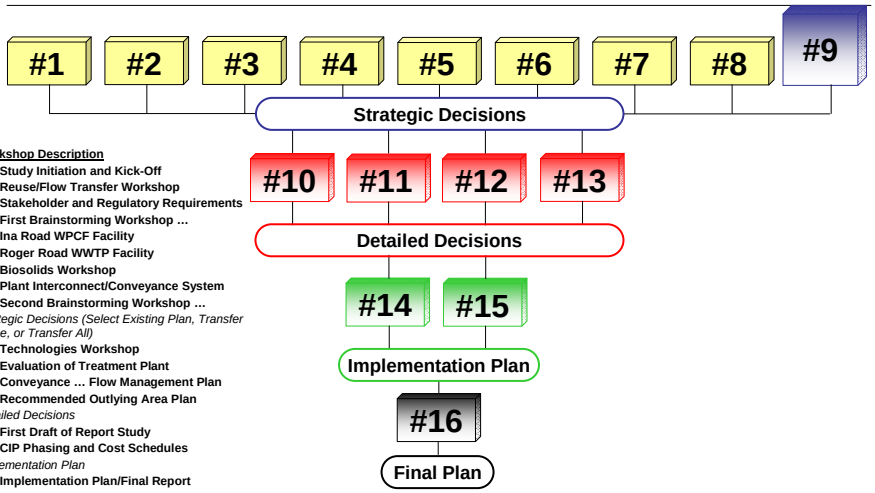
Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Workshop Objectives

- Agree on level of phosphorus removal for design
- Agree on influent loadings
- Agree on level of treatment plant detail adequate to select system configuration
- Agree on basis of cost estimates
- Agree on design criteria used to size treatment processes
- Agree on treatment process evaluation matrix
- Address concern that selection of only one treatment process for system configuration evaluation may bias selection of system configuration

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Tres Rios del Norte Project

PCFCD

Phosphorus Removal

Joe Popeck

Phosphorus Removal

- Background
- Regulatory / other drivers

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Phosphorus Removal Background

- PCWMD has expressed the desire to include P Removal a part of ROMP (preference for Bio – P)
- Neither current nor future (2014/2015) AZPDES Permits require P Removal

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P Removal – Regs/Other Drivers

- Drivers for P Removal
  - Prevent degradation of receiving waters
    - Algae Growth/Hypoxia – negative impacts on fish
    - N/P Ratio < 7.0, promotes growth of blue-green algae with related odor problems in receiving stream
  - Possibly of Tres Rios del Norte Project
  - Regulatory uncertainty/being investigated
  - Others???

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P Removal – Regs/Other Drivers

- Effluent P Requirements may be lower than 1 mg/L, perhaps 0.1 mg/L
  - Bio P not able to achieve the lower limit
  - However, Bio P can be coupled with Chemical P for polishing to lower limits

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Design Influent /Mass Loadings

Orrie Albertson

Preliminary Wastewater Characteristics from WS #4

Parameter	*Units*	*Primary Influent*	*Primary Effluent*
COD	mg/L	649	420
BOD_5	mg/L	300	207
sBOD	mg/L	122	122
TSS	mg/L	281	112
VSS	mg/L	219	92
TKN	mg/L	54.4	51.5
TP	mg/L	9.8	9.2

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Wastewater Characteristics RR 32 MGD

Parameter	*Units*	*Total Raw Influent*	*Recycles*	*Primary Influent*	*Primary Effluent*
Flow	MGD	32.1	1.1	33.2	32.6
COD	mg/L	648	1,011	659	443
BOD5	mg/L	294	506	301	214
SBOD5	mg/L	121	116	121	123
TSS	mg/L	286	1,011	310	126
VSS	mg/L	225	791	243	104
TKN	mg/L	47	51	47	46
TP	mg/L	10	19	10	10

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Wastewater Characteristics
IR 50 MGD

Parameter	*Units*	*Total Raw Influent*	*Recycles*	*Primary Influent*	*Primary Effluent*
Flow	MGD	50.2	2.3	52.6	51.4
COD	mg/L	663	1,265	689	456
BOD5	mg/L	318	456	324	229
SBOD5	mg/L	123	125	123	126
TSS	mg/L	319	1,201	358	146
VSS	mg/L	254	881	282	123
TKN	mg/L	55	219	63	61
TP	mg/L	11	102	15	14

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Wastewater Characteristics
RR 20 MGD

Parameter	*Units*	*Total Raw Influent*	*Recycles*	*Primary Influent*	*Primary Effluent*
Flow	MGD	20.1	0.7	20.8	20.4
COD	mg/L	665	1,014	677	455
BOD5	mg/L	303	507	310	220
SBOD5	mg/L	123	117	123	126
TSS	mg/L	304	1,014	329	134
VSS	mg/L	239	794	258	110
TKN	mg/L	48	51	48	47
TP	mg/L	10	19	10	10

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Wastewater Characteristics
IR 62 MGD

Parameter	*Units*	*Total Raw Influent*	*Recycles*	*Primary Influent*	*Primary Effluent*
Flow	MGD	62.2	2.7	64.9	63.6
COD	mg/L	654	1,238	679	441
BOD5	mg/L	311	461	317	223
SBOD5	mg/L	122	123	122	125
TSS	mg/L	307	1,172	343	140
VSS	mg/L	244	873	270	116
TKN	mg/L	54	196	59	57
TP	mg/L	11	90	14	13

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Wastewater Characteristics
IR 82 MGD

Parameter	*Units*	*Total Raw Influent*	*Recycles*	*Primary Influent*	*Primary Effluent*
Flow	MGD	82.3	3.4	85.7	84.0
COD	mg/L	654	1,184	675	452
BOD_5	mg/L	307	472	314	222
$SBOD_5$	mg/L	121	122	121	123
TSS	mg/L	304	1,140	337	138
VSS	mg/L	241	852	265	115
TKN	mg/L	52	165	56	54
TP	mg/L	10	75	13	12

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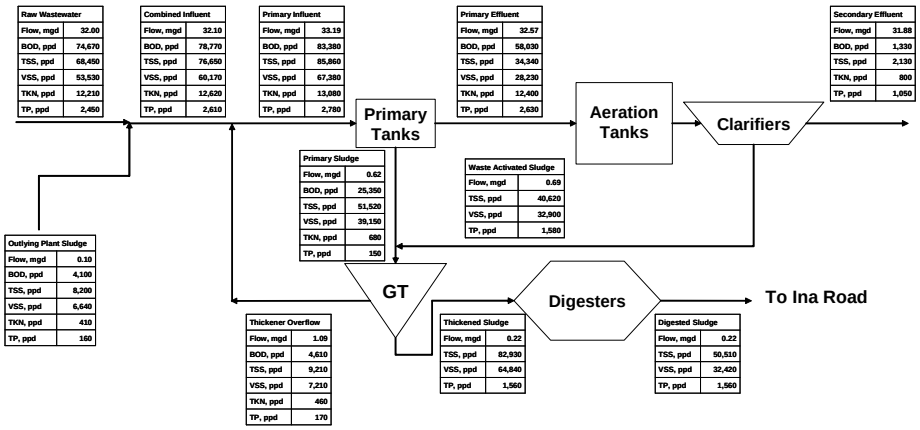
See Appendix

Roger Road Mass Balance – 32 mgd



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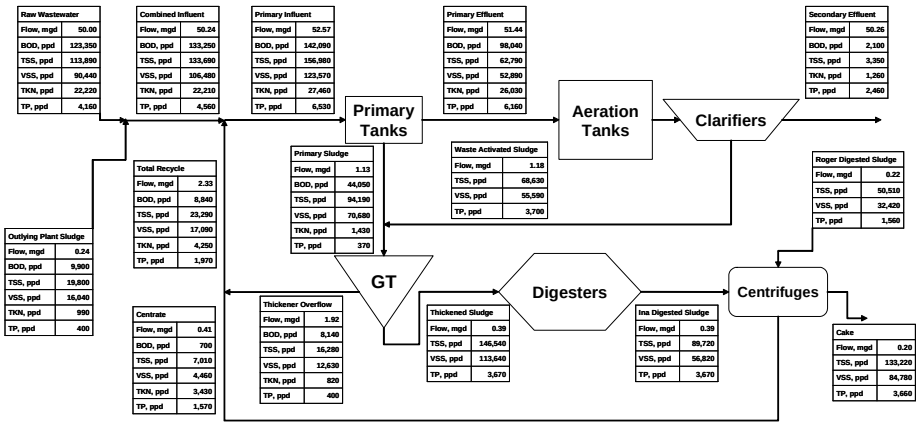
See Appendix

Ina Road Mass Balance – 50 mgd



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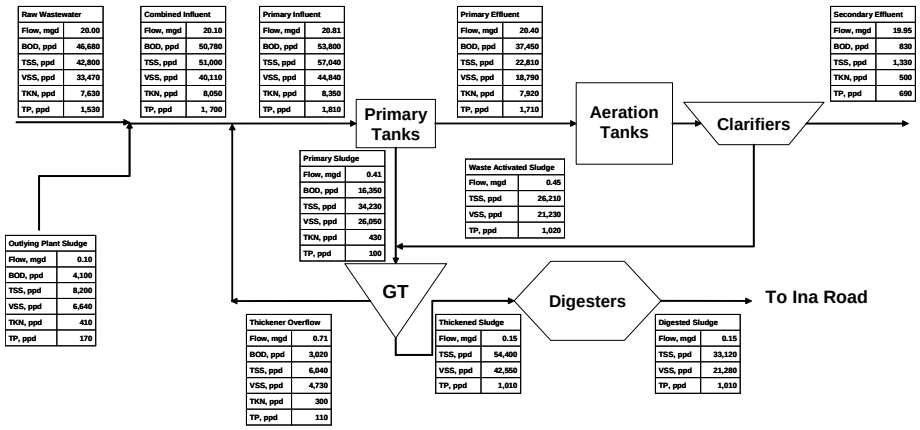
See Appendix

Roger Road Mass Balance – 20 mgd



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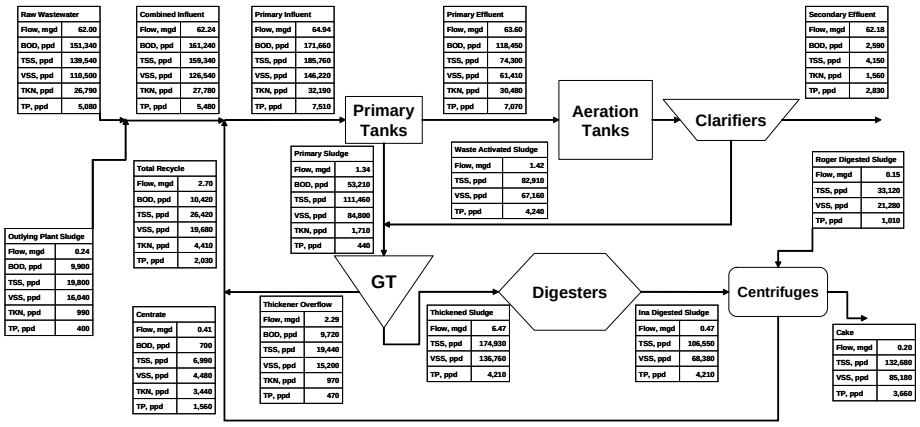
See Appendix

Ina Road Mass Balance – 62 mgd



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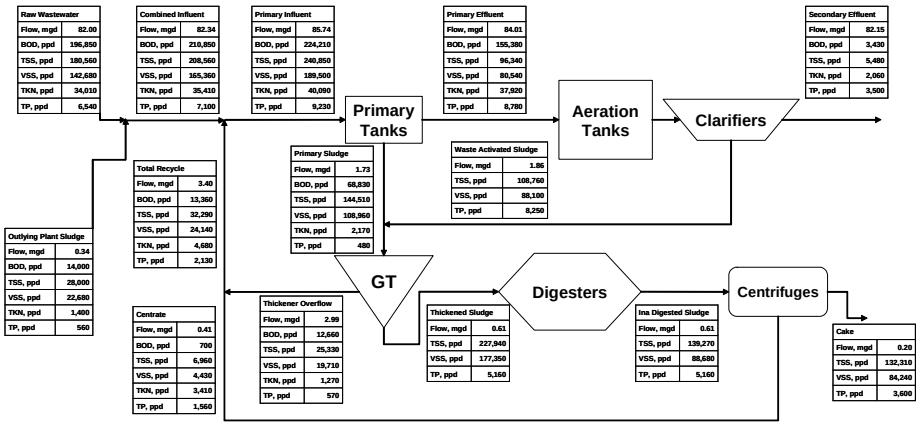
See Appendix

Ina Road Mass Balance – 82 mgd



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Raw Wastewater Characteristic Development

Preliminary vs. Special Testing WW Characteristics RR WWTP				
	RAW		*PRIMARY EFFLUENT*	
Parameter	*Preliminary, mg/L*	*Special Test, mg/L*	*Preliminary, mg/L*	*Special Test, mg/L*
COD	585	594 ± 63	408	352 ± 21
SCOD	-	207 ± 16	-	230 ± 16
BOD_5	261	231 ± 14	195	148 ± 13
$SBOD_5$	116	88 ± 7	117	106 ± 10
TSS	228	234 ± 17	103	57 ± 11
VSS	180	198 ± 11	84	48 ± 9
TKN	39	38.5 ± 2.2	43.4	33.2 ± 2.1
NH_4-N	-	22.7 ± 0.3	-	22.9 ± 0.9
TP	8	6.0 ± 0.3	8.7	4.8 ± 0.2

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Raw Wastewater Characteristic Development

Preliminary vs. Special Testing WW Characteristics IR WPCF				
	RAW		*PRIMARY EFFLUENT*	
Parameter	*Preliminary, mg/L*	*Special Test, mg/L*	*Preliminary, mg/L*	*Special Test, mg/L*
COD	590	557 ± 46	420	286 ± 42
SCOD	-	165 ±19	-	155 ± 21
BOD_5	300	223 ±15	207	106 ± 9
$SBOD_5$	125	63 ± 7	122	49 ± 9
TSS	270	258 ± 15	112	65 ± 14
VSS	220	217 ± 10	92	57 ± 13
TKN	57	40.7 ± 1.6	51.5	45.0 ± 5.3
NH_4-N	-	27.0 ± 7.6	-	33.7 ± 3.2
TP	10	6.6 ± 0.4	9.2	5.8 ± 0.6

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Process Evaluation Matrix Revisited

Gordon Culp

Process Evaluation Matrix Revisited

- Process Evaluation Matrix presents a single majority answer (from Peer Group) for each question for each process
- Questions are separated into "Primary" and "Secondary" considerations
- Process Evaluation Matrix are done separately for Roger Road WWTP and Ina Road WPCF

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Comprehensive Matrix

See Appendix

Legend

Sequence of Response: Joe Husband; Denny Parker (RR@20 mgd); Denny Parker (RR@32 mgd); Denny Parker (IR); Cindy Wallis-Lage (RR); Cindy Wallis-Lage (IR)

Shaded areas were not rated in Workshop #4

Underlined answers notate different rating than made in Workshop #4

Question	MLE	Bardenpho	AS/NTF	BT/NAS	StepNdeN	Biostyr/Biofor	IF/AS	MBR	BT/NdN	MBBR
1. Achieve <8mg/L N with inf = 55 mg/L	N, N, N, N, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, NA, Y	Y, Y, Y, NA, Y	N, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, M, M	Y, Y, Y, Y, M, M	Y, Y	Y, M, M
2. Emerging Contam. Removal	Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, NA, Y	Y, Y, Y, NA, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, DK, DK	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y	Y, Y, Y
3. High Methanol Use	N, N	N, N, N, N, N, N	Y, Y, Y, NA, Y	Y, N, Y, NA, Y	N, N, N, N, N, N	Y, Y, Y, Y, Y, Y	N, N, N, N, N, N	N, N, N, N, N, N	DK, Y	Y, Y, Y
4. Use Existing Biotowers	N, N, N, N	N, N, N, N, N, N	Y, Y, Y, NA, M	Y, Y, Y, NA, Y	N, N, N, N, N, N	Y, N, N, N, M	N, N, N, N, N	N, N, N, N, N, N	Y, Y	N, Y
5. Can use Bio P Removal	Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, NA, Y	N, N, N, NA, N	Y, N, N, N, Y, Y	N, N, N, N, N, N	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	N, N	Y, N, N
6. Capital Costs in Range of Bardenpho	N, DK, DK	Y, Y, Y, Y, Y, Y	DK, Y, Y, NA, DK	DK, Y, Y, NA, DK	DK, Y, Y, Y, DK, DK	N, N, N, N, N, N	Y, Y, Y, Y, Y, Y	DK, N, N, N, Y, Y	DK, DK	DK, DK, DK
7. Can use Existing Tankage	Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, NA, Y	Y, Y, Y, NA, Y	Y, Y, Y, Y, Y, Y	N, N, N, N, N, N	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y	Y, Y, Y
8. Achieve Eff. Turbidity <2 NTU	Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, NA, Y	Y, Y, Y, NA, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y, Y, Y, Y, Y	Y, Y	Y, Y, Y
9. Can use HPO System	Y, NA, NA, N, N	Y, NA, NA, N, N	N, NA, NA, NA	N, NA, NA, NA	N, NA, NA, N, N	N, NA, NA, N, M	Y, NA, NA, N, N	Y, NA, NA, N, N	N	N, M
10. O&M Costs in Range of Bardenpho	N, N, N	Y, Y, Y, Y, Y, Y	DK, N, N, NA, N	DK, N, N, NA, N	DK, Y, Y, Y, DK, DK	N, N, N, N, N, N	Y, Y, Y, Y, Y, Y	N, N, N, N, N, N	DK, N	N, N, N
11. Has been used in Bio N Removal in Plants >20 mgd, >3 yrs	Y, Y, Y	Y, Y, Y	DK, DK	DK, DK	Y, Y	Y, DK, DK	DK, N, N	DK, N, N	DK, DK	DK, DK, DK

Roger Road Matrix

See Appendix

Legend
Sequence of Response: Joe Husband; Denny Parker (RR@20 mgd); Denny Parker (RR@32 mgd); Cindy Wallis-Lage (RR);

Shaded areas were not rated in Workshop #4
Underlined answers notate different rating than made in Workshop #4

Question	MLE	Bardenpho	AS/NTF	BT/NAS	StepNdeN	Biostyr/Biofor	IF/AS	MBR	BT/NdN	MBBR
1. Achieve <8mg/L N with inf = 55 mg/L	N, N, N, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	N, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, M	Y, Y, Y, M	Y, Y	Y, M
2. Emerging Contam. Removal	Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, DK	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y	Y, Y
3. High Methanol Use	N	N, N, N, N	Y, Y, Y, Y	Y, N, Y, Y	N, N, N, N	Y, Y, Y, Y	N, N, N, N	N, N, N, N	DK, Y	Y, Y
4. Use Existing Biotowers	N, N, N, N	N, N, N, N	Y, Y, Y, M	Y, Y, Y, Y	N, N, N, N	Y, N, N, M	N, N, N, N	N, N, N, N	Y, Y	N, Y
5. Can use Bio P Removal	Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	N, N, N, N	Y, N, N, Y	N, N, N, N	Y, Y, Y, Y	Y, Y, Y, Y	N, N	Y, N
6. Capital Costs in Range of Bardenpho	N, DK	Y, Y, Y, Y	DK, Y, Y, DK	DK, Y, Y, DK	DK, Y, Y, DK	N, N, N, N	Y, Y, Y, Y	DK, N, N, Y	DK, DK	DK, DK
7. Can use Existing Tankage	Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	N, N, N, N	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y	Y, Y
8. Achieve Eff. Turbidity <2 NTU	Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y, Y, Y	Y, Y	Y, Y
9. Can use HPO System	Y, NA, NA	Y, NA, NA	N, NA, NA	N, NA, NA	N, NA, NA	N, NA, NA	Y, NA, NA	Y, NA, NA	N	N
10. O&M Costs in Range of Bardenpho	N, N	Y, Y, Y, Y	DK, N, N, N	DK, N, N, N	DK, Y, Y, DK	N, N, N, N	Y, Y, Y, Y	N, N, N, N	DK, N	N, N
11. Has been used in Bio N Removal in Plants >20 mgd, >3 yrs	Y, Y	Y, Y	DK, DK	DK, DK	Y	Y, DK	DK, N	DK, N	DK, DK	DK, DK

Roger Road Matrix Difference of Opinions

Process	*Question*	*Peer Group Answers*	*GH Team Answer*
MLE	Achieve <8 mg/L N with Inf = 55 mg/L	*3 Ns and 1 Y*	N
BT/NAS	High Methanol Use	*3 Ys and 1 N*	Y
StepNdeN	Achieve <8 mg/L N with Inf = 55 mg/L	3 Ys and 1 N	Y
StepNdeN	Can use Bio P	2 Ys and 2 Ns	N
Biostry/Biofor	Use Existing Biotowers	1 Y, 2 Ns and 1 M	N
IF/AS	Achieve <8 mg/L N with Inf = 55 mg/L	3 Ys and 1 M	Y
MBR	Achieve <8 mg/L N with Inf = 55 mg/L	3 Ys and 1 M	Y
MBR	Capital Cost in Range of Bardenpho	2 Ns and 1 Y	N
MBBR	Achieve <8 mg/L N with Inf = 55 mg/L	1 Y and 1 M	Y
MBBR	Use Existing Biotowers	1 Y and 1 N	N
MBBR	Can Use Bio P	1 Y and 1 N	N

Ina Road Matrix

See Appendix

Legend
Sequence of Response: Joe Husband; Denny Parker (IR); Cindy Wallis-Lage (IR)
Shaded areas were not rated in Workshop #4
Underlined answers notate different rating than made in Workshop #4

Question	MLE	Bardenpho	AS/NTF	BT/NAS	StepNdeN	Biostyr/Biofor	IF/AS	MBR	BT/NdN	MBBR
1. Achieve <8mg/L N with inf = 55 mg/L	N, N, Y	Y, Y, Y	Y, NA	Y, NA	N, Y, Y	Y, Y, Y	Y, Y, M	Y, Y, M	Y	Y, M
2. Emerging Contam. Removal	Y	Y, Y, Y	Y, NA	Y, NA	Y, Y, Y	Y, Y, DK	Y, Y, Y	Y, Y, Y	Y	Y, Y
3. High Methanol Use	N	N, N, N	Y, NA	Y, NA	N, N, N	Y, Y, Y	N, N, N	N, N, N	DK	Y, Y
4. Use Existing Biotowers	N	N, N	Y, NA	Y, NA	N, N	Y, N	N, N	N, N	Y	N
5. Can use Bio P Removal	Y, Y	Y, Y, Y	Y, NA	N, NA	Y, N, Y	N, N, N	Y, Y, Y	Y, Y, Y	N	Y, N
6. Capital Costs in Range of Bardenpho	N, DK	Y, Y, Y	DK, NA	DK, NA	DK, Y, DK	N, N, N	Y, Y, Y	DK, N, Y	DK	DK, DK
7. Can use Existing Tankage	Y, Y	Y, Y, Y	Y, NA	Y, NA	Y, Y, Y	N, N, N	Y, Y, Y	Y, Y, Y	Y	Y, Y
8. Achieve Eff. Turbidity <2 NTU	Y, Y	Y, Y, Y	Y, NA	Y, NA	Y, Y, Y	Y, Y, Y	Y, Y, Y	Y, Y, Y	Y	Y, Y
9. Can use HPO System	Y, N, N	Y, N, N	N, NA	N, NA	N, N, N	N, N, M	Y, N, N	Y, N, N	N	N, M
10. O&M Costs in Range of Bardenpho	N, N	Y, Y, Y	DK, NA	DK, NA	DK, Y, DK	N, N, N	Y, Y, Y	N, N, N	DK	N, N
11. Has been used in Bio N Removal in Plants >20 mgd, >3 yrs	Y, Y	Y, Y	DK	DK	Y, Y	Y, DK	DK, N	DK, N	DK	DK, DK

Ina Road Matrix Difference of Opinions

Process	*Question*	*Peer Group Answers*	*GH Team Answer*
MLE	Achieve <8 mg/L N with Inf = 55 mg/L	2 Ns and 1 Y	N
Bardenpho	Can use HPO System	1 Y and 2 Ns	N
StepNdeN	Achieve <8 mg/L N with Inf = 55 mg/L	1 N and 2 Ys	Y
StepNdeN	Can use Bio P	2 Ys and 1 N	N
IF/AS	Achieve <8 mg/L N with Inf = 55 mg/L	2 Ys and 1 M	Y
IF/AS	Can use HPO System	1 Y and 2 Ns	N

Ina Road Matrix Difference of Opinions

Process	*Question*	*Peer Group Answers*	*GH Team Answer*
MBR	Achieve <8 mg/L N with Inf = 55 mg/L	2 Ys and 1 M	Y
MBR	Capital Cost in Range of Bardenpho	1 N and 1 Y	N
MBR	Can use HPO System	1 Y and 2 Ns	N
MBBR	Achieve <8 mg/L N with Inf = 55 mg/L	1Y and 1 M	Y
MBBR	Can use Bio P	1 Y and 1 N	N
MBBR	Can use HPO System	1 N and 1 M	N

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See Appendix

Roger Road Matrix – Majority Answers

Shaded areas were not rated in Workshop #4

Question	MLE	Bardenpho	AS/NTF	BT/NAS	StepNdeN	Biostyr/Biofor	IF/AS	MBR	BT/NdN	MBBR
Primary Considerations										
1. Achieve <8mg/L N with inf = 55 mg/L	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
3. High Methanol Use	N	N	Y	Y	N	Y	N	N	Y	Y
5. Can use Bio P Removal	Y	Y	Y	N	Y/N	N	Y	Y	N	Y/N
6. Capital Costs in Range of Bardenpho	N	Y	Y	Y	Y	N	Y	N	DK	DK
7. Can use Existing Tankage	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
10. O&M Costs in Range of Bardenpho	N	Y	N	N	Y	N	Y	N	N	N
11. Has been used in Bio N Removal in Plants >20 mgd, >3 yrs	Y	Y	DK	DK	Y	Y	N	N	DK	DK
Secondary Considerations										
2. Emerging Contam. Removal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4. Use Existing Biotowers	N	N	Y	Y	N	N	N	N	Y	Y/N
8. Achieve Eff. Turbidity <2 NTU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Can use HPO System	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See Appendix

Ina Road
Matrix – Majority Answers

Shaded areas were not rated in Workshop #4

Question	MLE	Bardenpho	AS/NTF	BT/NAS	StepNdeN	Biostyr/Biofor	IF/AS	MBR	BT/NdN	MBBR
Primary Considerations										
1. Achieve <8mg/L N with inf = 55 mg/L	N	Y			Y	Y	Y	Y		Y
3. High Methanol Use	N	N			N	Y	N	N		Y
5. Can use Bio P Removal	Y	Y			Y	N	Y	Y		Y/N
6. Capital Costs in Range of Bardenpho	N	Y			Y	N	Y	N		DK
7. Can use Existing Tankage	Y	Y			Y	N	Y	Y		Y
10. O&M Costs in Range of Bardenpho	N	Y			Y	N	Y	N		N
11. Has been used in Bio N Removal in Plants >20 mgd, >3 Yrs	Y	Y			Y	Y	N	N		DK
Secondary Considerations										
2. Emerging Contam. Removal	Y	Y			Y	Y	Y	Y		Y
4. Use Existing Biotowers	NA	NA			NA	NA	NA	NA		NA
8. Achieve Eff. Turbidity <2 NTU	Y	Y			Y	Y	Y	Y		Y
9. Can use HPO System	N	N			N	N	N	NN		N

Process Evaluation Matrix Revisited

- Based upon the majority answers, Bardenpho is recommended for System Configuration Analysis
- MLE NdeN is recommended for Sensitivity Testing of System Configuration

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Phosphorus Removal – Part 2

Joe Popeck

Phosphorus Removal

- Capital Costs for P Removal
- Annual Costs for P Removal
- Summary and Previous Recommendations

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Phosphorus Removal

- Capital Costs for P Removal
  - Bio P – Range of $60K to $70K per MG to achieve 1.0 mg/L in effluent
  - Chemical P - About $10K per MG to achieve 1.0 mg/L in effluent

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Phosphorus Removal

- Bio P
  - If included now…
    - Capital Cost may be viewed as insurance
    - Operation in Bio P mode enhances receiving stream
    - Additionally, Operation in Bio P mode increases Sludge Settle-ability (SVI)
  - If added later…
    - Space would have to be reserved
    - Capital Cost will be far greater

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Phosphorus Removal

- Chemical P
  - If included now…
    - Capital Cost lower than providing for Bio P
  - If added later…
    - Space would have to be reserved
    - Capital Cost will be lower than providing for Bio P

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Phosphorus Removal

- Annual Costs for P Removal
  - Bio P – Range of $4K to $6K per MG to achieve 1.0 mg/L P in effluent
    - Assumes that some Chemical P treatment is necessary to consistently meet effluent standard of 1 mg/L P
  - Chemical P – Range of $100K to $110K per MG to achieve 1.0 mg/L P in effluent

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P Removal Costs – $1000's

Cost Element (per MG)	*Bio P*	*Chemical P*
Additional AT	$66	$0
Chemical S and H	$4	$10
Total Add'l Capital	$70	$10
Annual Chemical Cost	$4	$80
Add'l Annual Sludge Cost	$2	$25
Total Add'l Annual Cost	$6	$105
Present Worth	$130	$1,000

49

P Removal Costs – $1000's

Phosphorus Removal PW Cost Summary		
Plant Capacity	*Bio P*	*Chemical P*
20 MGD	$2,600	$20,000
32 MGD	$4,200	$32,000
50 MGD	$6,500	$50,000
62 MGD	$8,100	$62,000
82 MGD	$10,700	$82,000

50

Phosphorus Removal

- Summary:
  - Small, but real possibility of a regulatory P standard in the future
  - Bio P requires a relatively small capital investment to provide "insurance policy"
  - Operation in Bio P mode will enhance receiving stream
  - Operation in Bio P mode will improve sludge settle-ability (SVI)

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Phosphorus Removal

- Recommendations from WS #4
  - Include Bio P as a primary issue regarding Process Alternative Screening
  - Include Bio P in Process Alternative Cost Evaluations

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Phosphorus Removal

- Should the PCWMD ROMP include Bio P removal as a primary consideration in the selection of process alternatives?

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Key Design Criteria

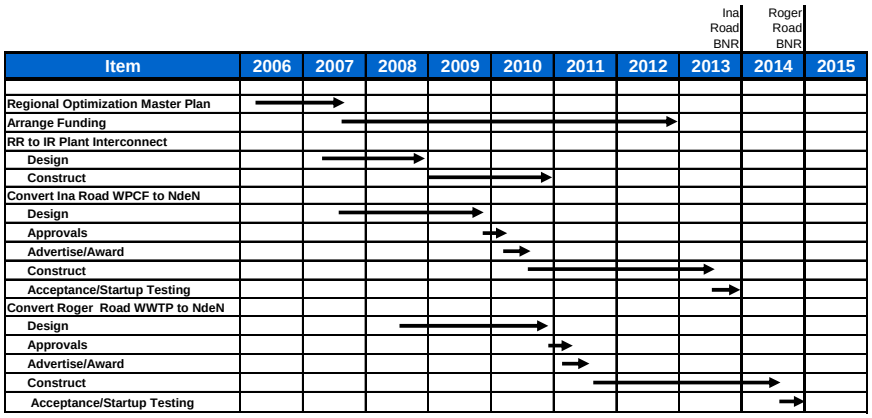
Joe Popeck

Key Design Criteria

- Schedule
- Level of detail for layouts of treatment plant alternatives
- Capital costs
- Strategic risk elements
- Value of existing facilities
- Annual costs/ present worth
- Design criteria used to size treatment processes

55

Project Implementation Schedule



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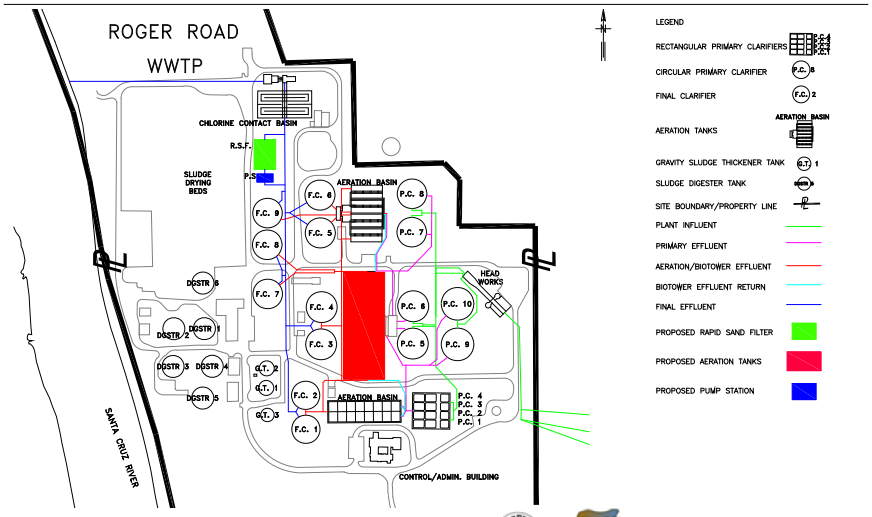
Level of Detail for Layouts of Treatment Plant Alternatives

- Show underground conduits and other significant physical constraints on site plans
- Identify capital cost associated with reconfiguration of underground conduits and other significant physical constraints in evaluation of alternatives
- Include requirements and costs for demolition/removal in evaluation of alternatives

57

Example Layout – Roger Road Bardenpho 20 MGD



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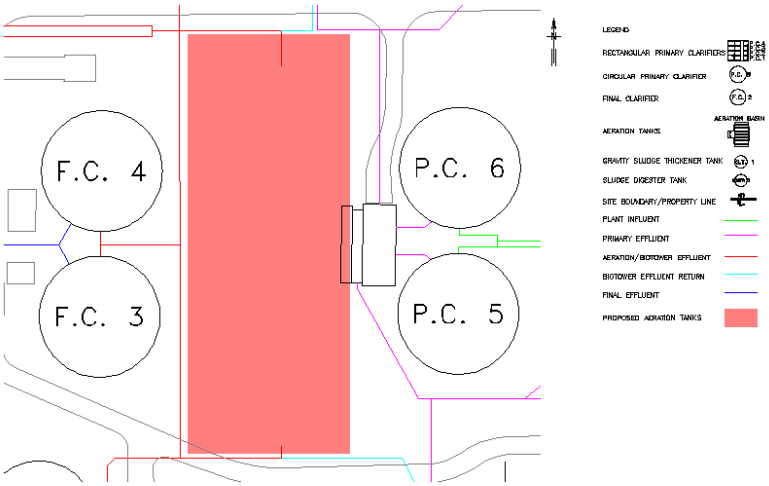
Example Layout – Roger Road Bardenpho 20 MGD



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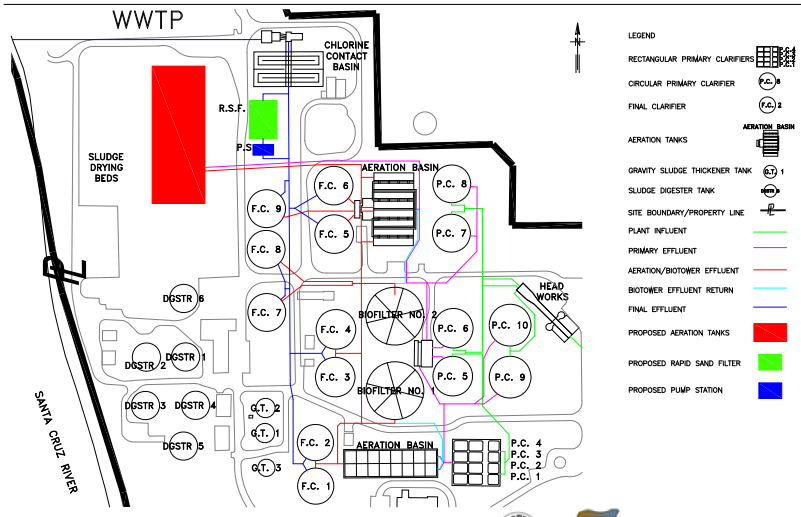
Example Layout - Roger Road Bardenpho 20 MGD



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Capital Costs

- Basis of capital cost estimates for process evaluations summarized in the Overview of W/W Costs Program
- Capital costs for IF/AS and Membrane Process alternatives - media, membranes and ancillary equipment not normally associated with conventional processes based on costs provided by vendors.

61

Strategic Risk Elements

- Mission Risk
  - Will PCWMD be able to delivery without interruption, wastewater treatment by depending on existing structures to meet the department's overall mission and goals?

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Strategic Risk Elements

- Operational Risk
  - Will PCWMD be able to ensure continuity of operations and the safety of those operating the facilities?
    - Functionality
    - Obsolescence
    - Maintaining treatment while constructing upgrades

63

Strategic Risk Elements

- Systems Risk
  - Will PCWMD be able to ensure that all unit processes will operate as intended in an overall wastewater treatment system?
    - Information Adequacy
    - Remaining useful life

64

Strategic Risk Elements

- Physical Risk
  - Will PCWMD have to deal proactively with any risks (unknowns) related to the long term utility of existing structures?
    - Latent Defects
    - Subsurface Risk
    - Time and access for inspections
    - Timing between planning, design and construction

65

Strategic Risk Elements

- Political Risk
  - Will PCWMD risk exposing the department to bad publicity by not being able to delivery the services the elected officials and the public expect?

66

Value Of Existing Facilities

- Existing facilities to be incorporated into the new scheme may have value
- However, determining the value of existing facilities requires risk adjusted pricing techniques to be employed

67

Risk Adjusted Pricing

- Utilizes standard utility valuation methodology
- Recognizes risks associated with use of existing assets
- Takes into consideration both condition and functionality of existing assets

68

Pricing Without Risk

If you DO NOT recognize risk associated with using existing assets, total cost of additional aeration basins would be priced:

Facility	*Total Capacity Needed (MG)*	*Existing Capacity (MG)*	*Additional Capacity Needed (MG)*	*Total Cost New at $1,000/MG*
Aeration Tank	**40**	**20**	**20**	**$ 20,000**

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Valuation Methodology

- Utilizes asset approach to determine investment value of existing assets
- Investment value recognizes value to a specific owner as opposed to the value to the marketplace as a whole

70

Risks Associated With Existing Assets

- Condition Risk – Poor condition of assets limits their usefulness
- Functional Risk – Design, configuration, or location may limit their usefulness

71

Determining Risk Adjusted Value

- Determine value if new:

Facility	*Existing Capacity (MG)*	*Value If New at $1,000/MG*
Aeration Tank	**20**	**$ 20,000**

72

Recognize Condition Risk

- Assign a condition factor to the asset that approximates its remaining useful life based on inspection of the asset
- Accuracy and precision of the condition factor affected by availability of information about the asset, and scope of the inspection performed

Condition	*Condition Factor*
Excellent	**90%**
Good	**70%**
Marginal	**40%**
Poor	**10%**

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Recognize Functional Risk

- Assign a functionality factor to the asset that characterizes its functionality and compatibility with respect to the rest of the new system. This factor should take into consideration asset's configuration and location as well as asset's potential for premature obsolescence

Functionality	*Functionality Factor*
Properly located and/or configured; compatible; newer technology	**75%**
Marginally located and/or configured; marginally compatible; older technology	**50%**
Poorly located and/or configured; incompatible outdated technology	**25%**

74

Develop Risk Adjusted Value

- Apply risk adjustment factors to value of asset if new to determine risk adjusted value:

Facility	*Existing Capacity (MG)*	*Value If New*	*Condition Factor*	*Condition Adjusted Value*	*Functionality Factor*	*Risk Adjusted Value*
Aeration Tank	**20**	**$ 20,000**	**70%**	**$ 14,000**	**75%**	**$ 10,500**

75

Develop Risk Adjusted Pricing

- Risk adjusted cost of the facility, using existing assets, is the cost new, less the risk adjusted value of existing assets

Facility	*Total Capacity Needed (MG)*	*Cost New at $1,000/MG*	*Risk Adjusted Value of Existing Assets*	*Risk Adjusted Cost*
Aeration Tank	**40**	**$ 40,000**	**$ 10,500**	**$ 29,500**

76

Annual Costs

- Power @ 8.7 cents per kWh
- Methanol @ 15 cents per pound ($1.00 per gallon)
- Alum @ $400 per ton (dry basis), $1.00 per gallon, liquid basis

77

Present Worth

- Present worth
  - The present worth analysis is based on 20 years with an 8 percent discount rate

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Design Criteria Used to Size Treatment Processes

- Step 1: Use GPS-X model for each plant to determine NdeN capacity existing of primary and secondary tankage if converted to the process alternative
  - Based on the ratio of the process specific NdeN capacity per MG of existing tank volume, computes volume of additional tankage required for each flow regime of a specific process alternative
  - Primary clarifier area – 1,000 gpsfpd
  - Secondary clarifier area – 600 gpsfpd
  - Rapid sand filter surface loading rate – 3 gpm/sf (equates to 6 gpm/sf @ peak hydraulic flow conditions)
  - Denitrification filter surface loading rate – 2 gpm/sf (equates to 4 gpm/sf @ peak hydraulic flow conditions)

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Design Criteria Used to Size Treatment Processes

- Step 2: Conduct "reasonableness" check with Process Team Members, based on:
  - Comparison of GPS-X model results to actual experience
  - Comparison of GPS-X model results to experience based hand calculations

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Design Criteria Used to Size Treatment Processes

- Step 3: Revise treatment process sizes based on consensus opinion of Process Team Members after Steps 1 and 2

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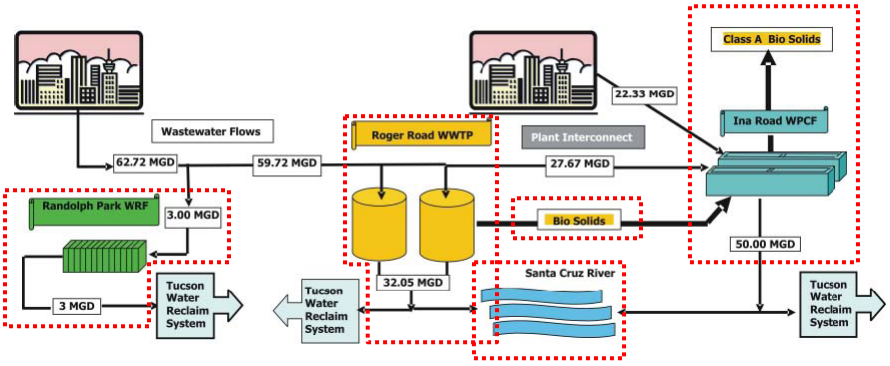
Pima County Wastewater Management Department

GREELEY AND HANSEN

Process System Configuration Evaluation & Second Treatment Process (Sensitivity Testing)

Gordon Culp

Existing Plan Schematic



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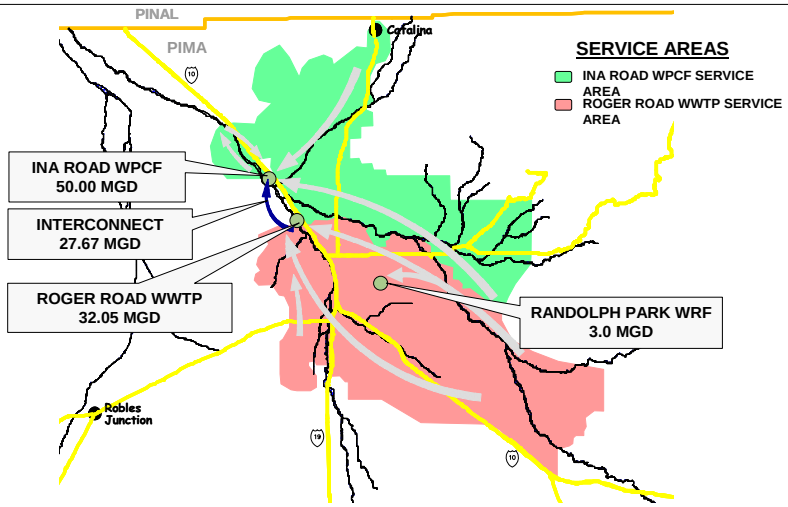
Existing Plan (2030)



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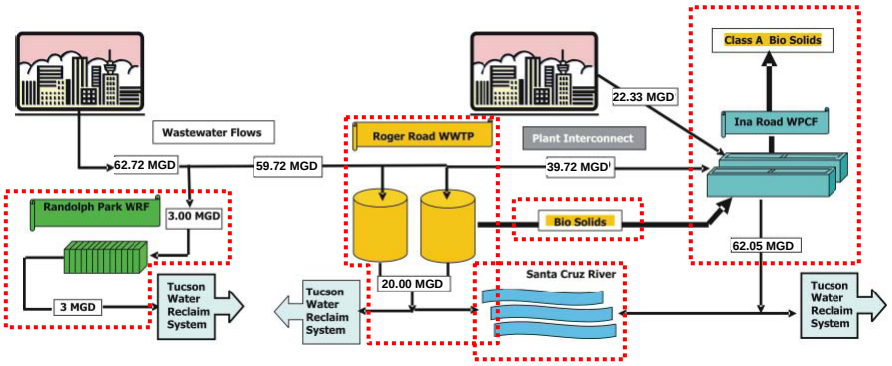
Transfer Some Schematic



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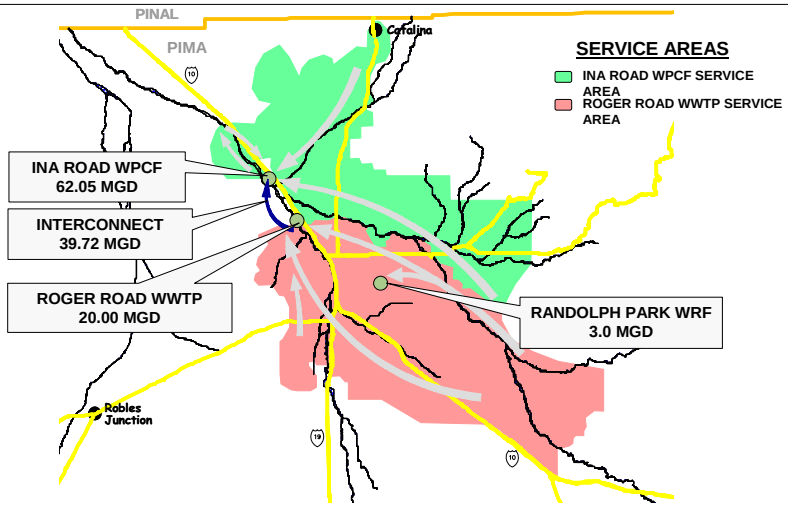
Transfer Some (2030)



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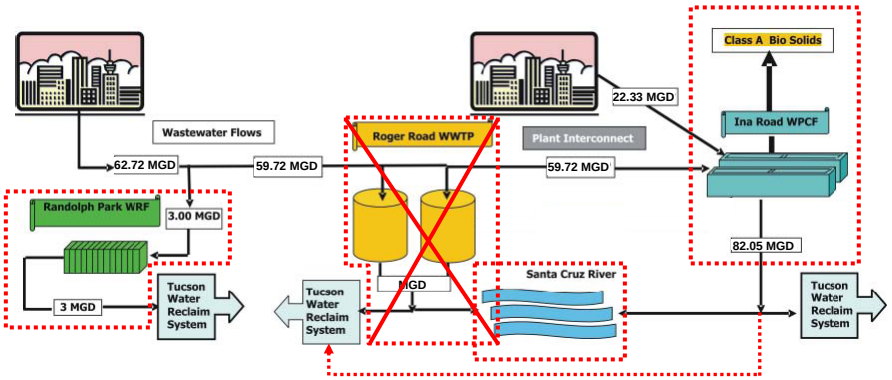
Transfer All Schematic



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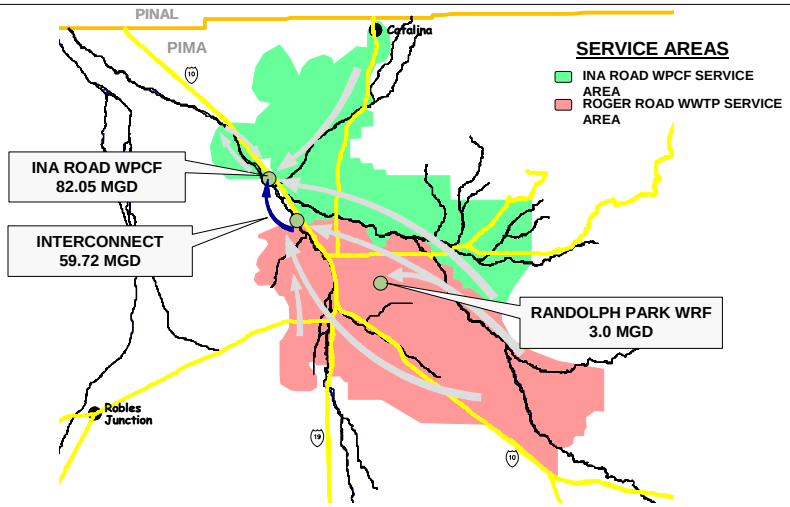
Transfer All (2030)



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System Configuration Evaluation

- Layout and evaluate Bardenpho and one other treatment approach for each site for the three system configuration options including a greenfield option at Roger Road WWTP
- Prepare cost evaluation matrices, one based on Bardenpho and one based on the second treatment approach
- Prepare non-economic evaluation matrix
- Select system configuration

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System Configuration Cost Evaluation

Criteria	*Existing Plan*	*Transfer Some – Rehab RR*	*Transfer Some – Greenfield RR*	*Transfer All*
Plant Interconnect	$	$	$	$
Conveyance to RR and IR	$	$	$	$
Rehab Roger Road WWTP	$	$		
Provide NdeN Removal at RR	$	$	$	
Demolish RR			$	$
Provide NdeN Removal at IR	$	$	$	$
Expand IR WPCF	$	$	$	$
Convey Effluent Back to RR for Reuse	(Depends)	(Depends)	$	$
Convey Effluent to Other Points of Reuse	$	$	$	$
Sludge Transfer to IR	$	$	$	$
TOTAL COST	$	$	$	$

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System Evaluation Matrix

Complete System Evaluation Matrix for Non-Economic Factors							
Criteria		*Ranking*			*Weighted Ranking*		
	Criteria Weight	*Existing Plan*	*Transfer Some*	*Transfer All*	*Existing Plan*	*Transfer Some*	*Transfer All*
Cost	5						
Schedule	5						
Constructability	3						
Flexibility	4						
Env. Impacts	4						
Water Reuse	5						
Public Acceptability	5						
Employee Safety	4						
Cost Sharing Potential	3						
Effects on Financing	3						
System Reliability	5						
TOTAL							

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Summary Wrap-Up

Andy Richardson

Summary Wrap-Up

- Comments by Group
- Closing Remarks

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Workshop #10
Technologies Workshop (System Configuration)

1. Workshop #10 – Technologies Workshop (System Configuration) for Pima County Regional Optimization Master Plan was held on September 26, 2006. For the record the agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
Controller
Jeff Nichols
PCWMD Staff
Bob Decker
Houssam Eljerdi
Laura Fairbanks
Dennis Froehlich
Frank Gall
Mary Hamilton
Michael Kostrzewski
Byron McMillan
Jeff Prevatt
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager
John Sherlock
John Warner
Ken Weber
Eric Wieduwilt
Legal
Chuck Wesselhoff

PIMA COUNTY PARKS & RECREATION
Rafael Payan, Director, Natural Resources
Stephen Dean

PIMA COUNTY
Deputy County Administrator
John Bernal (afternoon only)

TUCSON WATER
Tucson Water Staff
Mitch Basefsky
Melodee Loyer
Dennis Rule
Tim Thomure
Dean Trammel
Wally Wilson
Alan Forrest, CH2M Hill
Ken Thompson, CH2M Hill

PEER GROUP
Joe Husband, MPI
Gary Newman, B&C
Cindy Wallis-Lage, B&V

GREELEY AND HANSEN PROJECT TEAM
Orrie Albertson
Jerry Bish
Gordon Culp
Eric Petersen
Joe Popeck
Andy Richardson
Dave Stensel

2. Major topics and goals of the workshop were:
   - Topics
     - Review previous decisions regarding system configuration options and selected wastewater treatment processes
     - Review costs bases for cost development for options and alternatives
     - Examine the wastewater treatment processes considered and recommended
     - Examine conceptual site layouts for each option and process alternative
     - Review the present worth costs of each system configuration option and selected processes
     - Review impacts of Sports Park Complex at Roger Road
     - Discuss and agree on completed cost, process and evaluation matrices

   - Goals
     - Decide system configuration among the options for Roger Road WWTP and Ina Road WPCF
     - Decide process for wastewater treatment among selected alternatives at each facility

   A set of handouts were provided to each attendee which included presentation slides used during the workshop.

   Throughout the workshop notes were recorded on a set of "flip-charts". Those notes summarize questions, comments, and notes to be utilized by the project team while conducting the study. Those flip-chart notes are attached.

3. Mike Gritzuk, Director of the Wastewater Management, welcomed the attendees to Workshop #10 and invited those attending to spend the day drilling down on the issues and details of the system configuration options and the wastewater treatment processes for Roger Road WWTP and Ina Road WPCF. It is time to make decisions on the system configuration and process at each plant to meet ADEQ requirements in January. During the workshop Rafael Payan, Director of Pima County Natural Resources, will make a presentation on the Sports Park Complex that is planned on the County and City owned land along I-10 and around the Roger Road WWTP. Included in that presentation will be summary of the recreational and economic development opportunities that it brings to Pima County, the City of Tucson and the region.

   As in the other workshops, Tucson Water is welcome to the workshop to participate and contribute. In addition, John Bernal, Deputy County Administrator, will join the workshop in the afternoon as the discussion moves toward decisions on system configuration and treatment process selection.

4. Andy Richardson defined his role as facilitator with the task of moving the group through the agenda and to encourage participation. Pre-workshop materials provided to the attendees for review prior to the workshop included:

- Overview of wastewater costs program
- Cost estimate methodology
- MLE/Bardenpho preliminary designs
  - Roger Road
  - Ina Road
- IFAS design
- BT/NAS-deN filter with ME^{+3} and MeOH flow sheet
- Cost of condition risk
- Process evaluation cost data
- Presentation slide materials

Decisions from previous workshops (Workshops #4, #5/6 and # 9) regarding the system configuration and wastewater treatment process needed to the meet the ADEQ permit were reviewed. In addition, the goals of the workshop to make decisions on the system configuration and wastewater treatment process were summarized.

Agenda, groundrules, previous workshop decisions and goals of the workshop were presented and covered on pages 1 through 6 of the handout.

5. Gordon Culp reviewed the evaluation methodology for system configuration cost, process sensitivity comparisons and system evaluation that are used by the project team. The evaluation criteria for non economic factors and weighting of each criterion was developed with the workshop participants over several previous workshops and were applied to the data and information developed for the Pima County alternatives and options. The ranking of the criteria and the results will be discussed later in the meeting summary. Attendees were reminded that the system cost and evaluation matrices are indicators of the relative strengths and weakness of the each option, and provide a structure for discussion of the options. Judgment must be applied to the resulting rankings of the options.

   System configuration and process evaluations were covered on pages 6 and 7 of the handout.

6. Jerry Bish provided an overview of basis of the capital and operating costs used in development of the system configuration options and alternative costs. Construction costs for new systems were developed from various sources and applied uniformly across the alternatives and options. A risk adjusted pricing was applied to re-use of existing structures and systems to account for condition and functionality within the future system arrangement or scheme.

   Based on recent evaluations of the conveyance system it was stated that the interconnect pipeline sizing should be based on 2 times average flow to accommodate for diurnal and wet weather flows rather than the 1.4 times average flow. Alternatively, flow equalization would need to be provided at the Roger Road WWTP to address wet weather. The subsequent presentation of costs will demonstrate that the relative costs of the alternative system configuration would not be affected by increasing the size of the interconnect pipeline. The change in pipeline costs is a very small part of the present worth costs for the system configuration options.

Gary Newman indicated the existing 8-inch pipeline may be inadequate to convey all the sludge from Roger Road WWTP to Ina Road WPCF. It was pointed out that primary sludge would be collected and removed at Roger Road WWTP, and conveyed to Ina Road WPCF through the plant interconnect. The project team will check the capacity of the existing sludge force main to handle secondary sludge.

There was a feeling among several attendees that the estimated construction costs of approximately $4 to $5/gallon/day for the "greenfield" project at Roger Road may be low. Some stated that the current "rule of thumb" for construction costs may be closer to $8 to $10/gallon/day. It was pointed out that the "greenfield" plant does not include sludge thickening/dewatering and digestion facilities, which are major costs of wastewater facilities. It was further indicated that when costs of the 32 mgd "greenfield " facility at Roger Road are combined with the associated sludge digestion and thickening capacity at the Ina Road WPCF that the average cost is $8.50 per gallon per day for construction.

The capital costs used for evaluation are not for use in a capital improvement program, but are for comparison of costs related to the wastewater treatment process elements. Common elements to each system configuration were not included in the capital costs and when those elements are included, the planning level costs per gallon of capacity will increase further. Joe Husband observed that applying common element costs to each of the systems would bring the percentage of costs for each system closer together. It was suggested that the project team specifically identify the common elements not included in the system evaluations.

The costs bases for capital costs were covered on pages 8 through 10 of the handout.

7. Eric Petersen presented why it is important to recognize risk and its related cost when utilizing existing facilities for future use. Information inadequacy, latent defects, subsurface unknowns, maintenance of existing operations at high performance levels during construction, and other factors need to be considered. Risk consequences fall into three general categories: increased costs, schedule delays (possible permit violation and fines), and non-performance issues. Contractors translate unknowns into risk costs to cover their probable costs which inflate construction costs. The owner can reduce risk costs by accepting more risk for the unknowns to existing structures, but usually will pay a premium for change orders during construction if the unknowns cause additional work. There are some techniques to transfer "manageable" risk through different project delivery systems.

   There is uncertain cost exposure for contractor and owner from "open-ended" risk. With structures at Roger Road WWTP at 50 years of age, there may "open-ended" risks with the buried assets, as well as, risks in modifying or adapting existing structures into new uses.

   Condition risk, risk consequences and pricing of risk were covered on pages 11 through 13 of the handout.

8. Jerry Bish covered the bases of the operation and maintenance costs and the risk adjusted costs for existing structures utilized in the development of the present worth costs for the options and alternatives. Ken Weber indicated that Pima County is paying $2.40 for a gallon of methanol. Dave Stensel indicated that New York City is currently paying about $2.00 a gallon for methanol. These

methanol costs are higher than those used in the cost estimates, which were based on the current cost paid by Tampa, Florida, for their wastewater treatment plant.

Risk adjusted costs has two basic components. One component is for condition of the asset to be re-used and the other is for functionality of that asset in the final system arrangement. The risk adjusted cost represents the costs required to bring the asset up to a condition that will be compatible or operationally comparable with new assets incorporated into the process or system.

Risk adjusted pricing, and values for energy, chemicals and labor used for determining present worth for system options and alternatives were covered on pages 13 through 15 of the handout.

9. Orrie Albertson presented the information on the system configurations (existing plan, transfer some or transfer all) and processes considered with each system configuration option. The wastewater treatment process systems evaluated included Bardenpho, as the base case, and for sensitivity analysis the evaluation of MLE + denitrification filters, IFAS, BT/NAS (at 20 mgd for Roger Road WWTP only). Different wastewater characteristics are to be used for Roger Road WWTP than Ina Road WPCF. The project team is to review that it is was consistent in the application of wastewater characteristics. Under all alternatives biosolids treatment and processing are centralized and undertaken at the Ina Road WPCF.

   It was reported that the new BNRAS system which is in start-up at Ina Road was performing well. Effluent TKN values are 6.3 mg/L at a flow of 12.5 mgd. Dennis Froehlich indicated that the primary TKN is averaging 27 to 28 mg/L, a value lower than the assumed concentration in the process evaluations. In that regard Cindy Wallis-Lage asked if the historical TKN values had been reviewed. The response was that the historical information had been reviewed and was similar to the special testing program undertaken recently. For additional historical laboratory information, Joe Husband indicated that the Ina Road WPCF Effluent Denitrification Study, August 2004, had 3 months of information regarding influent COD and BOD for use in the process evaluation.

   Eric Weiduwilt asked how does different wastewater characteristics impact the system sizing and development and does it impact them equally. Cindy Wallis-Lage indicated that the aeration systems would be impacted the same, but that there may be some other impacts to the MLE + deN filters. Joe Husband saw a possible change in phasing of construction, but not necessarily on the system design. Both agreed that the sizing of the second anoxic zone would be impacted by the amount of TKN in the influent. Dennis Froehlich indicated that the handling of future flow and concentrations at 65 gcpd or 85 gcpd have implications on the design. Joe Popeck stated the values used are for planning purposes. While it will be valuable to discuss this further in the design phase, the results of the system configuration options evaluation will demonstrate that this is not a significant factor when comparing system configurations.

10. For the IFAS design a SRT of 3.5 days was used in the development of the system. The manufacture of the Kaldnes media recommends a SRT of 3.26 days. Denny Parker, although not present at the workshop indicated in a correspondence that an aggressive SRTs of 2 to 3 days should be evaluated in a pilot test. Those SRT values are well below the manufacture's recommendation. Another approach is to pre-bid a process with a manufacture, like Kaldnes, and negotiate a performance criteria. Cindy Wallis-Lage thought the original purpose for considering IFAS was to maximize the usage of existing tankage at Roger Road WWTP and believes that IFAS would be viable at Roger Road WWTP in the

existing tankage providing a capacity of 20 mgd plus or minus. If the flows at Roger Road WWTP are 32 mgd, then IFAS would probably not be cost effective.

11. For the MLE + deN filters process Frank Gall asked why the clarifiers are similar in size to the IFAS. The reason is that both systems have MLSS that needs to be separated from the treated wastewater. Mike Kostrzewski asked if the biogas will be produced at Ina Road only. The answer is yes, but until there is a need for Pima County to move to a Class A biosolids, biosolids would continue to be digested at the Roger and Ina Road facilities. Cindy Wallis-Lage suggested that there appears to be an inconsistency in the pre-workshop write-up on MLE and Bardenpho page 16, Table 8. The project team will review the write-up for consistency. Gary Newman asked if the rectangular primary tanks at Roger Road WWTP were to be used in the future. The answer is no for primary clarifer service, but would continue to be used for overflow service at the plant.

    Wastewater processes were covered on pages 15 through 21 of the handout.

12. Joe Popeck presented the site layouts and costs for the different system configuration options and process alternatives. System configurations included a "greenfield" facility at Roger Road for 20 and 32 mgd along with the rehabilitation and expansion of the existing facilities. Further the "greenfield" alternatives were looked at with circular and rectangular (for space saving purposes) clarifiers. The "greenfield" site was arbitrarily shown on the north side of the County property. The system configuration costs of the options indicate the least costly option to be the 32 mgd at Roger Road WTTP and 50 MGD at Ina Road WPCF.

    The amount of redundancy to be provided at a "greenfield" plant at Roger Road WWTP was raised as a concern. The concept to date has been to provide limited redundancy at the "greenfield" plant and rely on the plant interconnect to transfer flow to Ina Road WPCF during emergencies. Tucson Water indicated that if there were outages due to lack of redundancy at Roger Road that the pipeline for reclaimed water would need to be made larger to meet the demands for a reliable supply of reclaimed water at Roger Road. Joe Husband suggested providing more parallel unit processes at the "greenfield" facility to mitigate the effects of any unit out of operation would be prudent.

    John Warner suggested instead of placing a new plant in the middle of a park that it be moved immediately south of the existing plant at Roger Road. Paul Bennett indicated that there is a "greenspace" in front of the existing Roger Road plant on City and County property that is available to site a new facility. Melodee Loyer indicated that Tucson Water needs the pump station and reservoir to remain in service at Roger Road for the reclaimed water operations. Also, a question why 10 acres is needed by Tucson Water at Ina Road WPCF, if Class A+ water is discharged from the Ina Road WPCF. The response was that the area is needed at Ina Road WPCF for a reservoir and pump station system to serve the reclaimed water system.

    Dennis Froehlich asked why the cost of rectangular clarifiers was more expensive than circular tanks. Although common wall construction reduces space and construction costs, rectangular tank equipment and maintenance and operations expenses are more than circular tanks. The circular versus rectangular tanks is a debatable issue even amongst the project process team. Joe Husband asked about the sizing of filters. In response denitrification filters were sized on 2 gpm at average flows and 4 gpm at maximum flows, and rapid sand filters were sized at 3 gpm at average flows and 6 gpm at maximum flows. Joe Husband cautioned that phosphorus in the recycle flows at Ina Road WPCF

will need to be carefully addressed and that cost of chemicals to remove phosphorus from those flows need to be considered. Gary Newman observed that O&M costs were close for all options.

Site layouts for the system configuations and associated costs for capital, annual and present worth were coverd on pages 21 through 31of the handout.

13. Rafael Payan presented the current opportunity that the County and City has to provide the community with extraordinary multi-faceted recreational and ecological facilities for use by the region. The plan includes the construction of tournament grade facilities for amateur soccer, softball and baseball along I-10 at the site of the Roger Road WWTP and the restoration of riparian habitat along the Santa Cruz River. Walking and biking trails, picnicking areas and other features would connect Columbus Park to the new recreational areas and the surrounding communities. In addition, the plan offers a connection to the Silver Bell golf course to make one large public space for community use. The Transportation Department has targeted the intersection of Camino del Cerro and I-10 for improvement to increase access to the park site.

    The new recreational facilities would have the capacity to attract out-of-region events that in turn would support economic development to the area, including a hotel and restaurant facilities to serve the events. The recreational facilities would include: 12 baseball fields, 18 soccer fields and 12 softball fields.

    The University of Arizona is undertaking of the economic benefit analysis and their agriculture department is looking at the turf issues for the playing field. The site would be a world class park with approximately 375 acres that stretches along the main access corridor to the City of Tucson to further enhance one of the most livable cities in the U.S.

    Dennis Froehlich commented that the recreational fields would become an additional reclaimed water customer and offered that the Randolph Park Water Reclamation Facility is an example of a good neighbor plant that does not smell.

    Mike Gritzuk stated that the new “greenfield” wastewater treatment facility could be located on City or County owned land, and further commented that the existing Roger Road WWTP would not work as well into the park plan. The next steps for the PCWMD are to finalize the plan on the preferred option and treatment process, submit the plan to the Board of Supervisor for approval, and transmit the plan in a letter to ADEQ. The ADEQ letter does not specifically require a location of the treatment facilities at Roger Road which could give the park planners some more time to coordinate the location of facilities.

14. Gordon Culp presented the system configuration cost evaluation, process evaluation and system evaluation with the results of project team evaluation. The value of each criterion for each system configuration option was reviewed with the workshop attendees. After discussion by the group, adjustments were made in the criteria. The revised system evaluation matrix is provided below. Changes from the project team values are noted by shading.

Criteria	Weighting Factor	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	5	5	4	2	4	3	25	20	10	20	15
Schedule	5	3	3	5	5	5	15	15	25	25	25
Constructability	3	2	2	4	5	4	6	6	12	15	12
Flexibility	4	3	3	5	5	5	12	12	20	20	20
System Reliability	4	4	4	5	5	5	16	16	20	20	20
System Operability	4	3	3	4	4	4	12	12	16	16	16
Environmental Impacts	4	3	3	4	4	4	12	12	16	16	16
Water/Wastewater System Optimization	5	5	4	3	5	4	25	20	15	25	20
Public Acceptance	5	1	2	2	3	2	5	10	10	15	10
Potential for Cost Sharing	3	5	4	3	5	4	15	12	9	15	12
Effects on Financing	3	5	4	2	4	3	15	12	6	12	9
TOTAL		39	36	39	49	43	158	147	159	199	175

Mary Hamilton suggested the title of the criterion for Water/Wastewater System Optimization be retitled to reflect the criterion definition.

Paul Bennett suggested that the value of costs needed to be increased from 5 to 10 to test cost sensitivity. If the cost criteria weighting was changed from 5 to 10, the ranking of alternatives would not change except for rehabilitating Roger Road WWTP at 32 mgd moves from 4th to 3rd in ranking (see table below).

Cost	RR = 32 IR = 50 $431M	RR = 20 IR = 62 $464M	RR = 0 IR = 82 $514M	RRGF = 32 IR = 50 $457M	RRGF = 20 IR = 62 $480M
WT 5 Ranking	158	147	159	199	175
WT 10 Ranking	183	167	169	219	190

The evaluation matrices were covered on pages 32 through 37 of the handout.

15. The system configuration evaluation matrix indicates that the option to treat 32 mgd at Roger Road WWTP and 50 mgd at Ina Road WPCF is the preferred arrangement. In addition, there are clear indications in the evaluation matrix that a "greenfield" facility at Roger Road is preferred over rehabilitation and upgrades to the existing facilities. The "greenfield" facility eliminates the rehabilitation and sequencing of construction challenges within an existing operational facility. The "greenfield" also would work best within a Sports Park Complex.

    It was noted that the new aeration tanks for the Ina Road facility were located next to the property line and do not meet setback requirements. Joe Popeck indicated that the aeration tanks located along the property line could be moved to achieve the 350-foot setback requirements. In addition, Roger Road could probably be located south of the existing plant provided setbacks can be met.

Cindy Wallis-Lage indicated although that the ratings would not change, but asked at what cost differential would the "greenfield" plant become less attractive than the costs to rehabilitate and upgrade the existing Roger Road WWTP. It was agreed to review the construction cost difference between the "greenfield" and rehabilitation and upgrade at Roger Road WWTP, and make an assessment of the differential in costs to confirm the system arrangement at Roger Road.

16. Dennis Rule indicated that the recommended system configuration is consistent with the goals of Tucson Water, Pima County, and is consistent with the Sports Park Complex and that he could support the results. The peer group each agreed with the recommendation. Gary Newman opined that he hated to "jack hammer" existing infrastructure, but could accept the results.

    Ron Riska expressed concern over the estimated construction costs. John Bernal had thought the treatment facilities would be centralized at one location, which would allow addressing the land area between the plants for other uses. With this not being the case, it is important that the key points be developed to educate the public. Key points are:

    - Frees up property for economic development
    - Eliminates cost/schedule risk associated with rehabilitation of the Roger Road WWTP
    - System more flexible, reliable, operable
    - Better integration with reclaimed water
    - Least risk for regulatory non-compliance
    - Keeps eco-system in Santa Cruz River

    The recommended system configuration option was covered on page 38 of the handout.

17. For the process decision, Jeff Nichols indicated that the "end-users" should weigh in on their choice for process. The operations staff and the peer group were individually polled on the process choice. The operations staff and the peer group agreed that Bardenpho is the right answer. Several commented that Bardenpho eliminates or minimizes the need to utilize methanol in the process, as well as, eliminating the need to add alum or other coagulants to remove phosphorus in the future.

18. Mike Gritzuk indicated additional work was required to develop the economic plan for financing and determining the project delivery methods for the plan, and considering the regulatory deadlines it was fortunate that a system configuration and treatment process were selected during Workshop # 10. The meeting closed with a reference to the next workshop on October 11, 2006 on conveyance and flow management.

Agenda
Workshop #10 – Technologies Workshop (System Configuration)
September 26, 2006

Time	Topic	Presenter
7:45 am	*Continental Breakfast – The Historic Manning House, 450 W. Paseo Redondo*	
8:00 am	Opening Session	
	• Welcoming Remarks	Mike Gritzuk
	• Review Agenda	Andy Richardson
	• Previous Process Decisions	
	• Workshop Goals	
	• Evaluation Process Review	Gordon Culp
8:35 am	Cost Basis	Jerry Bish
	• Capital Cost	
	• Condition Risk	Eric Petersen
	• Risk Adjusted Cost Evaluations	
	• O&M Costs	
	• Present Worth Cost	
9:20 am	Processes	Orrie Albertson
	• System Configuration	
	• Biosolids and Bio Gas	
	• Bardenpho	
	• Sensitivity Evaluation	
9:45 am	Break	
10:00 am	Site Layouts and Costs	Joe Popeck
	• Bardenpho 32/50	
	• Bardenpho 20/62	
	• Bardenpho 0/82	
10:30 am	Sports Park	Rafael Payan/Andy Richardson
11:00 am	Site Layouts and Costs, continued	Joe Popeck
	• Bardenpho 32/50 (Green Field at Roger Road)	
	• Bardenpho 20/62 (Green Field at Roger Road)	
	• IF/AS 32/50	
	• MLE + deN Filters 32/50	
	• BT/NAS 20/62	
12:30 pm	Lunch	
1:00 pm	Evaluation Matrices	Gordon Culp
3:00 pm	Break	
3:15 pm	System Configuration Recommendation	Andy Richardson
3:30 pm	Process Recommendation	Andy Richardson
3:45 pm	Next Steps	Andy Richardson
4:00: pm	Summary Wrap-Up	Andy Richardson
	• Comments by Group	
	• Closing Remarks	Mike Gritzuk
4:15 pm	Adjourn	

Flip Chart Notes – September 26, 2006

Overview
- P removal criteria is included in the process
- Wastewater characteristics are different for Roger Road than Ina Road

Cost Estimate
- Cost number appears low – $4/gal/day
- Comparative cost elements – some elements not included
- What elements not included?
- Concern on demand costs

Cost Overview
- How much will plants be automated - not addressed in detail at this level of planning
- All costs numbers include "soft costs"
- Need to consider sludge transfer costs
- Easement costs are not included in conveyance costs

Risks
- Operation during construction meeting permit concerns
- Question on how factors (risk adjusted pricing) applies; provide an example in supplemental information
- Are MOPO costs included? No

Site Layout
- Over estimated rehabilitation and under estimated "greenfield" costs

Process
- Has COD data been reviewed? Yes
- Pilot plant data for effluent denitrification is available

Site Layouts
- Chances of setback varying are slim; may want to consider being within setbacks
- List assumptions on cost on what is included and is not included

Evaluation Matrix Discussion
- What happens if weighting for costs were changed from 5 to 10:

Cost	RR = 32 IR = 50 $431M	RR = 20 IR = 62 $464M	RR = 0 IR = 82 $514M	RRGF = 32 IR = 50 $457M	RRGF = 20 IR = 62 $480M
WT 5 Ranking	158	147	159	199	175
WT 10 Ranking	183	167	169	219	190

Pima County Regional Optimization Master Plan

Workshop #10
Technologies Workshop (System Configuration)

September 26, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator/Previous WS Decisions
Jerry Bish	Cost Basis
Orrie Albertson	Processes
Joe Popeck	Site Layouts and Costs
Rafael Payan	Sports Park Update
Gordon Culp	Cost Matrix/Evaluation Matrix
Andy Richardson	System/Process Recommendation/Next Steps/Wrap-Up

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop Goals
- Previous Workshop Decisions
- Cost Basis
- Processes
- Site Layouts and Costs
- Sports Park Update
- Cost and Evaluation Matrices
- System Configuration Recommendation
- Process Recommendation
- Next Steps
- Summary Wrap-Up

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

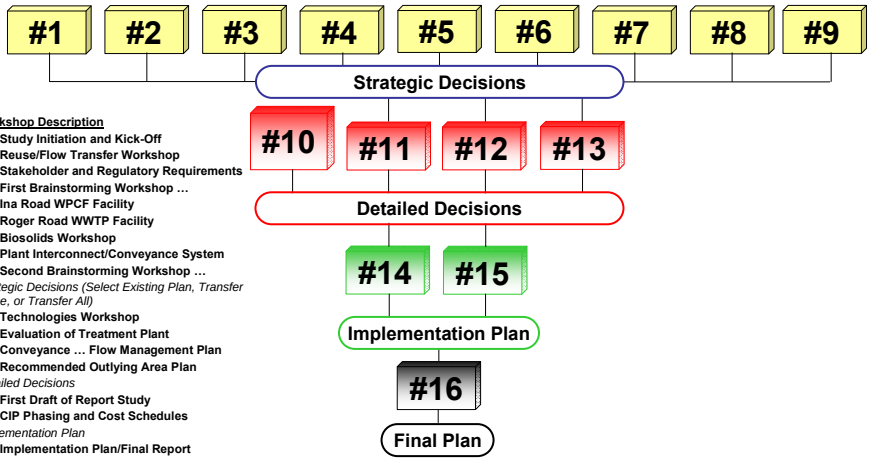
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

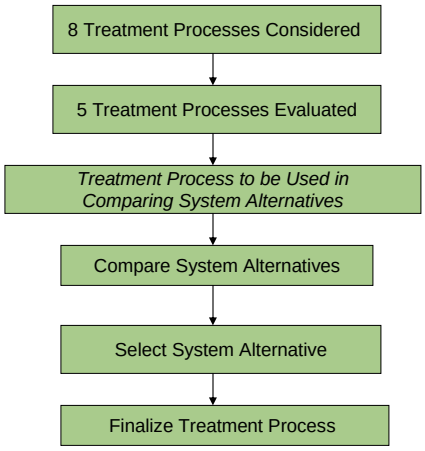
Final Plan

Previous Workshop Decisions

- Workshop #4 – June 5, 2006
  - Agreed on viable process alternatives
  - Agreed on matrix evaluation criteria
  - Agreed on matrix evaluation criteria weighting
  - Agreed to continue evaluating Bardenpho, MLE and IFAS and MBR
  - Agreed that P removal was a process criteria
  - Agreed to drop AS/NTF, BT/NAS, Step NdeN, Biostyr/Biofor and MBBR from further consideration

11

Treatment Process Selection



12

Previous Workshop Decisions

- Workshop #5/6 – July 12, 2006
  - Processes with nitrification only were eliminated
  - Agreed to further evaluation Bardenpho for system configuration options
  - Agreed to consider other processes with denitrification for sensitivity testing

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Previous Workshop Decisions

- Workshop #9 – August 8/9, 2006
  - Reaffirm P removal as a process criteria
  - Agreed on system evaluation matrix
  - Agreed no time available for pilot testing
  - Reaffirm Bardenpho for system configuration options

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Previous Workshop Decisions

- Workshop #9 – August 8/9, 2006 *(continued)*
  - Agreed on the flows for the system configuration options
    - Agreed upon 32/50, 20/62 & 0/82
    - Discarded 37.5/44.5,50/32 & 60/22
  - Agreed on WW characteristics for each plant
  - Agreed on MLE + deN filters, IFAS and Biotowers at RR (20 MGD only) for process sensitivity testing

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Workshop Goals

- Agree on system configuration
  - Existing Plan
  - Transfer Some
  - Transfer All
- Within system configuration
  - Rehab existing RR WWTP
  - Green Field RR WWTP
- Agree on process for NdeN

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System Configuration Evaluation and Process Evaluation

Gordon Culp

System Configuration Evaluation

- Layout and evaluate Bardenpho for each site for the three system configuration options including a greenfield option at Roger Road WWTP
- Prepare cost evaluation matrix comparing Bardenpho, IFAS, MLE +deN Filters and BT/NAS
- Prepare non-economic evaluation matrix
- Select system configuration

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System Configuration Cost Evaluation

COST MATRIX					
	RR=32 mgd IR=50 mgd	RR=20 mgd IR=62 mgd	RR=0 mgd IR=82 mgd	RRGF=32 mgd IR=50 mgd	RRGF=20 mgd IR=62 mgd
Capital Cost					
Plant interconnect					
RR Demolition and Removal					
Roger Road treatment plant					
Ina Road Treatment Plant					
Reclaimed water return					
Tucson Water Booster PS					
Tucson Water Reservoir					
Total Capital Cost	$0	$0	$0	$0	$0
Annual O&M Cost					
Labor					
Methanol					
Polymer-sludge thicken/dewater					
Alum for P removal					
Power-treatment					
Power-rec. water return + booster PS					
Interconnect line maint.					
Total annual cost					
Present Worth of Annual Costs					
Total Present Worth Cost	$0	$0	$0	$0	$0

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Process Evaluation

PROCESS SENSITIVITY COMPARISONS

PROCESS	FLOW RR/IR		PRESENT WORTH		CAPITAL
BARDENPHO	32/50				
IFAS @ RR & IR	32/50				
MLE + deN FILTERS @ RR & IR	32/50				
BARDENPHO/GREENFIELD-RR	32/50				
BARDENPHO	20/62				
BT/NAS RR + BARDENPHO IR	20/62				
BARDENPHO/GREENFIELD-RR	20/62				

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System Evaluation Matrix

Criteria	Weighting Factor	Unweighted Ranking					Weighted Ranking				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	5										
Schedule	5										
Constructability	3										
Flexibility	4										
System Reliability	4										
System Operability	4										
Environmental Impacts	4										
Water/Wastewater System Optimization	5										
Public Acceptance	5										
Potential for Cost Sharing	3										
Effects on Financing	3										
TOTAL											

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Cost Basis Overview

Jerry Bish

Cost Basis Overview

- Capital costs
- Cost of condition risk
- Risk adjusted pricing
- O&M costs
- Present worth costs

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Capital Costs

- Summary of bases in cost estimate memorandum
  - W W cost model
  - Quantity takeoffs/contractor bids
  - RS means
  - Vendor quotes
  - Other

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Capital Costs

- Demolition and removal costs
  - RS Means for various elements (concrete, steel, etc.)
- New influent screening facility – WW cost model
  - $60K per MGD
- New grit facilities – WW cost model
  - $50K per MGD
- Odor control – quantity takeoffs/contractor bids
  - $200 per sq. ft. for building enclosures
  - $75 per sq. ft. of alum covers
  - $50 per cfm for scrubbers

Capital Costs

- Aeration tanks – WW cost model
  - Cost = $14.00 per cu. ft. of required aeration volume
- Primary and secondary clarifiers – quantity takeoffs/contractor bids
  - Cost = $ 350.00 per sq. ft. of required area
- Denitrification filters - quantity takeoffs/contractor bids
  - Filter Cost = $3000 per sq. ft. of required area
- Rapid sand filters – WW cost model
  - Cost = $2300 per sq. ft. of required area

Capital Costs

- In plant pump stations – WW cost model
  - $60K per MGD
- UV disinfection facilities – based on UV disinfection costs developed for MWRDGC UAA analysis
  - $60 K per MGD
- Sludge thickening & dewatering – quantity takeoffs/contractor bids
  - Site specific
- Sludge digestion – quantity takeoffs/contractor bids
  - $35,400,000

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Capital Costs

- IFAS media
  - Cost = $20 per cu. ft. of required volume

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Capital Costs

- Plant interconnect
  - 60 feet of available head
  - Distance = 5 miles
  - $11 per inch foot, gravity flow
  - Peak flow factor = 1.4 x average Q

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Capital Costs

- Reclaimed water return line and PS
  - Pipeline velocity = 5 fps
  - $11 per inch foot
  - 37-MGD flow to be available at RR
  - 85% pump efficiency
  - Pump station cost from WW cost model

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Condition Risk

- Information adequacy
  - Drawings, plans and specifications
- Remaining useful life
  - Estimates of various remaining useful lives
- Functionality

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Condition Risk *(continued)*

- Latent defects
  - Design defects
  - Construction defects
- Subsurface risks
  - Buried infrastructure
  - Operating tankage
- Obsolescence
  - Equipment, structures or processes

32

Condition Risk *(continued)*

- Time and access for inspections
- Timing
  - Asset condition deterioration
  - Capital maintenance following asset evaluation
- Maintaining treatment while constructing upgrades
  - Construction sequencing plans

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Risk Consequences

- Three general risk consequences
  - Increased cost
  - Schedule delays
  - Non-performance issues
- Example
  - The "Big Dig" highway rebuild in Boston

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Risk Assumption Under Various Delivery Methods

- Traditional "Bid-Build"
  - Owner retains condition risks
- Construction Manager at Risk
  - Owner retains condition risks

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Risk Assumption Under Various Delivery Methods *(continued)*

- D/B and D/B/O
  - Large construction or operating firms may accept some condition risk
  - Senior management analysis of condition risk
  - Hedging the assumption of risk

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Pricing of Condition Risk

- Manageable risk
- Above-ground assets v. buried infrastructure
- Uncertain cost exposure from open-ended risk

37

Risk Adjusted Pricing

- Utilizes standard utility valuation methodology
- Recognizes risks associated with use of existing assets
- Takes into consideration both condition and functionality of existing assets

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Risks Associated with Existing Assets

- Condition Risk – Poor condition of assets limits their usefulness
- Functional Risk – Design, configuration, or location may limit their usefulness

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Recognize Condition Risk

- Assign a condition factor to asset that approximates its remaining useful life based on inspection of asset
- Accuracy and precision of condition factor affected by availability of information about the asset, and scope of inspection performed

Condition	*Condition Factor*
Excellent	**90%**
Good	**70%**
Marginal	**40%**
Poor	**10%**

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Recognize Functional Risk

- Assign a functionality factor to an asset that characterizes its functionality and compatibility with respect to the rest of the new system. This factor takes into consideration asset's configuration and location as well as asset's potential for premature obsolescence

Functionality	*Functionality Factor*
Properly located and/or configured; compatible; newer technology	75%
Marginally located and/or configured; marginally compatible; older technology	50%
Poorly located and/or configured; incompatible outdated technology	25%

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O&M Costs

- Power Cost @ 8.7 cents per kWh
- Methanol @ $1.00 per gallon
- Alum @ $1.00 per gallon
- Polymer @ $2.00 per pound
- Labor @ $35.00 per hour
  (2080 hrs per year per person)

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Present Worth

- Present worth
  - Present worth analysis is based on 20 years with an 8 percent discount rate

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Processes

Orrie Albertson

Processes

- System configuration
- Biosolids and bio gas
- Bardenpho
- Sensitivity analysis

45

System Configuration

- Existing Plan
- Transfer Some
- Transfer All

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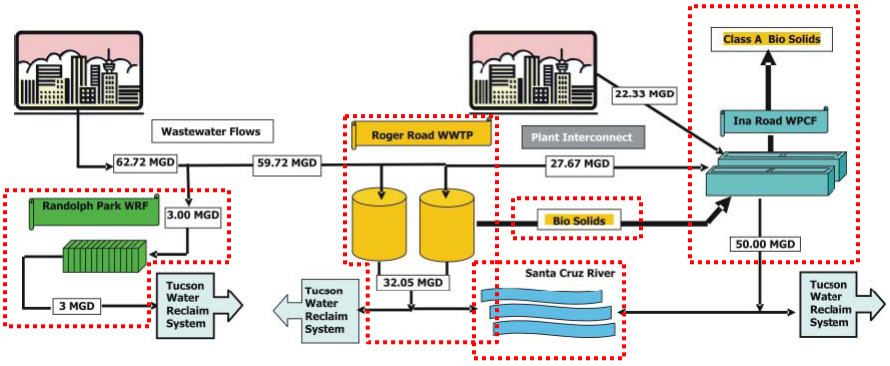
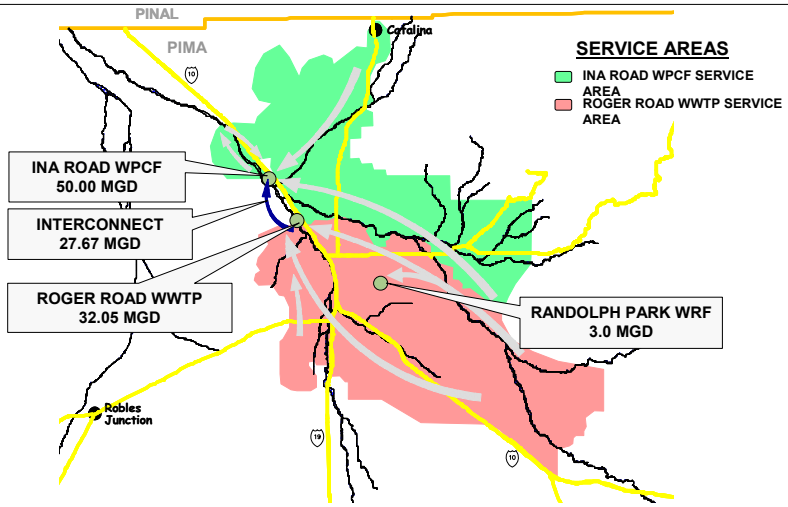
Existing Plan Schematic



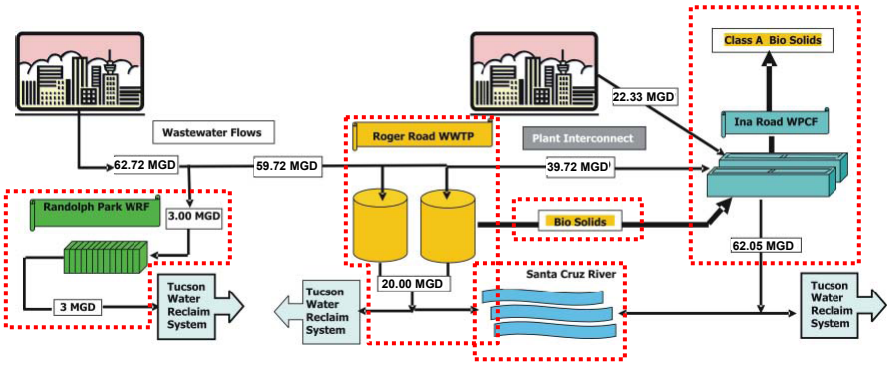
47

Existing Plan (2030)

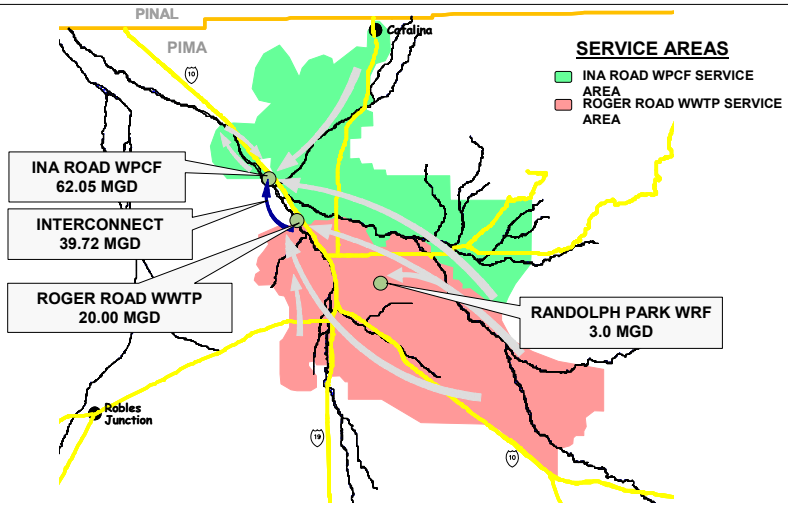


48

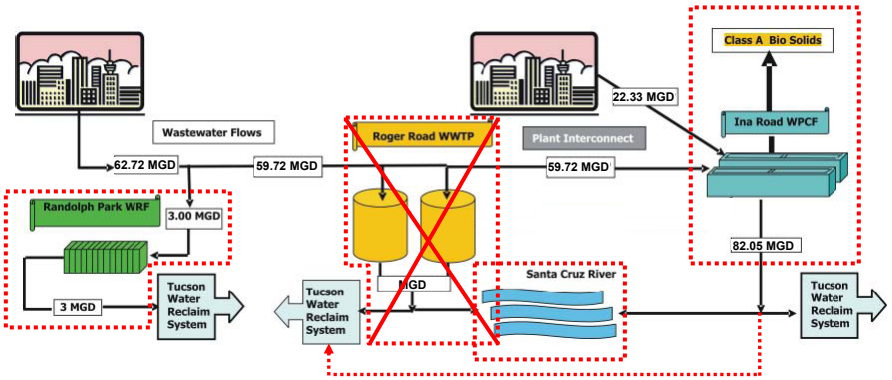
Transfer Some Schematic



Transfer Some (2030)

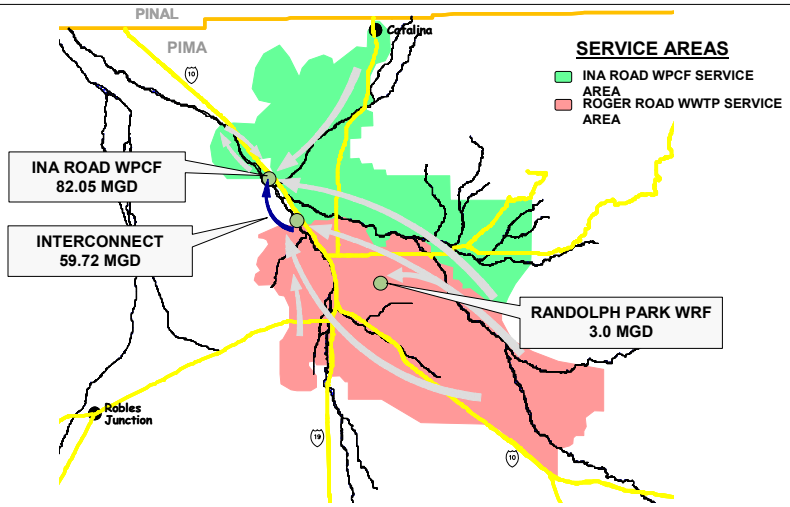


Transfer All Schematic



51

Transfer All (2030)



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Process Evaluations/ Sensitivity Testing

- Process evaluations
  - Bardenpho
- Sensitivity testing
  - MLE + deN Filters
  - IF/AS
  - BT/NAS (20 MGD @ RR)

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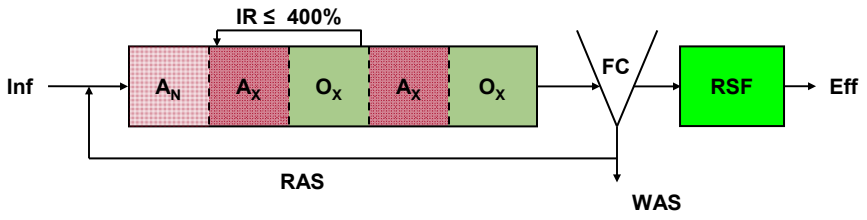
5-Stage Bardenpho

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

Bardenpho Nitrification-Denitrification (NdeN)



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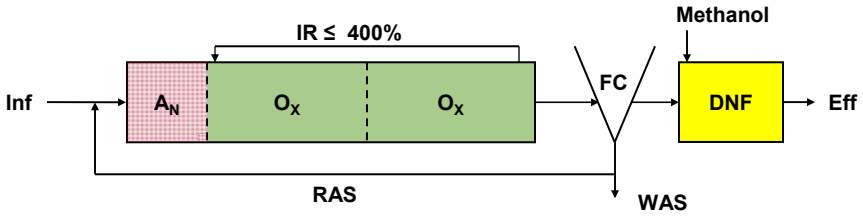
MLE + deN Filters

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

MLE Nitrification + Denitrification Filters

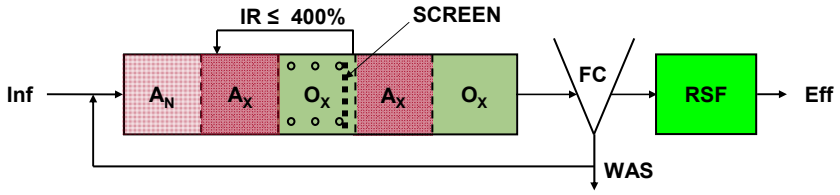


55

IFAS

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

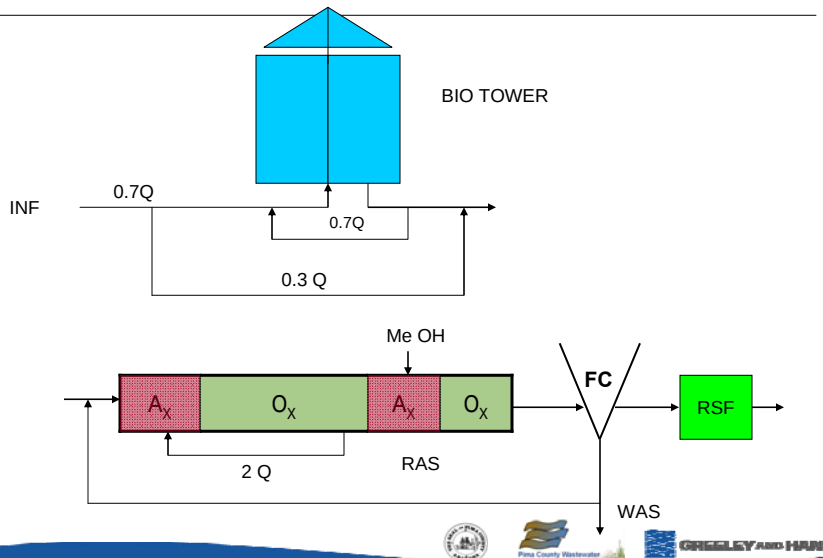
IFAS Nitrification-Denitrification - NdeN



56

BT/NAS

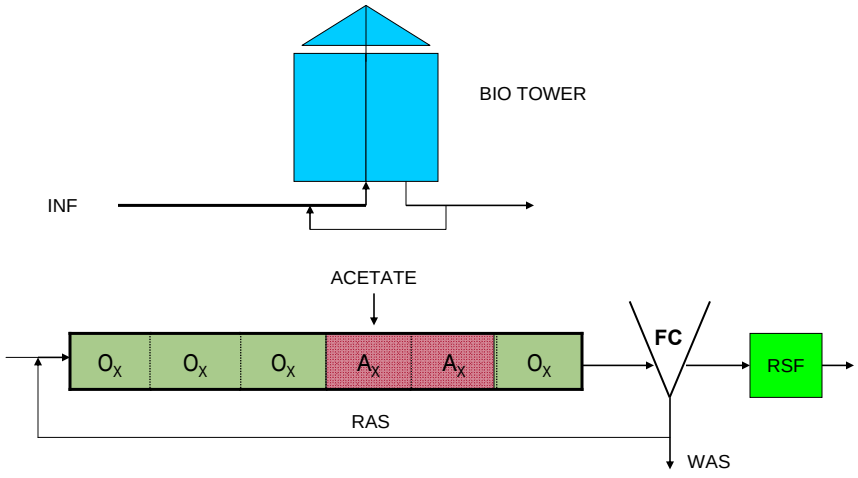
AN = A
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter



57

BT/NAS

AN = A
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter



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Biosolids and Bio Gas

- For all process alternative evaluations:
  - For each System Configuration Alternative, it was assumed that sludge would be thickened at the respective WWTP
  - All biosolids were assumed to be digested and dewatered at Ina Road
  - Thermo/Meso Anaerobic Digestion was assumed

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Biosolids and Bio Gas

- Bio Gas utilization studies currently underway:
  - Current sludge gas utilization is the base line condition
  - Investigating
    - Evaluation of Bio-Gas (BG) usage potential and power supply facilities

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Biosolids and Bio Gas

- Evaluation of Bio-Gas (BG) usage potential and power supply facilities
  1. Introduction
  2. Summary
  3. Bio-gas Quantities, Quality and Energy Potential
  4. End Uses of Energy
  5. Bio-gas Conversion Alternatives
  6. Alternatives Selection and Economic Analysis
  7. Alternatives Evaluation and Ranking
  8. Conclusions and Recommendations

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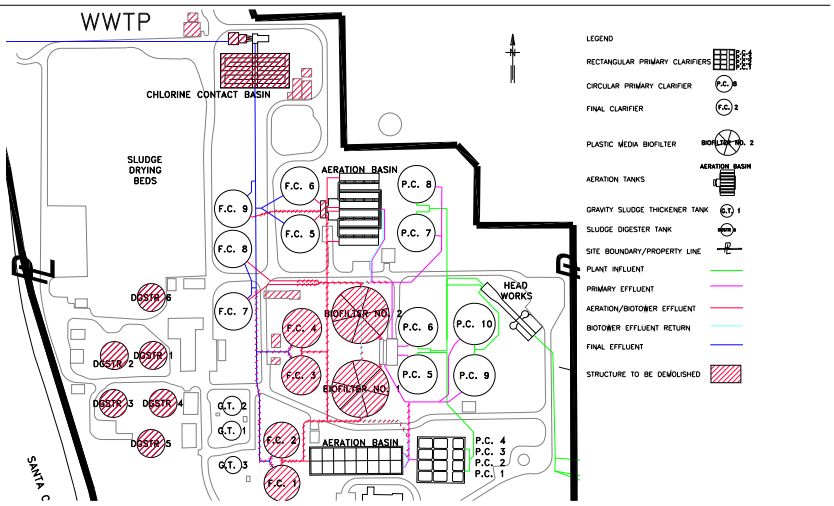
Site Layouts and Costs

Joe Popeck

Roger Road
Site Layout 32 MGD- Demo



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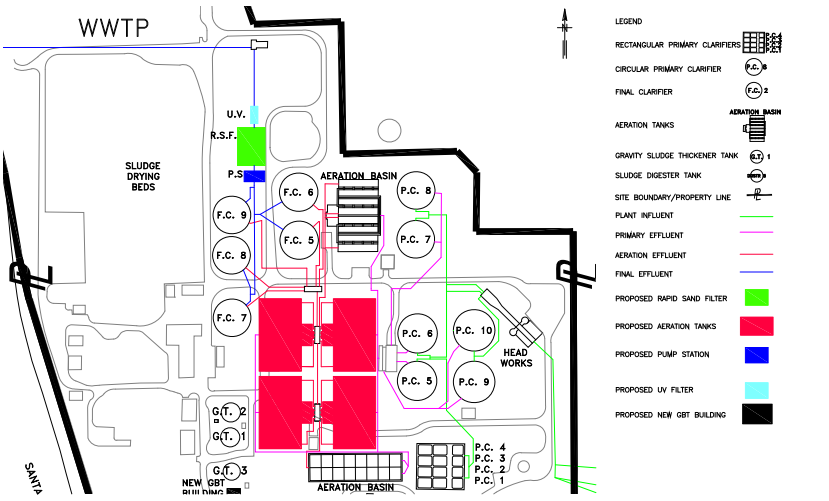
Roger Road
Site Layout – Bardenpho 32 MGD



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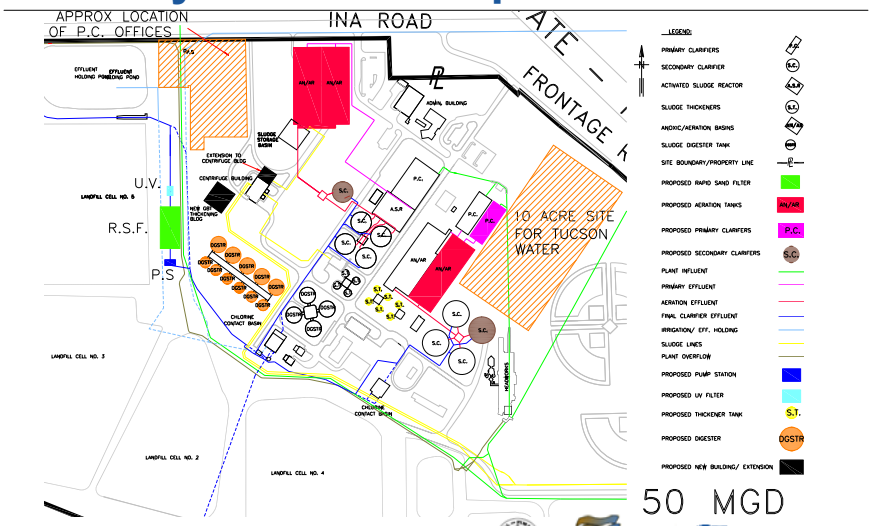
Ina Road
Site Layout – Bardenpho 50 MGD



Capital Costs – $1000's

5 Stage Bardenpho	32-MGD Existing RR WWTP	50-MGD IR WPCF
Demolition and Removal Costs	$4,000	$0
New Influent Screening Facility	$0	$0
New Influent Grit Facility	$0	$0
Odor Control	$16,000	$17,300
Primary Clarifiers	$5,500	$7,800
Aeration Tanks	$27,900	$43,500
Final Clarifiers	$8,500	$10,000
Pump Station to Filters/UV Disinfection	$1,920	$3,000
Filters	$17,200	$26,800
UV Disinfection	$1,920	$3,000
Chemical Feed Systems	$0	$0
Sludge Thickening & Dewatering Facilities	$2,600	$20,700
Sludge Digestion Facilities	$0	$35,400
Total Treatment Plant Capital Costs	$85,540	$167,500

Capital Costs – $1000's

Capital Costs	*32-MGD Existing RR WWTP and 50-MGD IR WPCF*
Total RR and IR Plant Capital Costs	$253,040
Plant Interconnect	$22,000
TW Reservoir	$11,000
Reclaimed Water Return Line & PS to RR	$270
TW Booster PS	$810
Total Other Capital Costs	$287,100

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Annual Costs – 1000's

Annual O&M Cost	*32-MGD Existing RR WWTP*	*50-MGD IR WPCF*
Labor	$3,500	$4,000
Methanol	$0	$0
Polymer-sludge thicken/dewater	$30	$700
Alum for P removal	$0	$0
Power-Treatment	$2,313	$3,738
Power-Rec. water+ booster PS	$0	$395
Interconnect pipeline maintenance	$10	$0
Total Annual Cost	$5,853	$8,833
Combined Total Annual Cost	$14,685	-
Present Worth of Annual Costs	$144,200,000	-

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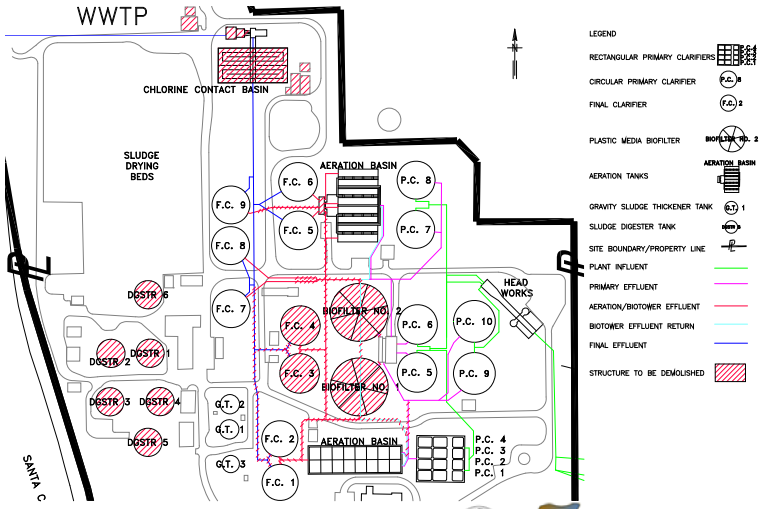
Total Present Worth of Existing RR 32 MGD and IR 50 MGD – $1000's

Item	*Cost*
Capital Cost	$287,100
Present Worth of Annual Costs	$144,200
Total Present Worth	$431,300

69

Roger Road Site Layout 20 MGD – Demo



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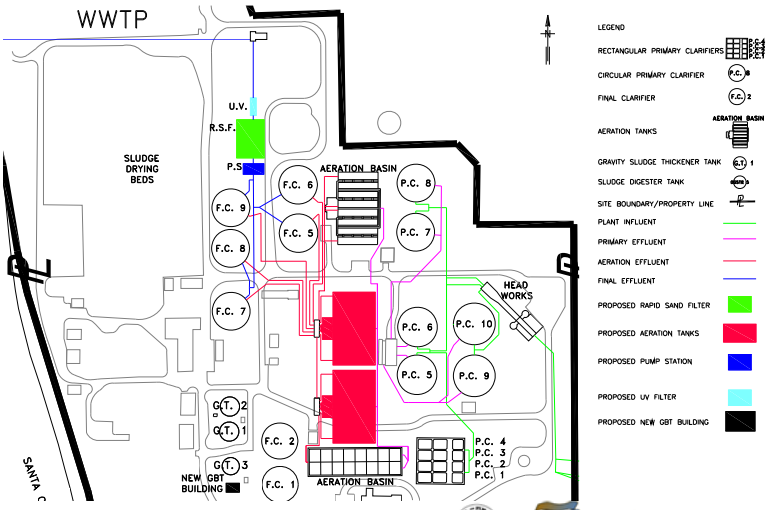
Roger Road
Site Layout – Bardenpho 20 MGD



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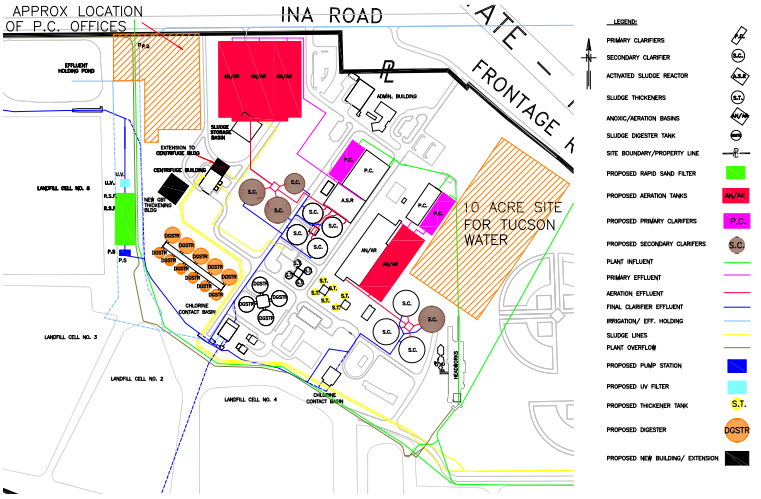
Ina Road
Site Layout – Bardenpho 62 MGD



72

Total Present Worth of Existing RR 20 MGD and IR 62 MGD – $1000's

Item	*Cost*
Capital Cost	$318,600
Present Worth of Annual Costs	$145,200
Total Present Worth	$463,800

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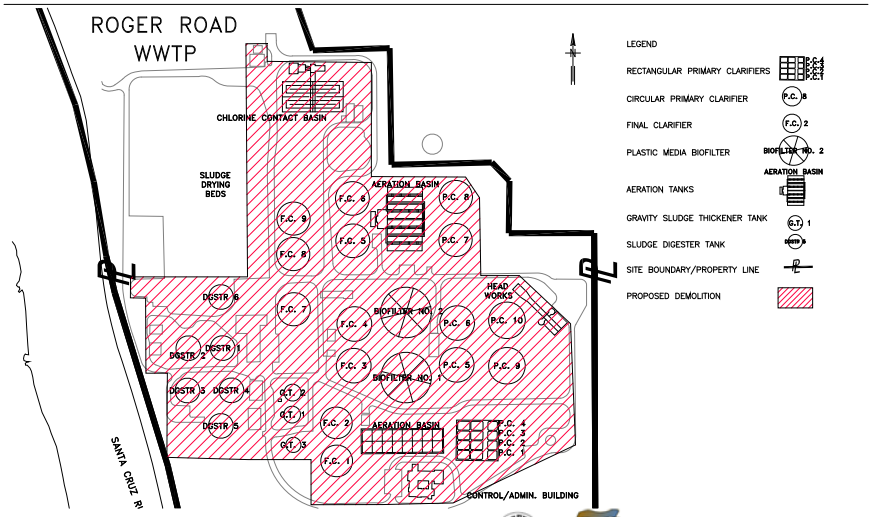
Roger Road Plant Demolition – All Flow to IR



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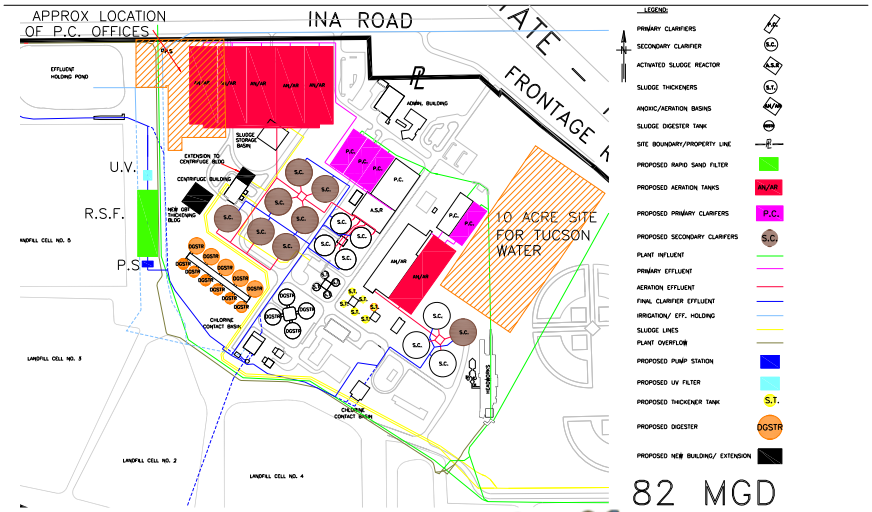
Ina Road
Site Layout – Bardenpho 82 MGD



75

Total Present Worth of RR 0 MGD and IR 82 MGD – $1000's

Item	*Cost*
Capital Cost	$374,600
Present Worth of Annual Costs	$139,100
Total Present Worth	$513,700

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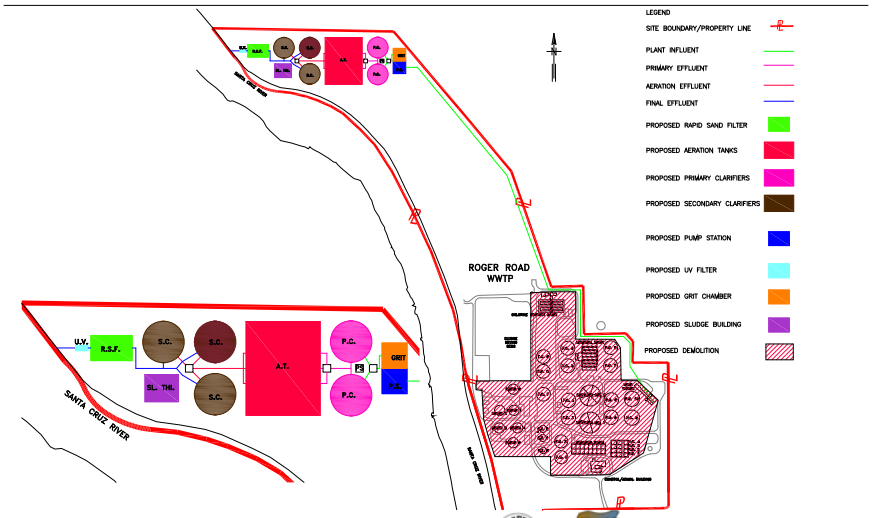
Sports Park Update

Rafael Payan / Andy Richardson

Roger Road – Green Field Site Layout 32 MGD-Option 1



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Total Present Worth of Green Field RR 32 MGD (Option 1) and IR 50 MGD – $1000's

Item	*Cost*
Capital Cost	$319,800
Present Worth of Annual Costs	$137,300
Total Present Worth	$457,100

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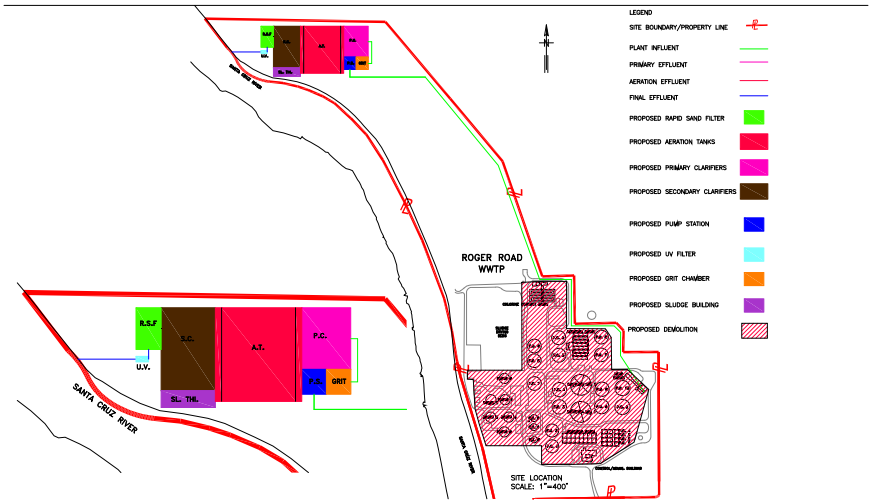
Roger Road – Green Field Site Layout 32 MGD-Option 2



80

Total Present Worth of Green Field RR 32 MGD (Option 2) and IR 50 MGD – $1000's

Item	*Cost*
Capital Cost	$328,800
Present Worth of Annual Costs	$137,300
Total Present Worth	$466,100

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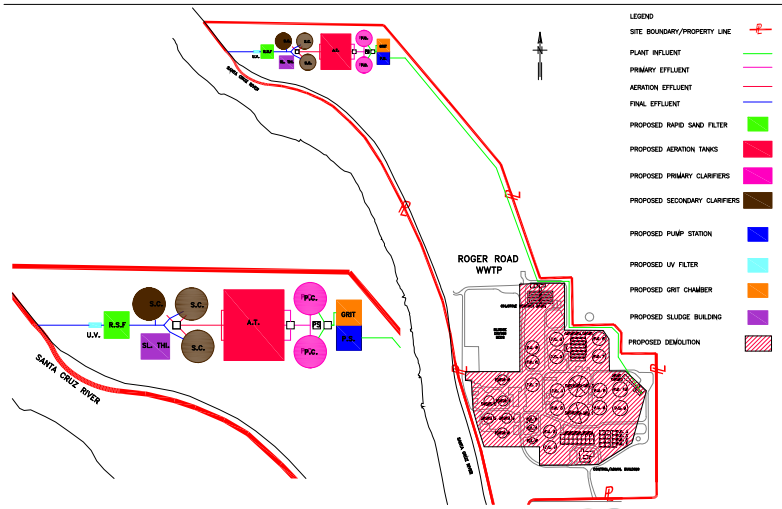
Roger Road – Green Field Site Layout 20 MGD-Option 1



82

Total Present Worth of Green Field RR 20 MGD (Option 1) and IR 62 MGD – $1000's

Item	*Cost*
Capital Cost	$340,000
Present Worth of Annual Costs	$140,300
Total Present Worth	$480,300

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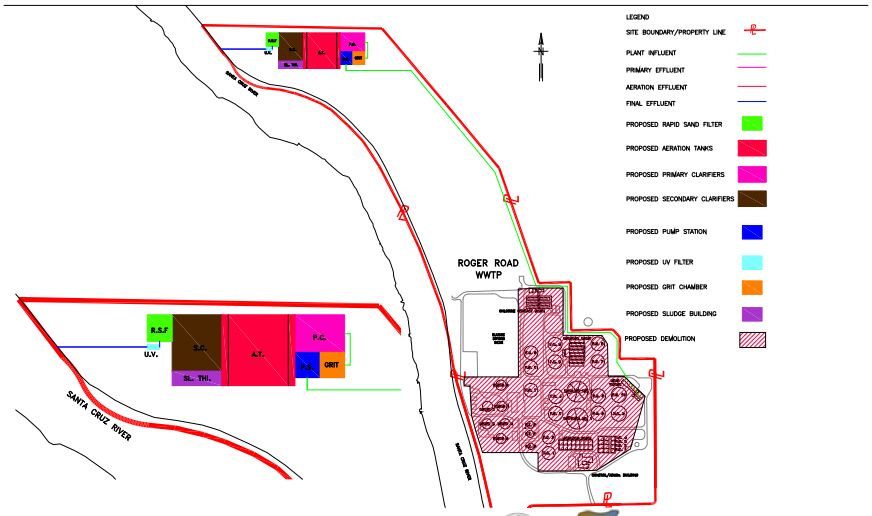
Roger Road – Green Field Site Layout 20 MGD-Option 2



84

Total Present Worth of Green Field RR 20 MGD (Option 2) and IR 62 MGD – $1000's

Item	*Cost*
Capital Cost	$345,600
Present Worth of Annual Costs	$140,300
Total Present Worth	$485,900

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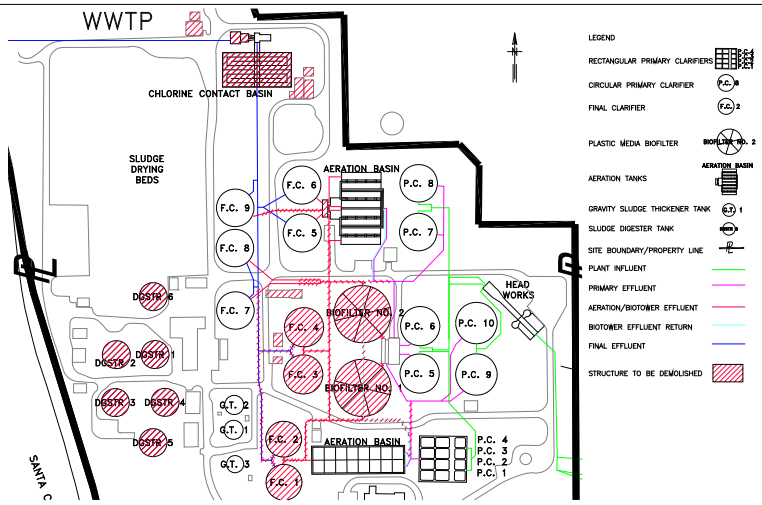
Roger Road
Site Layout 32 MGD – Demo



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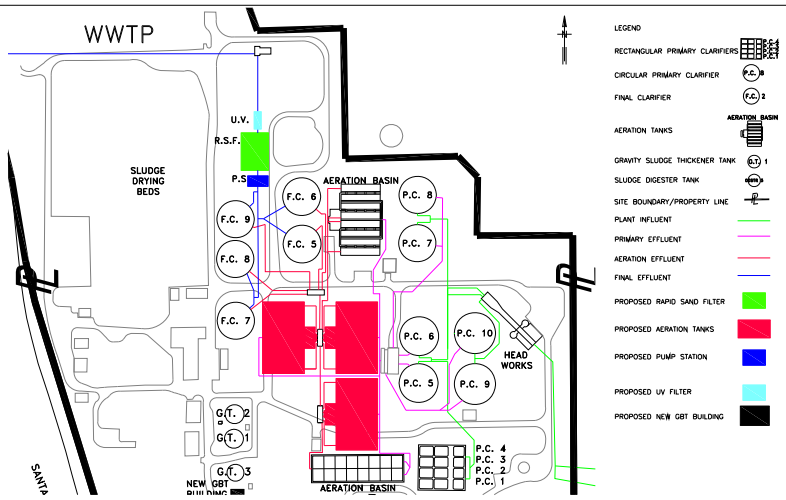
Roger Road
Site Layout 32 MGD – IF/AS



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Total Present Worth of IF/AS RR 32 MGD and IF/AS IR 50 MGD – $1000's

Item	*Cost*
Capital Cost	$294,600
Present Worth of Annual Costs	$144,200
Total Present Worth	$438,800

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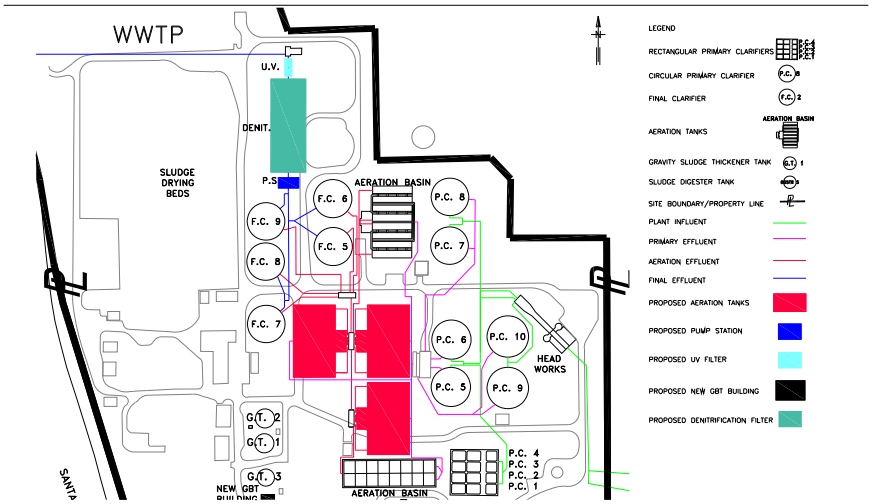
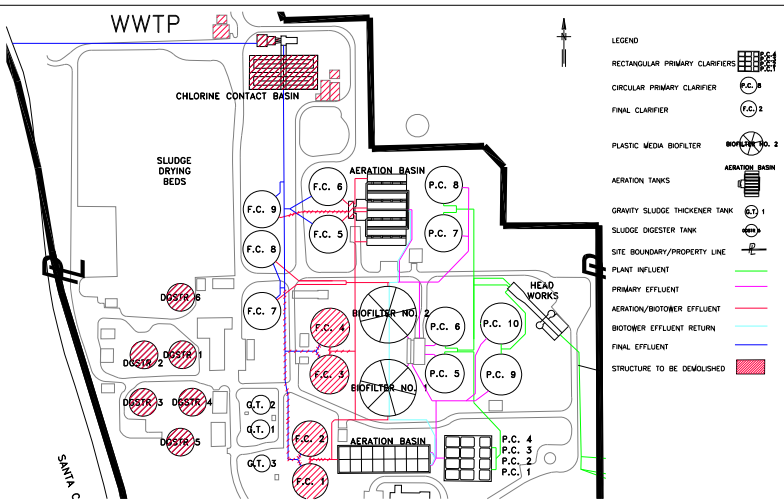
Roger Road
Site Layout 32 MGD – MLE + deN Filters



Total Present Worth of MLE + deN RR 32 MGD and MLE + deN IR 50 MGD – $1000's

Item	*Cost*
Capital Cost	$299,600
Present Worth of Annual Costs	$139,200
Total Present Worth	$438,800

Roger Road
Site Layout 20 MGD-BT/NAS Demo



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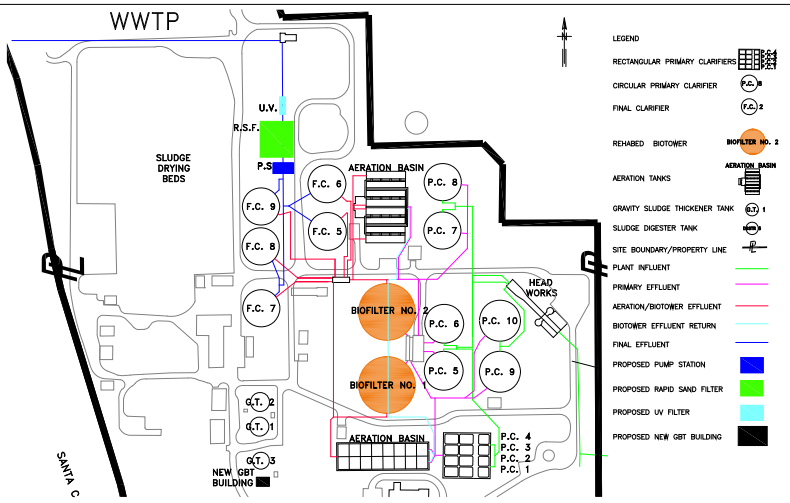
Roger Road
Plant Layout 20 MGD-BT/NAS



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Total Present Worth of BT/NAS RR 20 MGD and Bardenpho IR 62 MGD – $1000's

Item	*Cost*
Capital Cost	$326,600
Present Worth of Annual Costs	$152,000
Total Present Worth	$478,600

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Evaluation Matrices

Gordon Culp

System Configuration Cost Evaluation

COST MATRIX					
	RR=32 mgd IR=50 mgd	RR=20 mgd IR=62 mgd	RR=0 mgd IR=82 mgd	RRGF=32 mgd IR=50 mgd	RRGF=20 mgd IR=62 mgd
Capital Cost					
Plant interconnect	$22,000,000	$25,100,000	$31,600,000	$22,000,000	$25,100,000
RR Demolition and Removal	$4,000,000	$4,000,000	$16,100,000	$16,100,000	$16,100,000
Roger Road treatment plant	$81,540,000	$56,500,000	$0	$102,160,000	$65,800,000
Ina Road Treatment Plant	$167,500,000	$211,400,000	$284,660,000	$167,500,000	$211,360,000
Reclaimed water return	$270,000	$9,800,000	$19,400,000	$270,000	$9,800,000
Tucson Water Booster PS	$810,000	$810,000	$810,000	$810,000	$810,000
Tucson Water Reservoir	$11,000,000	$11,000,000	$22,000,000	$11,000,000	$11,000,000
Total Capital Cost	**$287,100,000**	**$318,600,000**	**$374,600,000**	**$319,800,000**	**$340,000,000**
Annual O&M Cost					
Labor	$7,500,000	$7,300,000	$6,200,000	$6,800,000	$6,800,000
Methanol	$0	$0	$0	$0	$0
Polymer-sludge thicken/dewater	$730,000	$720,000	$700,000	$730,000	$720,000
Alum for P removal	$0	$0	$0	$0	$0
Power-treatment	$6,050,000	$6,050,000	$6,050,000	$6,050,000	$6,050,000
Power-rec. water return + booster PS	$395,000	$710,000	$1,210,000	$395,000	$710,000
Interconnect line maint.	$10,000	$10,000	$10,000	$10,000	$10,000
Total annual cost	$14,685,000	$14,790,000	$14,170,000	$13,985,000	$14,290,000
Present Worth of Annual Costs	$144,200,000	$145,200,000	$139,100,000	$137,300,000	$140,300,000
Total Present Worth Cost	**$431,300,000**	**$463,800,000**	**$513,700,000**	**$457,100,000**	**$480,300,000**

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Process Evaluation

PROCESS SENSITIVITY COMPARISONS

PROCESS	FLOW RR/IR	PRESENT WORTH	CAPITAL
BARDENPHO	32/50	$431,300,000	$287,100,000
IFAS @ RR & IR	32/50	$438,800,000	$294,600,000
MLE + deN FILTERS @ RR & IR	32/50	$445,800,000	$299,600,000
BARDENPHO/GREENFIELD-RR	32/50	$457,100,000	$319,800,000
BARDENPHO	20/62	$463,800,000	$318,600,000
BT/NAS RR + BARDENPHO IR	20/62	$478,600,000	$326,600,000
BARDENPHO/GREENFIELD-RR	20/62	$480,300,000	$340,000,000

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System Evaluation Matrix

- Uses criterion and weights agreed to in earlier workshop for comparing system alternatives
- This is a tool to have a structured and focused discussion on the relative merits of the alternatives – judgment must be applied to the result

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System Evaluation Matrix

		Unweighted Ranking					Weighted Ranking				
Criteria	Weighting Factor	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	5										
Schedule	5										
Constructability	3										
Flexibility	4										
System Reliability	4										
System Operability	4										
Environmental Impacts	4										
Water/Wastewater System Optimization	5										
Public Acceptance	5										
Potential for Cost Sharing	3										
Effects on Financing	3										
TOTAL											

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Cost	**5 $431M**	**4 $464M**	**2 $514M**	**4 $457M**	**3 $480M**
Ratio to lowest cost	1.00	1.08	1.19	1.06	1.11
Incremental cost above lowest cost	$0	$33M	$73M	$26M	$49M

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Schedule	**4**	**4**	**5**	**5**	**5**

- All can meet schedule
- Alternatives involving rehab of Roger Road have greater schedule risk due to uncertainty associated with construction within existing plant

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Constructability	**2**	**2**	**4**	**5**	**4**

- Construction within Roger Road plant will be very difficult
- Greenfield Roger Road at 32 MGD involves the least construction within existing plants
- Greenfield Roger Road at 20 MGD and Roger Road at 0 MGD involves more construction within existing Ina Road site than Greenfield at 32 MGD

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Flexibility	**3**	**3**	**5**	**5**	**5**

- May not be possible to create same degree of flexibility in plant design when working within constraints of existing Roger Road plant
- Greenfield Roger Road and Transfer All options offer fewest restrictions on designing plant for flexibility

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
System Reliability	**4**	**4**	**5**	**5**	**5**

- Greenfield Roger Road and Transfer All options offer more new components that can be similar in design
- Rehabilitated Roger Road plant will be less reliable due to the older components that will remain

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
System Operability	**3**	**3**	**5**	**4**	**4**

- Transfer All option – all O&M under one command, all training deals with one system
- Greenfield options will be easier to operate than rehabilitated Roger Road plant but involve operating two plants
- Rehabilitated Roger Road plant more difficult to operate, old components and cumbersome layout

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Environmental Impacts	**3**	**3**	**5**	**4**	**4**

- All options deliver 37 MGD to Roger Road for reuse and riparian habitat maintenance
- Concentrating construction and operation at one location (Ina Road) would have least short and long term environmental impacts
- Greenfield options reduce chance that construction will cause a plant upset and related environmental damage and regulatory non-compliance
- Rehabilitation of Roger Road options increase chance of construction-related plant upsets and regulatory non-compliance

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Water/Wastewater System Optimization	**5**	**4**	**3**	**5**	**4**

- 32-MGD Roger Road options make best use of existing collection system, can use existing 24-inch reclaimed water line to convey needed volume of reclaimed water from Ina Road to Roger Road, and maintains greater volume at higher elevation for potential reuse
- 20-MGD Roger Road options retain less reclaimed water at Roger Road and Transfer All option retains none at Roger Road

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Public Acceptance	**2**	**2**	**2**	**2**	**2**

- A Greenfield option may be viewed as an improvement over the existing plant or a desirable buffer for the proposed sports park
- Others may oppose the new location involved in a Greenfield plant or want the Roger Road plant gone
- Putting all wastewater treatment at Ina Road may be opposed by those near the Ina Road plant
- All likely to have a mix of support and opposition and all are considered equal

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Potential Cost Sharing	**5**	**4**	**3**	**5**	**4**

- 32-MGD Roger Road options involve least cost to provide needed volume of reclaimed water at Roger Road and perhaps greater potential for cost sharing with Tucson Water
- 20-MGD Roger Road options involve more cost to provide needed volume of reclaimed water at Roger Road and could meet more resistance for cost sharing by Tucson Water
- Transfer All option involves most cost to provide needed volume of reclaimed water at Roger Road

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System Evaluation Matrix

	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
Effects on Financing	**4**	**3**	**2**	**3**	**3**

- Differences are based on the relative magnitude of funding required

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System Evaluation Matrix

Criterion	Weight
Cost	5
Schedule	5
Constructability	3
Flexibility	4
System reliability	4
System operability	4
Environmental impacts	4
Water/wastewater system optimization	5
Public acceptance	5
Potential cost sharing	3
Effects on financing	3

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System Evaluation Matrix

Criteria	Weighting Factor	Unweighted Ranking					Weighted Ranking				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	5	5	4	2	4	3	25	20	10	20	15
Schedule	5	4	4	5	5	5	20	20	25	25	25
Constructability	3	2	2	4	5	4	6	6	12	15	12
Flexibility	4	3	3	5	5	5	12	12	20	20	20
System Reliability	4	4	4	5	5	5	16	16	20	20	20
System Operability	4	3	3	5	4	4	12	12	20	16	16
Environmental Impacts	4	3	3	5	4	4	12	12	20	16	16
Water/Wastewater System Optimization	5	5	4	3	5	4	25	20	15	25	20
Public Acceptance	5	2	2	2	2	2	10	10	10	10	10
Potential for Cost Sharing	3	5	4	3	5	4	15	12	9	15	12
Effects on Financing	3	4	3	2	3	3	12	9	6	9	9
TOTAL		40	36	41	47	43	165	149	167	191	175

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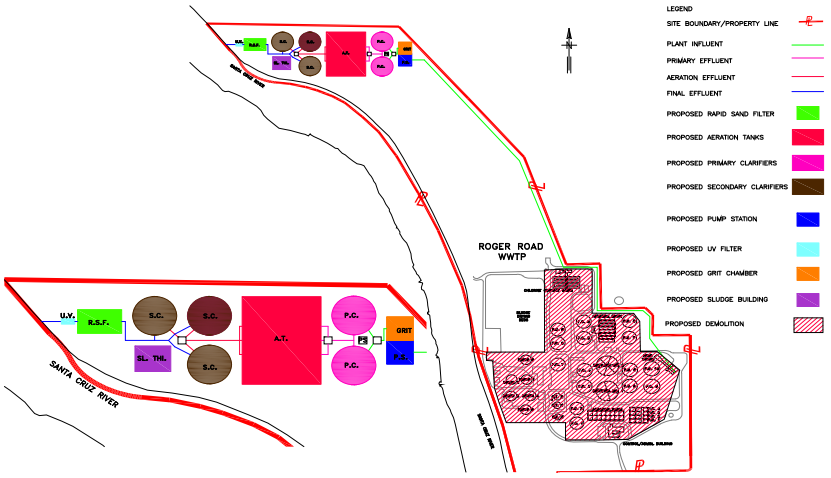
Roger Road Recommended 32-MGD Option



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Greenfield at Roger Road

- Frees up property for economic development
- Eliminates cost/schedule risk associated with rehab
- System more flexible, reliable, operable
- Better integration with reclaimed water
- Least risk for regulatory non-compliance
- Keeps eco-system in Santa Cruz River

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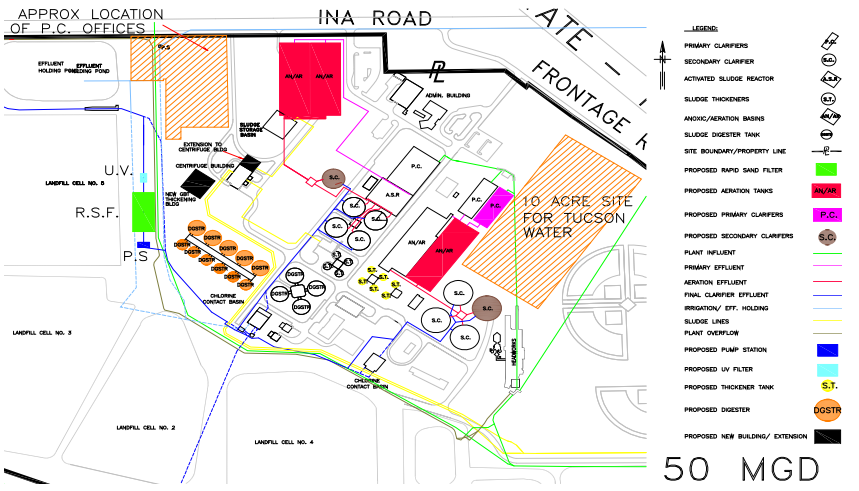
Ina Road Recommended 50-MGD Option



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Pima County Wastewater Management Department

GREELEY AND HANSEN

Next Steps

Andy Richardson

Pima County Wastewater Management Department

GREELEY AND HANSEN

Summary

Andy Richardson

Pima County Wastewater Management Department

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Workshop #11 Meeting Notes
Evaluation of Treatment Plant

1. The Evaluation of Treatment Plant Workshop for Pima County Regional Optimization Master Plan was held on December 13, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
Jeff Nichols, Finance
PCWMD Staff
David Bartos
Bob Buecher
John Carlson
Ed Curley
Jim Doyle
Laura Fairbanks
Frank Gall
David Garrett
Mary Hamilton
Tim Harmon
Michael Kostrzewski
Mike Lueken
Byron McMillan
John Munden
Steve Munsell
Jeff Prevatt
Karen Ramage
Prakash Rao
Helen Rhudy
Bill Richardson
Ron Riska, Project Manager
Mandley Rust
John Sherlock
John Warner
Ken Weber
Eric Wieduwilt
Legal
Harlan Agnew
Chuck Wesselhoff

WASTEWATER MANAGEMENT ADVISORY COMMITTEE
John Carlson
Brad DeSpain, Town of Marana

PIMA COUNTY PARKS & RECREATION
Rafael Payan,
Director, Natural Resources
Stephen Dean
Linda Mayro

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Tim Thomure
Wally Wilson
Alan Forrest, CH2M Hill
Ken Thompson, CH2M Hill

PEER GROUP
Gary Newman, B&C
Denny Parker, B&C
Joe Husband, MPI

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Gordon Culp
Carl Koch
Andy Richardson
Harold Smith

COUNTY ADMINISTRATION
(afternoon for one-hour summary)
Chuck Huckelberry,
County Administrator
John Bernal,
Deputy County Administrator

2. Major topics of the workshop were:

- Workshop #11: Evaluation of Treatment Plant
  - Process Evaluation Review
  - Recommended System Configuration/Layouts
  - Project Sequencing
  - System Costs
  - Project Financing
  - ADEQ Response

A set of handouts were provided to each attendee in advance of the workshop. Additional information was presented during the workshop.

Throughout the workshop a set of notes were recorded on "flip-charts." Those notes summarize questions, comments and notes to be utilized by the project team while conducting the study and are provided at the end of this summary. Some, but not all, of the flip chart notes are incorporated into the following items.

3. Mike Gritzuk welcomed the attendees to the evaluation of the treatment plant workshop. The goal is to advance the preferred plan to the recommended plan by the end of the day by drilling down into the details of the project and examining the construction costs updates. It was noted that the County Administrator, Chuck Huckelberry, and Deputy County Administrator, John Bernal, would be joining the workshop in the afternoon to view the recommended plan, construction costs and financing plan for the project. Until then the group will discuss the details of the recommended plan. The peer group was acknowledged for their continued involvement in the workshop activities. Tucson Water was also acknowledged for their presence and continued participation and contributions to the workshops.

4. Andy Richardson outlined his role as facilitator and encouraged all to participate, but reminded all that he will adjust the program upon arrival of the County Administrator and the Deputy County Administrator in the afternoon to summarize the project elements and review the decisions. After reviewing the agenda and groundrules, the previous workshop decisions and goals to be achieved during the Workshop #11 were outlined.

   Agenda, groundrules, previous decisions and goals were covered on pages 2 through 6 of the handout.

5. Gordon Culp presented the evaluation processes developed and followed in the previous workshops. Evaluations of the system configuration, system configuration costs, non-economic considerations and process from previous workshops were reviewed. Ron Riska asked if the costs were modified. An action from the last workshop was to hire a contractor to review the construction costs. Those results will be provided later in the workshop. Presentation matrices and costs provided from the previous workshop materials were not modified. It was reiterated that costs in the earlier workshops were planning level estimates for project elements not common to all alternatives or options. Therefore, those costs were not total costs, but were developed for comparative purposes.

Jeff Nichols stated that the risk of operating during construction, as-built drawing accuracies (inaccuracies) and unforeseen items need to be addressed with the rehabilitation alternatives. Further, Mike Bunch asked if there are examples of projects where actual costs for rehabilitation costs of old facilities were significantly more than bid construction due to these risk factors. Phoenix 91st Avenue project was offered as an example where there was a 50 percent premium due to risk type issues. Mike Gritzuk asked if there were other examples in the wastewater industry. This will be explored by the project team.

The evaluation process review and previous outcomes were covered on pages 6 through 9 of the handout.

6. Jerry Bish reviewed the assessment of the various system configurations and flows to be treated at each facility. Over the course of the project and in discussions at previous workshops, three system configurations were evaluated and three others considered. Analysis of the results indicates that the least cost alternative is treating 32 mgd of wastewater at Roger Road WWTP and 50 mgd at Ina Road WWTP. Mike Gritzuk asked why this flow arrangement was the least costly to the County. Since the County owns land at each site, there are two principal factors in the cost evaluation considerations. First, there are relatively new headworks at Ina Road WPCF that can accommodate 50 mgd. Secondly, as more flow is transferred to Ina Road WPCF from the Roger Road service area, the larger and more expensive the transfer pipeline becomes. Therefore, the least cost for Pima County is to fully utilize the headworks at Ina Road WPCF and to build the remaining treatment capacity at Roger Road to minimize the additional expense of the transfer pipeline.

   Basis of the plant capacities at each plant site was covered on pages 9 through 11 of the handout.

7. Carl Koch reviewed the treatment plant process and the possible use of side-stream treatment of solids handling recycle flows. Bardenpho was selected as the best treatment technology for the raw wastewater characteristics and effluent quality requirements. This process has a long history of reliable performance and has the benefit of addressing phosphorus removal when and if required. Recommended at Roger Road is a 32-mgd facility without primary sedimentation tanks. With the process model runs, using GPS-X, the system will achieve an effluent of less than 8 mg/L total nitrogen, less than 2 mg/L ammonia and under 1 mg/L phosphorus without the addition of chemical. This performance will meet and exceed the performance criteria required by current and anticipated facility ADEQ permits during the study horizon.

   Denny Parker indicated that the original Bardenpho process was developed and operated in South Africa and was constructed without primary sedimentation tanks, but since then primary sedimentation tanks have been added. Without primary tanks the process units need to be increased in size to accommodate the wastewater load normally removed by primary sedimentation. Therefore, to reduce operating energy costs related to raw wastewater being processed through Bardenpho, it was advised to consider adding primary sedimentation tanks to the process train. Jim Doyle indicated that he saw nothing wrong in adding raw wastewater directly to the Bardenpho process so as to utilize the carbon source associated with the primary wastewater sludge in the wastewater process system. During startup at the Ina Road WPCF, raw wastewater is being conveyed around the primary clarifiers and added directly to the MLE system (BNRAS) with a consistent total nitrogen result of 3.5 mg/L in the effluent. This is being accomplished without appreciable additional air from the blower system. From the operations

perspective, there appears to be benefits of not having primary sedimentation tanks. Joe Husband offered that a careful life-cycle analysis is required to determine the effects of eliminating the primary sedimentation tanks.

At Ina Road WPCF the recommended Bardenpho system is sized to handle the recycle loads with a flow of 50 mgd. From GPS-X modeling, effluent total nitrogen and ammonia concentrations will be less than 8 mg/L and 2 mg/L, respectively. Effluent phosphorus concentration of less than 1 mg/L will not be achieved without the addition of metal salts. However, significant phosphorus can be removed from the wastewater before the addition of chemicals.

Most of the recycle loads will be addressed at the Ina Road WPCF. At the new Roger Road WTTP the waste activated sludge will be thickened to 3 percent before being transferred to Ina Road for digestion. The thickening filtrate will be recycled to the head end of the plant for processing in the main wastewater process stream. At Ina Road the filtrate/centrate from pre-digestion thickening, and post-digestion thickening and dewatering (if required) of sludge will be recycled and processed in the main wastewater process stream. Jim Doyle suggested eliminating thickening at Roger Road and transferring the solids to Ina Road through the plant interconnect.

Carl Koch offered that without primary sedimentation tanks that the headworks at Roger Road would need to be aggressively sized to remove grit and screenings. Ron Riska asked if there were primary sedimentation tanks at Roger Road and those solids were placed into the plant interconnect whether this would create any adverse conveyance system conditions. At this time John Warner did not see any adverse issues from the conveyance perspective. Gary Newman suggested that headworks be provided at Roger Road to address the Roger Road WWTP flow and the plant interconnect.

Denny Parker suggested treatment of recycle side-streams at Ina Road WPCF to make more carbon available in the future for phosphorus removal. It was agreed that it is not necessary to make the decision now because phosphorus removal is not required, but it would be wise to reserve space for consideration of future side-stream treatment. Joe Husband indicated that side-stream treatment studies at Ina Road WPCF proved to save money. John Sherlock expressed that having extra process tankage, or a spare tank, is desirable from an operator's perspective.

For phosphorus removal, Denny Parker believes that from a crystal ball viewpoint that there will someday be regulatory limits imposed on Pima County. Furthermore, when regulated, phosphorus standards of much less than 1 mg/L will be imposed. A phosphorus standard of 0.05 mg/L should be considered in the site allocation in the master plan. A separation or filtration process may be required to achieve low phosphorus removals. Ron Riska has heard that chemical sludges are hard to handle and may have an impact on the end use of the sludge. It was indicated that sludge from phosphorus removal systems are more problematic than conventional wastewater treatment system sludge and should be address in the biosolids handling.

In general, the peer group confirmed that the Bardenpho process is a good program for the master plan. Carl Koch indicated that the system would be designed with flexibility to operate over a range of modes associated with a multi-staged treatment process. Also, based on the unforgiving schedule for implementation, Bardenpho is optimal process for achieving nutrient limits in the effluent.

The wastewater treatment process and recycle treatment at Roger Road WWTP and Ina Road WPCF were covered on pages 12 and 13 of the handout.

8. Carl Koch reviewed the biosolids handling and treatment processes for Roger Road WWTP and Ina Road WPCF. All biosolids stabilization and processing will occur at the Ina Road WPCF. Stabilization will be by mesophilic anaerobic digestion until Class A requirements are imposed. At this time there is uncertainty when Class A biosolids may be required for Pima County biosolids, if ever. The strategy for Pima County is to prepare for achieving Class A biosolids, but not proceed until the marketplace, regulatory agencies or public demand a higher level of biosolids treatment. Plant site layouts are developed around the most land intense system (thermophilic anaerobic digestion, TPAD, followed by dewatering). By accommodating TPAD the plant site could accommodate Cambi or heat drying operations. It was noted that currently the Cambi process has not been granted Class A status by EPA, but it is anticipated that it will be granted in the future.

Jim Doyle asked if thickening of waste activated sludge to 3 percent at Roger Road WWTP was necessary. Thickening assures capacity in the sludge transfer pipeline. Gary Newman indicated that if the proposed operating schedule for the biosolids thickening or dewatering operations was not 24/7, that an equalization tank for the recycle may be necessary to address the cyclic plant loads imposed by recycle flows. Carl Koch pointed out that the TPAD process was developed on a batch feed basis because a continuous feed mode has not been approved by the regulatory agencies.

Dave Garrett asked where biosolids will be placed, if the current disposal site is unavailable. Brad DeSpain offered that there are other nearby agriculture lands available for disposal including land in Pinal County. Jackson Jenkins suggested that the Cambi product may be more desirable to the County. The Cambi product could be used for landfill cover and on park lands. A proposal had been received from Cambi to process up to 16 dry tons per day. Denny Parker indicated that San Francisco had a pilot study of Cambi shutdown because of site constraints and was using other Class A processes.

John Sherlock observed that the current wastewater treatment operations are limited by its biosolids and handling capacity and that the “back end” of the plant may drive the upgrade and expansion program. Currently biosolids processing is at “most risk” at the Roger Road WWTP. Operations are barely keeping up with the handling of sludge. Furthermore, Pima County has one of the few liquid sludge application operations left in the U.S. Mike Gritzuk stated that solids handling at the plants are critical.

It was noted that California does not want biosolids applied to its land. Ed Curley indicated that California communities were disposing of biosolids in Arizona. Because of this, the time for application of Class B biosolids on the land in Arizona may be limited. It was concluded that the provisions for Class A biosolids would be included in the site plan layouts.

Biosolids handling and treatment at Roger Road WWTP and Ina Road WPCF were covered on pages 14 through 18 of the handout along with three additional slides provided at the end of this meeting summary (see attached pages 17 and 18).

9. Jerry Bish covered the projected needs for reclaimed water system for Tucson Water and the possible riparian habitat allocations for the Santa Cruz River between Roger Road and Ina Road. Tucson Water has projected a need for approximately 30 mgd of plant effluent for reclaimed water use at Roger Road, and approximately 20 mgd of plant effluent for reclaimed water use at Ina Road to meet demand. Based on the regulatory requirements for future wastewater treatment, the effluent from the future Roger Road WWTP and Ina Road WPCF will be classified as A+. With this classification Tucson Water would be able to decommission its pressure filter treatment system at Roger Road and feed the distribution system directly after chlorine addition to meet residual requirements. Tucson Water will construct the necessary pump station, reservoir (10 million gallons), pipeline and chlorine residual facilities at Ina Road WPCF to provide for its reclaimed water needs.

The Sweetwater wetlands and recharge basins at Roger Road would be kept operational by Tucson Water. Recharge basins serve to provide for wintertime underground water storage for summertime recovery to meet peak reclaimed water demands. It was noted that Tucson Water provides the pumps for the Silver Bell Golf Course.

The current riparian habitat in the Santa Cruz River between Roger Road and Ina Road is entirely supported by the effluent from the Roger Road WWTP. The Tres Rios Del Notre project looked at that stretch of the river from several perspectives that would provide a benefit to the County. Other County agencies and public groups, such as environmental organizations, have a keen interest in sustaining or enhancing the riparian habitat in the Santa Cruz River.

Water requirements in the Santa Cruz River vary dependent on the results to be achieved. The range is from 1.4 mgd to 16 mgd. The lower value is estimated to sustain the current habitat. The upper range would provide for a major sustainable ecosystem restoration on vacant public and private lands along the Santa Cruz, which would be costly and most likely not be achieved. A probable program would require about 7 mgd, which would serve the existing habitat on public owned properties, keep water in the channel, and allow for some managed recharge. For purposes of the master plan, providing up to 7 mgd of discharge to the Santa Cruz is set as the target. Mike Gritzuk indicated that the reclaimed water needs for the proposed sports park complex need to be determined. It had been estimated earlier that the sports park complex would require approximately 3/4 to 1 mgd of reclaimed water.

With the Roger Road plant rated at 32 mgd, additional effluent water is required to meet both the Tucson Water needs of 30 mgd and the potential Santa Cruz River need of 7 mgd. Effluent water from Ina Road could be pumped to Roger Road to meet the additional demand. With construction of additional pumping capacity at Ina Road, 5 mgd and perhaps as much as 10 mgd, could be conveyed through an existing 24-inch Tucson Water distribution main that passes between the two wastewater treatment plants.

Effluent water discharged from the wastewater treatment facilities is fully allocated by agreements of several parties. Pima County does not have an allocated share of the discharge from the Roger Road facility. Harlan Agnew stated that it was necessary to define whose water goes to the sports park complex and to the Santa Cruz River.

The existing and future reclaimed water needs and riparian habitat water issues in the Santa Cruz River were covered on pages 18 through 20 of the handout.

10. Jerry Bish reviewed the plant interconnect between Roger Road WWTP and Ina Road WPCF needs, sizing and routing. The plant interconnect was previously discussed in Workshops #7 and #12 (note Workshop #12 preceded Workshop #11). Since the last workshop, the historic record of high flows to the Roger Road WWTP were examined to determine the maximum pipeline capacity needed to transfer flow to the Ina Road WPCF from the Roger Road service area. From an analysis of the flow records, the peak flow requirement, including wastewater diurnal flow variations, is 72 mgd. Therefore, for an average flow transfer of 28 mgd, the peak hydraulic capacity of the plant interconnect would need to be approximately 75 mgd (72 mgd). Bob Buecher asked if the headworks capacity at the Ina Road WPCF was capable of handling the interconnect peak flow as well as the wet weather peaks in the Ina Road service area. The headworks capacity at Ina Road WPCF will need to be evaluated. Denny Parker suggested that the secondary clarifiers at both plants be oversized to cushion the impact of higher flows.

    John Carlson asked if building a new plant in the southern end of the conveyance system would reduce wet weather flow to Roger Road WWTP. Paul Bennett offered that the economics were not good to build a facility in the southern end. Jackson Jenkins stated that it had been decided not to build a facility at the southern end.

    Three route alternatives were further evaluated with a pipeline capacity of 75 mgd. Alternative Route 3 was eliminated from consideration in Workshop #12. Each of the remaining three routes (1, 2 and 4) can transfer flow by gravity. The probable construction costs were evaluated for each route. Route 1, along the existing sludge transfer line, is the least costly by a significant amount. Barring right-of-way issues or other unknown factors, Route 1 is the recommended route alternative. It was noted that from recent survey information that the existing sludge line weaves across the existing right-of-way and may need to be relocated in some areas to allow for construction of the plant interconnect. This would add cost to the alternative Route 1 pipeline construction, but since that route is approximately $6 million less expensive, it would most likely remain the less costly approach. John Warner asked whether costs for alternative Route 4, which includes augmentation of a section of existing sewer as part of the route, was taken into account in the costing of the alternatives. This was evaluated earlier and was found that the total costs were less to keep them as separate projects. Laura Fairbanks stated that neighborhood issues work against Route 4.

    The plant interconnect was covered on pages 20 through 24 of the handout.

11. Gordon Culp reviewed the system costs and input from a contractor, JR Filanc Construction Company Inc. (Filanc), who provided construction costs for the Roger Road and Ina Road facilities. Filanc specializes in water and wastewater utility construction in California and Arizona. Previous project cost developments were for comparative wastewater process purposes and did not include common costs for the various alternatives, such as site work, landscaping, security fencing, paving, and so forth. Further, costs were based on 2006 construction cost dollars, which were not escalated to the time of actual construction. The construction costs prepared by the contractor were for 2006 construction and included common elements for the

facilities. Construction costs were not escalated to the time of actual construction. The contractor's costs revealed what is commonly known in the construction industry that there has been a volatile commodities market in recent times, especially for steel and concrete.

Construction costs were prepared for two facilities at Roger Road: 1) upgrade and rehabilitation of existing facilities, and 2) a new "Greenfield" plant. The rehabilitation costs did not include contingencies for latent defects, unforeseen conditions and other construction costs related to the age and condition of the existing facilities. Jackson Jenkins cited that a recent drain failed at the Roger Road WWTP and needed to be repair, and the location was not where the "as-built" plans indicated. It was found under a concrete slab, which required additional cost to fix. Mike Bunch indicated that the existing yard piping arrangement is less than ideal. Costs of making a better arrangement to suit future needs was not included in the rehabilitation costs. It was further offered that the costs of keeping the facility in service, while the rehabilitation is underway, could not be overstated. This cost was not included in the rehabilitation costs. Therefore, costs for the rehabilitation alternative are unrealistic. Denny Parker offered that for master planning, rehabilitation costs are difficult to quantify. To refine the costs of rehabilitation would require a 10 to 15 percent level of design to uncover where the unknown costs are and to apply a price to those elements. Mike Bunch indicated that more of the subjective rehabilitation issues need to be addressed as tangible items and added to the rehabilitation costs. This requires the assignment of costs to the risk factors that are known to exist at the Roger Road WWTP. John Sherlock offered that currently contractors that are working at the Roger Road WWTP are placing a 40 percent premium on construction projects to address the unknowns. John Carlson, retired professional engineer, indicated that from his experience as an ex-contractor that a range of probable costs would be appropriate for the rehabilitation of the existing facilities. From a contractor's viewpoint, working with structures 30 to 40 years old are scary to build onto.

System costs were covered on pages 29 through 31 of the handout.

12. Gordon Culp reviewed a probable sequence of events regarding the upgrades and expansions of the Roger Road WWTP and Ina Road WPCF facilities to meet the ADEQ requirements. Mike Gritzuk asked if the project sequence considered the possibility of delaying components of the project other than those required for treatment and the laboratory. The sequence includes constructing a 24-mgd "Greenfield" facility at Roger Road WWTP by January 2015 and a 50 mgd expansion and upgrade of the Ina Road WPCF by January 2014. An additional 8 mgd of capacity will be constructed at Roger Road after 2015 along with associated sludge facilities at Ina Road WPCF. The class A sludge facilities were not included in the first phase of construction and was assumed to be constructed after the expansions and upgrades at Roger Road WWTP and Ina Road WPCF were complete. The project sequencing analysis indicated that advancing the plant interconnect construction was important to meet the continued increase in wastewater flows at the plants. Mike Bunch reinforced that the plant interconnect was needed to serve population growth in the community. This may have financing implications. It was noted that Interstate 10 is scheduled for widening in the near future, which may impact the construction of the upgrades and expansions at the wastewater plants.

Project sequencing was covered on pages 32 through 34 of the handout.

13. Harold Smith reviewed the capital financing issues to construct the projects outlined in the project sequence provided above, including a "first cut" at annual costs for the County. Key variables include project timing and sequencing, growth of wastewater flows, inflation and interest on bonds. Laura Fairbanks stated that current plant flows are 62 to 66 mgd, including flows to Randolph Park WRF. Therefore, system development fees could be used for parts of the project. Wastewater flows are projected to reach 85 mgd by the year 2030 based on 85 gallons per capita per day. Future water conservation efforts may impact plant flows. Denny Parker stated that flow projections are a surrogate for loads to the plant. Future flows may decrease, but loadings will increase based on population growth, and the plants need to be sized to treat the increased loads. The program to design, construct and startup facilities outlined to meet the ADEQ letter requirements is based on nine years for Roger Road WWTP and eight years for Ina Road WPCF.

    Preliminary annual costs were developed based on 20-year bonds with sales in 2008, 2010 and 2012 to finance the projects. Capital costs were not inflated and were shown in 2006 dollars. O&M costs were escalated at the historic rate of about 3 percent. For sake of the annual costs development, O&M staffing was assumed to be constant between the operation of the existing facilities and the operation of the new facilities. Harold Smith reiterated that the numbers are very, very preliminary. Upon review of the numbers, Mike Kostrzewski indicated that the debt for the County will increase by a factor of 6. Mike Gritzuk indicated that the use of a 2010 bond will probably not be possible and the use of 30-year bonds needs to be looked at to soften rate impacts.

    Capital plan financing issues were covered on pages 35 through 38 of the handout along with four additional slides provided at the end of this meeting summary (see attached pages 19 and 20).

14. Jerry Bish presented site layouts of the year 2030 recommended plan with a 32-mgd Roger Road WWTP and 50-mgd Ina Road WPCF. The recommended plan for future "Greenfield" facilities at Roger Road WWTP are shown along Sweetwater Drive on the south side of the existing wastewater facilities and the Tucson Water reclaimed water filtration plant, reservoir and pumping station operations. The location along Sweetwater Drive meets the regulatory requirements for setbacks using City of Tucson owned land, maximizes the availability of public land for alternative uses (including a new sports complex), enables upstream discharge to the Santa Cruz River to sustain riparian habitat and locates operations adjacent to the existing and future reclaimed water operation. The recommended plan at Roger Road WWTP is for a facility without primary sedimentation tanks. The existing facilities will continue operations until the new facilities are commissioned, after which the existing facilities would be demolished. The site plan includes space for future expansion of facilities capacity by 50 percent beyond the year 2030.

    Gary Newman suggested that the existing headworks and primary sedimentation tanks at Roger Road WWTP could be utilized in front of the new facilities located along Sweetwater Drive. Denny Parker thought the new secondary system could be placed where the new primary sedimentation tanks were shown to get the effluent closer to the Tucson Water facilities. The issue of continued use of the existing headworks and primary sedimentation tanks is both an issue of location of the units relative to the new facilities and suitability of the existing units to function for the intended service. Because of these issues, the existing systems are planned to be retired.

Jack Van Riper asked about backup power supply and where the stormwater collection point for the new facilities was located. These will need to be determined in a more detailed plan of the site. Jackson Jenkins wanted assurance that flexibility would be built into the system; for example, route flow from any aeration tank to any clarifier. Also, how will extra flow at Roger Road be handled if part of the plant is out of service? Extra flows will be transferred to Ina Road WPCF for treatment, or storage in the overflow basins then treatment. For this reason, consideration will be given to add a fourth overflow basin at Ina Road to accommodate future overflow conditions.

At Ina Road WPCF the future facilities will treat 50 mgd of wastewater and will become the centralized location for handling and treatment of Class A biosolids. The site includes space beyond the year 2030 for expansion of both the wastewater and biosolids capacity by 50 percent. That future space would utilize some of the County-owned property at the sports park south of the existing plant. Melodee Loyer wanted to know the location of the future Tucson Water reclaimed water site and to confirm that 10 acres were set aside in the planning for Tucson Water use. The Tucson Water site is located on a 2-acre parcel along the effluent conduit of the treatment works. Additional land can be made available to provide a total of 10 acres.

Jackson Jenkins was interested in having two sludge storage bladders in the future and retiring the existing unit because of its age. Also, where will be the primary and secondary electrical power sources for the Ina Road plant? Gary Newman suggested that onsite generation with gas may be preferable to a second power feed.

Site plans for the future Roger Road WWTP and Ina Road WPCF facilities were covered on pages 24 through 29 of the handout.

15. Andy Richardson reviewed with the workshop group the specific recommendations for the expansions and upgrades of the Roger Road WWTP and Ina Road WPCF. The bases of the recommendations are the decisions from previous workshops and decisions on the materials presented in Workshop #11. The plan is to construct a new 24-mgd water campus like facility at Roger Road along Sweetwater Drive, and construct an additional 8-mgd module before the year 2030 to serve the population growth. Bardenpho is the selected wastewater treatment process.

For Ina Road WPCF the plan is to expand the existing facilities to 50 mgd. Bardenpho is the selected wastewater process. A gravity sewer pipeline with a capacity of 28 mgd (at least 72 mgd peak) will interconnect the service areas of the wastewater facilities.

Sludge facilities will be centralized at the Ina Road WPCF. Mesophilic digestion will be provided until Class A biosolids are required. At that time a batch TPAD process, or some less land intensive alternative such as Cambi or heat drying, will be provided.

Effluent water will be made available to Tucson Water for reclaimed water service at the future Roger Road WWTP and the Ina Road WPCF. The plan allows for approximately 30 mgd at Roger Road WWTP and approximately 20 mgd at Ina Road based on allocated effluent water shares. Up to 7 mgd would be made available for discharge into the Santa Cruz River at the Roger Road WWTP site.

System recommendations were covered on pages 38 and 39 of the handout.

16. Andy Richardson reviewed the general requirements of the ADEQ letters as prescribed in the current operating permits for the Roger Road WWTP and Ina Road WPCF, and outlined the basic probable response based on current planning activities by the Wastewater Management Department. Mike Gritzuk indicated that the plan would need to be updated with the input of this workshop, and meetings will be scheduled with the local ADEQ office and ADEQ headquarters in Phoenix before the letters would be filed with the State. In addition, meetings to review the plan will be held with County Administrator, Chuck Huckelberry and Deputy Administrator, John Bernal before the Board of Supervisors meeting on January 16, 2007.

    General requirements for the ADEQ permit response were covered on pages 39 through 42 of the handout.

17. County Administrator, Chuck Huckelberry, and Deputy County Administrator, John Bernal, joined the workshop in mid-afternoon. A brief review of the recommended plan was provided. Site plan layouts, projected construction costs in 2006 dollars and preliminary annual costs for the recommended 2030 wastewater facilities were included in the review.

18. While there is general agreement among the workshop group with the recommended plan, Andy Richardson led a wrap-up session of the workshop by inviting each participate to express his or her considerations or concerns on the recommended plan. Many were concerned over the costs of the upgrades and expansions at Roger Road WWTP and Ina Road WPCF, and raising the money to finance the new facilities. Some view that the facilities costs as understated at $500 million shown in 2006 dollars, while costs will be closer to $800 million in real dollars when inflation is taken into account.

    For various reasons many expressed support to build a new "Greenfield" facility, and not rehabilitate the existing Roger Road WWTP. Recent experience with rehabilitation of facilities at Roger Road has been bad and costly, and some thought rehabilitation of the existing Roger Road WWTP would be a disaster. A better case for new versus rehabilitation is required that includes real probable costs of rehabilitation.

    There were expressions that the plant interconnect needs to constructed very soon, while others were concerned over low flows in the plant interconnect at startup that might lead to odors being released from the plant interconnect into the community. Some consideration should be given to two interconnect pipelines for reliability. The plant interconnect project may want to be sped up with the widening of Interstate 10 project scheduled to begin in the near future.

    There was a thought that costs of these facilities could be shown as an environmental fee on the customer bills to highlight facility costs, and ratepayers would be informed that those costs would be eventually dropped off the bill. Byron McMillan cautioned that the planning activity needs to be flexible to address future regulations on air quality standards, effluent discharges, and aquifer protection permits. ADEQ and EPA may add more regulations and the sooner they are known the better.

John Munden wants the blower building to be shown on the Roger Road WWTP layouts, energy generation and consumption to be addressed at both sites and adequate restrooms to be provided for employees in the future facilities.

Ed Curley believes that Class A biosolids will be required in Arizona sooner rather than later and provisions will be needed to include the appropriate processing. The Class A biosolids requirements may be imposed by the State suddenly, like the ban on ocean dumping. Disposing of Class B biosolids in a landfill may be required until Class A facilities are placed into operation.

There was support for providing a riparian habitat in the Santa Cruz River, but the big question is who was going to place the water into the river.

Denny Parker thought that getting construction costs from a contractor at the planning stage was great, but more details would be needed to fully develop the risk factors associated with rehabilitation of existing facilities. Several thought that costs for rehabilitation of facilities at the existing Roger Road WWTP were too low.

On the phosphorus issue, make provisions but do not build facilities now; add in the future when required by ADEQ. Further, add room on the site plan development for 2-stage filtration in the future to address more stringent phosphorus removal standards, if required. It was encouraged that provisions for flexibility be included in the design development of the wastewater and biosolids systems.

It was expressed that timing is important and that there are several presentations needed to sell the plan to the Board of Supervisors and others. Mike Gritzuk provided an outline of next steps: complete the risk assessment by assigning appropriate costs to rehabilitation of facilities at Roger Road, look at stretching the costs over the construction period provided by the permits and beyond (are there items beside 8 mgd at Roger Road WWTP that can be deferred?), develop a roll-out plan for the regulators and finance director (need more detail on rate impact analysis), and provide more detail to strengthen the biosolids plan development. Several meetings will be required with the regulatory agency, public officials and stakeholders over the next month or so to present the plan. Other stakeholders include the Chamber of Commerce and the League of Women Voters.

19. Mike Gritzuk closed the meeting by thanking all for their participation with a special thanks to the peer group for their valuable input. He further indicated that much work was needed to advance the program from this point.

Agenda
Workshop #11 – Evaluation of Treatment Plant
December 13, 2006

Time	Topic	Presenter
8:00 am	*Continental Breakfast – Rio Nuevo, Upstairs Conference Room, 52 W. Congress*	
8:30 am	Opening Session • Welcoming Remarks • Review Agenda • Previous Decisions • Workshop Goals	 Mike Gritzuk Andy Richardson
9:00 am	Evaluation Process Review	Gordon Culp
9:15 am	System Configuration • Bardenpho ► Wastewater Treatment ► Recycle Flows • Biosolids Treatment • Reclaimed Water • Plant Interconnect	Carl Koch/Jerry Bish
10:30 am	Break	
10:45 am	Site Layouts • Roger Road WWTP (32 mgd) • Basis of Proposed Plant Capacity ► Wastewater ► Reclaimed Water • Ina Road WPCF (50 mgd) • Basis of Proposed Plant Capacity ► Wastewater ► Biosolids ► Reclaimed Water	Jerry Bish
12:00 pm	Lunch	
1:00 pm	System Costs • Roger Road WWTP (32 mgd) • Ina Road WPCF (50 mgd) • Biosolids Treatment • Reclaimed Water • Plant Interconnect	Gordon Culp
1:30 pm	Project Sequencing • Plant Interconnect • Roger Road WWTP (32 mgd) • Ina Road WPCF (50 mgd) • Biosolids Treatment • Reclaimed Water	Gordon Culp
2:00 pm	Capital Plan Financing Issues	Harold Smith
2:30 pm	Break	
2:45 pm	System Recommendation	Andy Richardson
3:15 pm	ADEQ Presentation/ADEQ Permit Response	Andy Richardson
3:30 pm	Summary Wrap-Up • Comments by Group • Closing Remarks	Andy Richardson Mike Gritzuk
4:00 pm	Adjourn	

Flip Chart Notes – December 13, 2006

EVALUATION REVIEW

- Need to explain planning costs versus final cost.
- Need case studies/real examples of "Cost" risk associated with rehabilitation of existing facilities in water/wastewater industry.
- What is the reason for 50 MGD at Ina Road? Cost of plant interconnect?
- What is the impact on the plant interconnect sizing with flow already at Roger Road?

WASTEWATER TREATMENT

- Question of "No" Primary Sedimentation at Roger Road "Greenfield" Plant.
  - Look at total annual cost with and without primaries –particularly at additional energy without primaries.
  - Should not have primaries at Roger Road – bypassing the primaries at Ina Road WPCF BNRAS has made the process easy to operate.
- Concerns with discharging solids into plant interconnect – will there be an impact?
- Ina Road WPCF: 40% BOD removal in the primary clarifiers.
- Side stream treatment vs. addition of metal salts?
- Why design Bio "P" into process if there will be a need to add metal salts?
- Bio P sludge is more difficult to handle than regular sludge. Has this been taken into consideration?
- P removal will be more stringent than 1 mg/L; could be 0.05 mg/L; something to think about?

BIOSOLIDS

- Why thicken WAS at Roger Road WWTP to 3%? Just put in sludge line to Ina Road WPCF?
- Dewatering schedule – Plan is not to run 24/7. Need to consider loading on plant based on operating schedule
- Need to look at a schedule of achieving class A biosolids in a quick time frame, make sure class B facility work toward that schedule.
- Where is the timeframe and schedule for biosolids – where are we going to place it?
- Current and future biosolids treatment could be on the critical path.
- Biosolids is used elsewhere as landfill cover.
- Current limited solids handling capacity is an operational risk.

RECLAIMED WATER

- Will 30 mgd at Roger Road WWTP be required upon startup of new facilities in 2015? No, this is a future number.
- Is the flow 24/7? The answer is "No."
- Randolph Park WRF provides reclaimed water to the County and Tucson Water.
- How much water does Parks & Recreation want in the Santa Cruz River? about 7 mgd?
- Need to understand whose water discharges from Roger Road WWTP (County does not have water rights to Roger Road WWTP effluent) and how much goes to Santa Cruz? 7 mgd has been allocated for planning.
- Whoever wants the effluent water in the Santa Cruz River should make application for the water.

PLANT INTERCONNECT

- How much flow is at Ina Road service area now and the future? How does this flow have an impact on the flow transfer from Roger Road?
- Is there room at both Ina Road WPCF and Roger Road WWTP for future expansion based on how the plant interconnect is sized?
- Future flows need to be planned for that in sizing of WWTP Facilities.
- For the selected route try to avoid public areas
- Route 4 is really an interceptor route that alleviates other conveyance system issues as well as transfers flow.

COSTS

- Need to address with real examples of the △ between rehabilitation and Greenfield. What does an additional $60 million provide Pima County?
- Need net present value of useful life on rehabilitation vs. Greenfield.
- Convert some of the evaluation criteria on evaluation matrix to $.
- Need to consider another level of detail.
- Need to look at $/gallon numbers on a benchmark basis.
- Add costs associated with keeping the rehabilitation operation in service.
- Need to take into consideration impact of interstate I-10 construction on the implementation of the program.

FINANCING ISSUES

- Need to look at how to make a case for growth to use as a funding source.
  - Already system is at 78.5 % of capacity of the future flows.
  - Plant interconnect could be considered a growth issue.
  - Look at construction time frame and how it relates to cash flow and potential savings?

SITE LAYOUTS

- What are the total acres and pump costs forTucson Water?
- Need to include support facilities on future site plans.
- Where is the area for stormwater collection, need to be located.
- Look at using existing primaries at Roger Road WWTP.
- Will there be an electrical generator building on Roger Road WWTP?
- How will flow split be worked out at in front of Roger Road WWTP to send flow to Ina Road WPCF?
- Tucson Water needs 10 acres per IGA at Ina Road WPCF site.
- Can the existing headworks take the maximum flow from the plant interconnect? Is it sized for the capacity that is needed?
- Provide headworks for all the service area flow at Roger Road WWTP and then send flow to Ina Road WPCF through the plant interconnect.
- Provide 1-day of storage for overflow issues.
- What is the long term standby and primary power plan?
- At Ina Road WPCF look at generation of power with gas.

CONCERNS/CONSIDERATIONS FROM GROUP

- Go to additional level of costing on Roger rehab plan, check facility cost.
- Concerns on interconnect transfer route.
- Concerns on cost to construct facilities.
- Methods to finance – funding sources.
- Low flow on interconnect – Will equalization be required?
- Experience on rehabilitation at Pima County facilities has been bad and costly.
- Riparian area maintenance – who owns water?
- Make sure we have a way to monitor future flows.
- Provide interconnect sooner – consider two lines .
- Benchmark treatment costs at $7/Gal. and go upon cost.
- Construction of interconnect will have some deep excavation cuts.
- Go back to contractor for a guaranteed DB costs number.
- New standards on river discharges; air quality standards; APP standards – need to be taken into consideration.
- Class A biosolids need to be addressed much sooner; concern for public perception of biosolids.
- Construction costs are low.
- Look at bond program – how scheduled to receive funds in time for construction.
- Bottleneck on solids handling.
- Implementation – need funding in place.
- Go to board with inflated inflated construction costs.
- Who is going to water the river?
- Provide for flexibility on site layouts.
- Accommodate cost increases in the funding program.
- Need to figure out scope for designs.
- ADEQ vs. EPA – who's calling the shots?
- How will this project impact costs in region with other projects – timing?
- Manpower costs on plant operations in the future.
- Give thought to strategy on presentation for "Selling Plan."
- $1/2 billion is too low.
- Need cost of risk elements in the construction costs.
- Implementation plan – How far out can remaining elements be stretched?
- Look at all other elements of ROMP and can they be moved out to be constructed at a later time?
- Presentation of plan is important – To finance director.
- Politically is 2010 bond realistic?
- Plan presentations
  - 12/21/06 Recommended Plan to Wastewater Advisory Committee
  - 12/20/06 to County Administration
  - Before 12/31/06 Presentation to local ADEQ office
  - Early January present plan to ADEQ headquarters
  - Presentation to City of Tucson and other stakeholder groups

ADDITIONAL WORKSHOP PRESENTATION SLIDES:

Alternate Class A Options

- Utilize mesophilic digestion for all
- Cambi would add:
  - Pre-digestion thickening to 15%
  - Patented 3 step hydrolysis process prior to digesters
- Heat Drying would add:
  - Driers after digestion and dewatering

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Cambi Process Considerations

- No U.S. installations
- Requires steam and high pressure (safety issues)
- Not currently given Class A status (likely to meet requirements)
- Product too dry for liquid land application
- Potential odors and strong recycle stream

Keep process in picture for future if more development in U.S. and need to pilot test if strong interest in use

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Heat Drying Considerations

- Product too dry for liquid land application
- High energy consumption
- Fire and explosion potential
- High quality product
- Need of known/ready market for the investment

Could be added instead of thermophilic digestion based on future market conditions

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Project Schedule & Costs

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Interconnect	**$22,300,000**															
Design		$1,338,000														
Construct				$20,962,000												
Ina Rd	**$243,900,000**															
Design 50 mgd		$14,634,000														
Construct 50 mgd						$212,193,000										
Construct Thermophilic Digestion														$17,073,000		
Roger Rd	**$234,800,000**															
Design 32 mgd			$12,660,000													
Construct 24 mgd							$148,755,000									
Demo Existing Plant									$23,800,000							
Construct 8 mgd											$49,585,000					

Total ROMP Projects Cost $501,000,000

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Preliminary Financing Plan

1997 Bonds	**$4.1 M**
Other CIP	*$4.1 M*
2004 Bonds	**$132.6 M**
Design Ina 50 MGD	*$14.6 M*
Interconnect	*$22.3 M*
Other CIP	*$95.7 M*
SDF's	**$92.3 M**
Other CIP	*$92.3 M*
2008 Bonds	**$345.0 M**
Construct Ina 50 MGD Ph I	*$127.3 M*
Design Roger 32 MGD	*$12.7 M*
Other CIP	*$205.0 M*
2010 Bonds	**$307.1 M**
Construct Ina 50 MGD Ph II	*$84.9 M*
Construct Roger 24 MGD	*$148.8 M*
Demo Existing Roger	*$23.8 M*
Final 8 MGD Roger	*$49.6 M*
2012 Bonds	**$17.1 M**
Thermophilic Digestion-Ina	*$17.1 M*

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Preliminary Annual Costs

	2007	2008	2009	2010	2011	2012	2013
Annual Project Costs	**$ 47.8**	**$ 74.3**	**$ 79.2**	**$ 73.4**	**$ 78.3**	**$ 103.5**	**$ 130.5**
Existing Annual Debt Service	$ 15.5	$ 16.2	$ 16.2	$ 16.3	$ 16.4	$ 16.4	$ 15.9
Proposed Annual Debt Service	$ 2.6	$ 7.6	$ 12.2	$ 16.9	$ 24.0	$ 33.4	$ 45.2
Total Debt Service	**$ 18.0**	**$ 23.8**	**$ 28.5**	**$ 33.2**	**$ 40.4**	**$ 49.8**	**$ 61.0**
Annual O&M Costs	$ 70.0	$ 72.6	$ 75.4	$ 78.3	$ 81.3	$ 84.4	$ 87.7
Annual Capital Outlay	$ 5.4	$ 6.1	$ 7.8	$ 10.0	$ 12.2	$ 14.4	$ 15.7
Total O&M and Capital Outlay	**$ 75.4**	**$ 78.8**	**$ 83.2**	**$ 88.3**	**$ 93.5**	**$ 98.9**	**$ 103.3**
Total Annual Costs	**$ 93.4**	**$ 102.6**	**$ 111.7**	**$ 121.5**	**$ 133.9**	**$ 148.7**	**$ 164.4**
% Annual Increse/(Decrease)		10%	9%	9%	10%	11%	11%

	2014	2015	2016	2017	2018	2019	2020
Annual Project Costs	**$ 81.6**	**$ 64.4**	**$ 72.0**	**$ 66.1**	**$ 9.9**	**$ -**	**$ 8.5**
Existing Annual Debt Service	$ 13.8	$ 14.5	$ 15.3	$ 7.1	$ 1.3	$ 1.3	$ 1.3
Proposed Annual Debt Service	$ 52.5	$ 58.2	$ 64.7	$ 70.6	$ 71.5	$ 71.5	$ 72.3
Total Debt Service	**$ 66.3**	**$ 72.7**	**$ 80.0**	**$ 77.7**	**$ 72.8**	**$ 72.8**	**$ 73.6**
Annual O&M Costs	$ 91.9	$ 96.1	$ 99.1	$ 102.3	$ 105.5	$ 108.9	$ 112.4
Annual Capital Outlay	$ 16.9	$ 19.1	$ 20.4	$ 19.6	$ 19.8	$ 20.0	$ 20.3
Total O&M and Capital Outlay	**$ 108.8**	**$ 115.2**	**$ 119.5**	**$ 121.8**	**$ 125.3**	**$ 128.9**	**$ 132.7**
Total Annual Costs	**$ 175.1**	**$ 187.9**	**$ 199.5**	**$ 199.5**	**$ 198.2**	**$ 201.8**	**$ 206.3**
% Annual Increse/(Decrease)	7%	7%	6%	0%	(1%)	2%	2%

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Preliminary Unit Cost

	2007	2008	2009	2010	2011	2012	2013
Annual Unit Cost							
($/CCF)	$2.94	$3.08	$3.19	$3.32	$3.58	$3.89	$4.22
% Increase/(Decrease)		4.4%	3.8%	3.9%	7.9%	8.7%	8.4%

	2014	2015	2016	2017	2018	2019	2020
Annual Unit Cost							
($/CCF)	$4.40	$4.64	$4.83	$4.74	$4.62	$4.62	$4.64
% Increase/(Decrease)	4.4%	5.2%	4.1%	(1.8%)	(2.5%)	(0.0%)	0.4%

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Pima County Regional Optimization Master Plan

Workshop #11
Evaluation of Treatment Plant

December 13, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator/Previous WS Decisions
Gordon Culp	Evaluation Process Review/System Costs/ Project Sequencing
Jerry Bish/Carl Koch	System Configuration
Jerry Bish	Site Layouts
Harold Smith	Capital Plan Financing Issues
Andy Richardson	System Recommendation/ADEQ Permit Response/Wrap-Up

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Workshop Goals
- Previous Workshop Decisions
- Evaluation Process Review
- System Configuration
- Site Layouts
- Project Sequencing
- System Costs
- Capital Plan Financing
- System Recommendation
- ADEQ Permit Response
- Summary Wrap-up

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

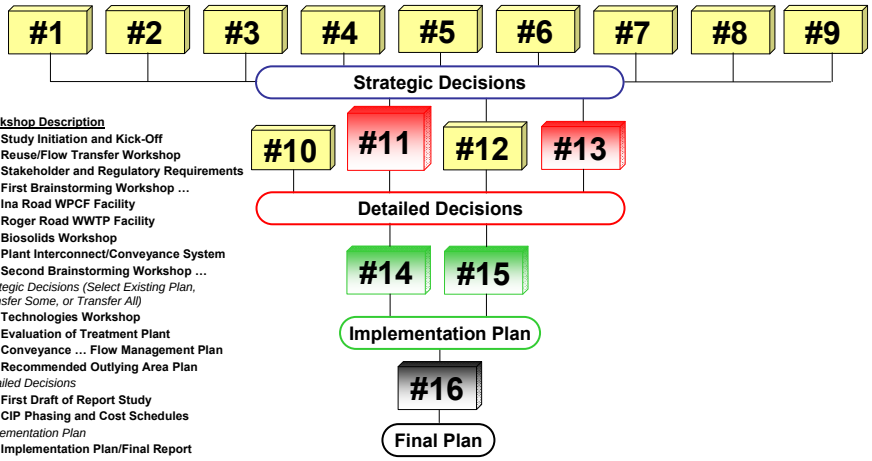
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in "parking lot"

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Previous Workshop Decisions

- Workshop #4 – June 5, 2006
  - Agreed on viable process alternatives
  - Agreed on matrix evaluation criteria
  - Agreed on matrix evaluation criteria weighting
  - Agreed to continue evaluating Bardenpho, MLE and IFAS and MBR
  - Agreed that P removal was a process criteria
  - Agreed to drop AS/NTF, BT/NAS, Step NdeN, Biostyr/Biofor and MBBR from further consideration

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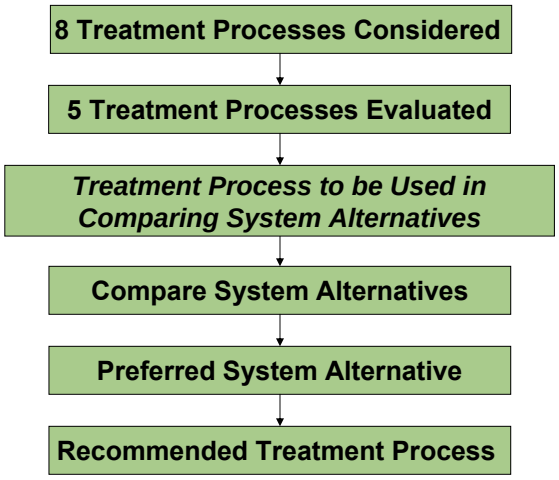
Treatment Process Selection



12

Previous Workshop Decisions

- Workshop #5/6 – July 12, 2006
  - Processes with nitrification only were eliminated
  - Agreed to further evaluation Bardenpho for system configuration options
  - Agreed to consider other processes with denitrification for sensitivity testing

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Previous Workshop Decisions

- Workshop #9 – August 8/9, 2006
  - Reaffirm P removal as a process criteria
  - Agreed on system evaluation matrix
  - Agreed no time available for pilot testing
  - Reaffirm Bardenpho for system configuration options

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Previous Workshop Decisions

- **Workshop #9 – August 8/9, 2006** *(continued)*
  - Agreed on the flows for the system configuration options
    - Agreed upon 32/50, 20/62 & 0/82
    - Discarded 37.5/44.5,50/32 & 60/22
  - Agreed on WW characteristics for each plant
  - Agreed on MLE + deN filters, IFAS and Biotowers at RR (20 mgd only) for process sensitivity testing

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Previous Workshop Decisions

- **Workshop #10 – September 26, 2006**
  - Agreed on system configuration
    - Existing plan
  - Within system configuration, agreed upon
    - Greenfield RR WWTP
  - Agreed on process for NdeN
    - Bardenpho

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Workshop Goals

- Go from preferred to recommended plan
- Agree on recycle stream treatment
- Agree on sequence of construction
- Agree on content of ADEQ letter

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Evaluation Process Review

Gordon Culp

System Configuration Evaluation

- Layout and evaluate Bardenpho for each site for three system configuration options including a greenfield option at Roger Road WWTP
- Prepare cost evaluation matrix comparing Bardenpho, IFAS, MLE +deN Filters and BT/NAS
- Prepare non-economic evaluation matrix
- Select system configuration

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System Configuration Cost Evaluation

COST MATRIX					
	RR=32 mgd IR=50 mgd	RR=20 mgd IR=62 mgd	RR=0 mgd IR=82 mgd	RRGF=32 mgd IR=50 mgd	RRGF=20 mgd IR=62 mgd
Capital Cost					
Plant interconnect	$22,000,000	$25,100,000	$31,600,000	$22,000,000	$25,100,000
RR Demolition and Removal	$4,000,000	$4,000,000	$16,100,000	$16,100,000	$16,100,000
Roger Road treatment plant	$81,540,000	$56,500,000	$0	$102,160,000	$65,800,000
Ina Road Treatment Plant	$167,500,000	$211,400,000	$284,660,000	$167,500,000	$211,360,000
Reclaimed water return	$270,000	$9,800,000	$19,400,000	$270,000	$9,800,000
Tucson Water Booster PS	$810,000	$810,000	$810,000	$810,000	$810,000
Tucson Water Reservoir	$11,000,000	$11,000,000	$22,000,000	$11,000,000	$11,000,000
Total Capital Cost	**$287,100,000**	**$318,600,000**	**$374,600,000**	**$319,800,000**	**$340,000,000**
Annual O&M Cost					
Labor	$7,500,000	$7,300,000	$6,200,000	$6,800,000	$6,800,000
Methanol	$0	$0	$0	$0	$0
Polymer-sludge thicken/dewater	$730,000	$720,000	$700,000	$730,000	$720,000
Alum for P removal	$0	$0	$0	$0	$0
Power-treatment	$6,050,000	$6,050,000	$6,050,000	$6,050,000	$6,050,000
Power-rec. water return + booster PS	$395,000	$710,000	$1,210,000	$395,000	$710,000
Interconnect line maint.	$10,000	$10,000	$10,000	$10,000	$10,000
Total annual cost	$14,685,000	$14,790,000	$14,170,000	$13,985,000	$14,290,000
Present Worth of Annual Costs	$144,200,000	$145,200,000	$139,100,000	$137,300,000	$140,300,000
Total Present Worth Cost	**$431,300,000**	**$463,800,000**	**$513,700,000**	**$457,100,000**	**$480,300,000**

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Process Evaluation

- Process Sensitivity Comparisons

Process	Flow RR / IR	Present Worth	Capital
Bardenpho	32 / 50	$431,300,000	$287,100,000
IFAS at RR & IR	32 / 50	$438,800,000	$294,600,000
MLE = deN Filters at RR & IR	32 / 50	$445,800,000	$299,600,000
Bardenpho / Greenfield-RR	32 / 50	$457,100,000	$319,800,000
Bardenpho	20 / 62	$463,800,000	$318,600,000
BT/NAS RR + Bardenpho IR	20 / 62	$478,600,000	$326,600,000
Bardenpho/Greenfield-RR	20 / 62	$480,300,000	$340,000,000

System Evaluation Matrix

- Uses criterion and weights agreed to in earlier workshop for comparing system alternatives
- This is a tool to have a structured and focused discussion on relative merits of alternatives – judgment must be applied to results

System Evaluation Matrix by Consultant Team

Criteria	Weighting Factor	Unweighted Ranking					Weighted Ranking				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	5	5	4	2	4	3	25	20	10	20	15
Schedule	5	4	4	5	5	5	20	20	25	25	25
Constructability	3	2	2	4	5	4	6	6	12	15	12
Flexibility	4	3	3	5	5	5	12	12	20	20	20
System Reliability	4	4	4	5	5	5	16	16	20	20	20
System Operability	4	3	3	5	4	4	12	12	20	16	16
Environmental Impacts	4	3	3	5	4	4	12	12	20	16	16
Water/Wastewater System Optimization	5	5	4	3	5	4	25	20	15	25	20
Public Acceptance	5	2	2	2	2	2	10	10	10	10	10
Potential for Cost Sharing	3	5	4	3	5	4	15	12	9	15	12
Effects on Financing	3	4	3	2	3	3	12	9	6	9	9
TOTAL		40	36	41	47	43	165	149	167	191	175

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System Evaluation Matrix by Workshop Attendees

Criteria	Weighting Factor	Unweighted Ranking					Weighted Ranking				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	5	5	4	2	4	3	25	20	10	20	15
Schedule	5	3	3	5	5	5	15	15	25	25	25
Constructability	3	2	2	4	5	4	6	6	12	15	12
Flexibility	4	3	3	5	5	5	12	12	20	20	20
System Reliability	4	4	4	5	5	5	16	16	20	20	20
System Operability	4	3	3	4	4	4	12	12	16	16	16
Environmental Impacts	4	3	3	4	4	4	12	12	16	16	16
Water/Wastewater System Optimization	5	5	4	3	5	4	25	20	15	25	20
Public Acceptance	5	1	2	2	3	2	5	10	10	15	10
Potential for Cost Sharing	3	5	4	3	5	4	15	12	9	15	12
Effects on Financing	3	5	4	2	4	3	15	12	6	12	9
TOTAL		39	36	39	49	43	158	147	159	199	175

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System Evaluation Matrix by Workshop Attendees (Cost Factor = 10)

Criteria	Weighting Factor	Unweighted Ranking					Weighted Ranking				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	10	5	4	2	4	3	50	40	20	40	30
Schedule	5	3	3	5	5	5	15	15	25	25	25
Constructability	3	2	2	4	5	4	6	6	12	15	12
Flexibility	4	3	3	5	5	5	12	12	20	20	20
System Reliability	4	4	4	5	5	5	16	16	20	20	20
System Operability	4	3	3	4	4	4	12	12	16	16	16
Environmental Impacts	4	3	3	4	4	4	12	12	16	16	16
Water/Wastewater System Optimization	5	5	4	3	5	4	25	20	15	25	20
Public Acceptance	5	1	2	2	3	2	5	10	10	15	10
Potential for Cost Sharing	3	5	4	3	5	4	15	12	9	15	12
Effects on Financing	3	5	4	2	4	3	15	12	6	12	9
TOTAL		39	36	39	49	43	183	167	169	219	190

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System Configuration and Process Evaluation Summary

- Existing plan system configuration selected
  - 50 mgd at Ina Road WPCF
  - 32 mgd Greenfield at Roger Road WWTP
- Bardenpho process selected

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System Configuration

- Wastewater Treatment and Recycle Flows
- Biosolids Treatment
- Reclaimed Water
- Plant Interconnect

Basis of Proposed Plant Capacity

- History
  - Project required assessment of various system configurations:
    - Existing Plan - 32 mgd @ RR & 50 mgd @ IR
    - Transfer Some – 20 mgd @ RR & 62 mgd @ IR
    - Transfer All – 0 mgd @ RR & 82 mgd @ IR

IR = Ina Road WPCF RR = Roger Road WWTP

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Basis of Proposed Plant Capacity

- Workshop #4 continued use of these flows for system configuration analysis

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Basis of Proposed Plant Capacity

- System configuration flows considered in Workshop #9:

IR (mgd)	RR (mgd)	RR, Greenfield (mgd)
22	60	60
38	44	44
45	37	37
50*	32*	32
62*	20*(1)	20
82*	0*	--

IR = Ina Road WPCF
RR = Roger Road WWTP

* = Flows from Workshop #4
(1) Use of Biotower Option at RR

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Basis of Proposed Plant Capacity

- Workshop #9 considerations:
  - Need 50 mgd at IR for recycle flow treatment
  - Transfer more from RR increases cost of plant interconnect
  - Investment of newer infrastructure @ IR (headworks and secondary facilities)
  - 12.5-mgd modules started with BNRAS plant

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Basis of Proposed Plant Capacity

- Consensus agreement from Workshop #9:
  - Existing Plan – 32 mgd @ RR & 50 mgd @ IR
  - Transfer Some – 20 mgd @ RR & 62 mgd @ IR
  - Transfer All – 0 mgd @ RR & 82 mgd @ IR

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Basis of Proposed Plant Capacity

- Workshop #10 costs evaluation rankings:
  - Least costly - 32 mgd @ RR & 50 mgd @ IR
  - Middle cost - 20 mgd @ RR & 62 mgd @ IR
  - Highest cost - 0 mgd @ RR & 82 mgd @ IR

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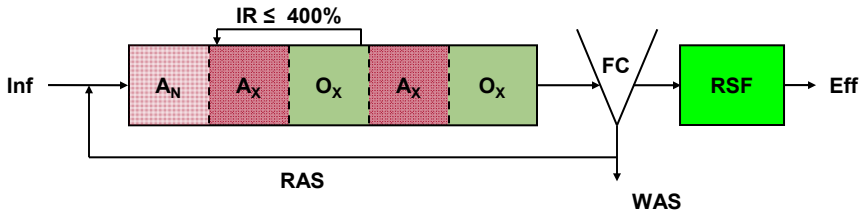
Wastewater Treatment and Recycle Flows

Carl Koch

Wastewater Treatment

AN = Anaerobic
AX = Anoxic
OX = Oxic
FC = Final Clarifier
DNF = Denit Filter
RSF = Rapid Sand Filter

5-Stage Bardenpho



Bardenpho Nitrification-Denitrification (NdeN)

Wastewater Treatment

- **Roger Road Greenfield Plant :**
  - No primary sedimentation tanks
  - No chemical requirements to achieve:
    - TN ≤ 8 mg/L
    - Ammonia ≤ 2 mg/L
    - P ≤ 1 mg/L

Wastewater Treatment

- Ina Road WPCF:
  - No chemical requirements to achieve:
    - TN ≤ 8 mg/L
    - Ammonia ≤ 2 mg/L
  - Need metal salts to achieve:
    - P ≤ 1 mg/L
    - Add metal salts ahead of primary/final clarifiers

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Major Recycle Flows

- At Roger Road WWTP
  - Only centrate from WAS thickening
  - Can be treated in main WW process stream

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Major Recycle Flows

- At Ina Road WPCF
  - Centrate from primary sludge and WAS thickening
  - Centrate from digested sludge thickening/dewatering
  - Can be treated in Main WW process stream

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Biosolids Treatment

Carl Koch

Workshop No. 7 Conclusions

- All biosolids stabilization at Ina Road WPCF for all Ina and Roger options
- All biosolids alternatives include mesophilic digestion
- Class A Screened Alternatives
  - Temperature Phased Anaerobic Digestion (TPAD)
  - Heat drying
  - Cambi

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Biosolids Treatment Options

- Class B
  - Mesophilic digestion (current process)
- Class A – liquid processes
  - Temperature Phased Anaerobic Digestion (TPAD)
- Class A – cake or dry product processes
  - Temperature Phased Anaerobic Digestion (TPAD) + dewatering
  - Cambi + Mesophilic Digestion (potential future option) + dewatering
  - Heat drying + dewatering

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Alternate Class A Options

- Utilize mesophilic digestion for all
- Cambi would add:
  - Pre-digestion thickening to 15%
  - Patented 3 step hydrolysis process prior to digesters
- Heat Drying would add:
  - Driers after digestion and dewatering

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Cambi Process Considerations

- No U.S. installations
- Requires steam and high pressure (safety issues)
- Not currently given Class A status (likely to meet requirements)
- Product too dry for liquid land application
- Potential odors and strong recycle stream

Keep process in picture for future if more development in U.S. and need to pilot test if strong interest in use

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Heat Drying Considerations

- Product too dry for liquid land application
- High energy consumption
- Fire and explosion potential
- High quality product
- Need of known/ready market for the investment

Could be added instead of thermophilic digestion based on future market conditions

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Planning Decisions

- When to Implement Class A?
  - Digest to Class B until Class A is required
  - Watch for triggers to Class A (NBP public participation)
- Selected Class A approach?
  - For existing market: TPAD
  - For drier product markets: TPAD, Heat Drying, or possibly Cambi
- Location for Class A
  - Ina Road WPCF

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Biosolids Arrangements

- Site layouts for processing biosolids from a total 82-mgd flow
  - Space reserved for processing biosolids from an additional 41-mgd flow
  - Based on 50-mgd Ina Road and 32-mgd Roger Road "Greenfield" Alternative (with no primaries)
  - Primary and WAS thickening, TPAD, post digestion thickening/dewatering

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Biosolids Class B Facilities

- Roger Road WWTP
  - GBT Thickening Facility for WAS to 3% solids
- Ina Road WPCF
  - Gravity thickening/DAF for Primary Sludge to 5% solids
  - GBT Thickening Facility to thicken WAS to 5% solids
  - Nine mesophilic digesters (5 new)
  - Expand Centrifuge Dewatering Facility

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Biosolids Class A Facilities

- Roger Road WWTP
  - GBT Thickening Facility for WAS to 3% solids
- Ina Road WPCF
  - Gravity thickening/DAF for Primary Sludge to 5% solids
  - GBT Thickening Facility to thicken WAS to 5% solids
  - Six mesophilic digesters
  - Nine thermophilic digesters
  - Expand Centrifuge Dewatering Facility

Biosolids and Bio Gas

- For all process alternative evaluations:
  - For each System Configuration Alternative - assumed that sludge is thickened at the respective wastewater plant
  - All biosolids are assumed to be digested and dewatered at Ina Road
  - Thermo/Meso Anaerobic Digestion was assumed

Biosolids and Bio Gas

- Bio Gas utilization studies currently underway:
  - Current sludge gas utilization is base line condition
  - Investigating
    - Evaluation of Bio-Gas usage potential and power supply facilities

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Biosolids and Bio Gas

- Evaluation of Bio-Gas usage potential and power supply facilities
  1. Introduction
  2. Summary
  3. Bio-gas Quantities, Quality and Energy Potential
  4. End Uses of Energy
  5. Bio-gas Conversion Alternatives
  6. Alternatives Selection and Economic Analysis
  7. Alternatives Evaluation and Ranking
  8. Conclusions and Recommendations

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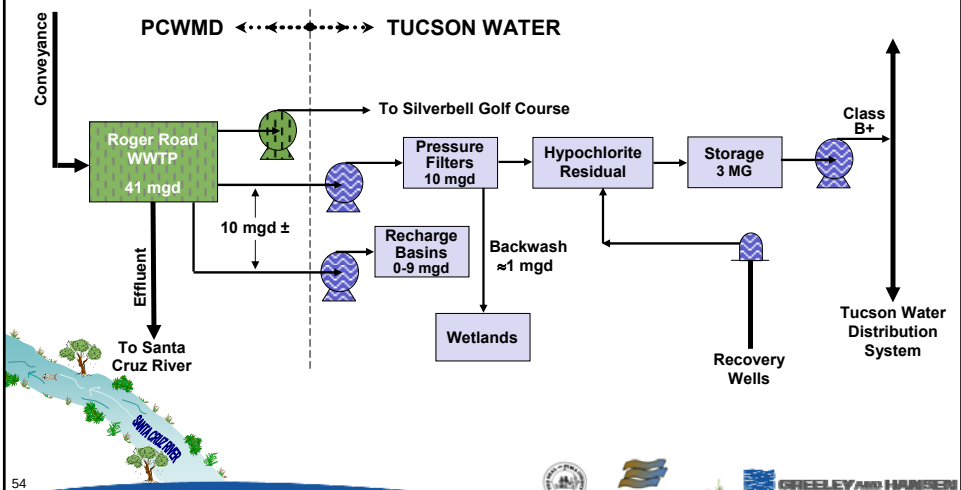
Reclaimed Water

Jerry Bish

Sweetwater Facilities (Existing)



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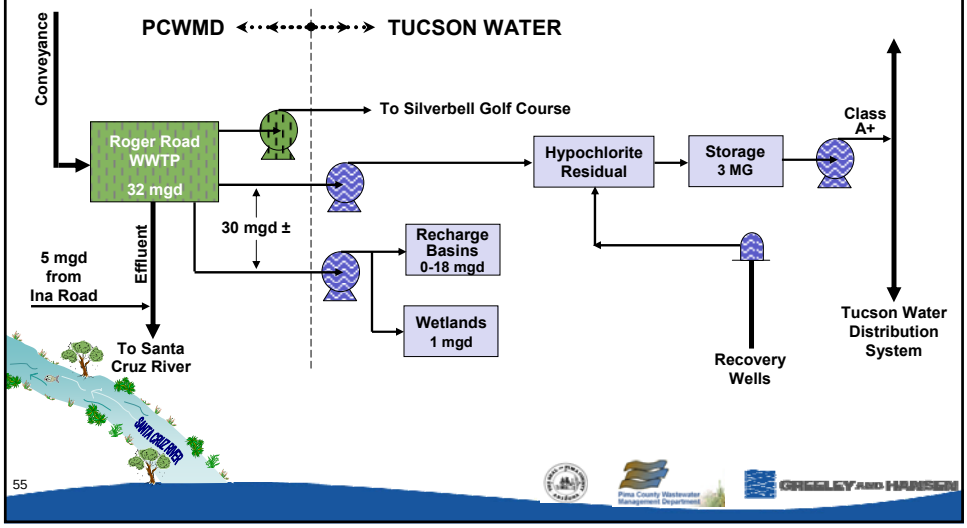
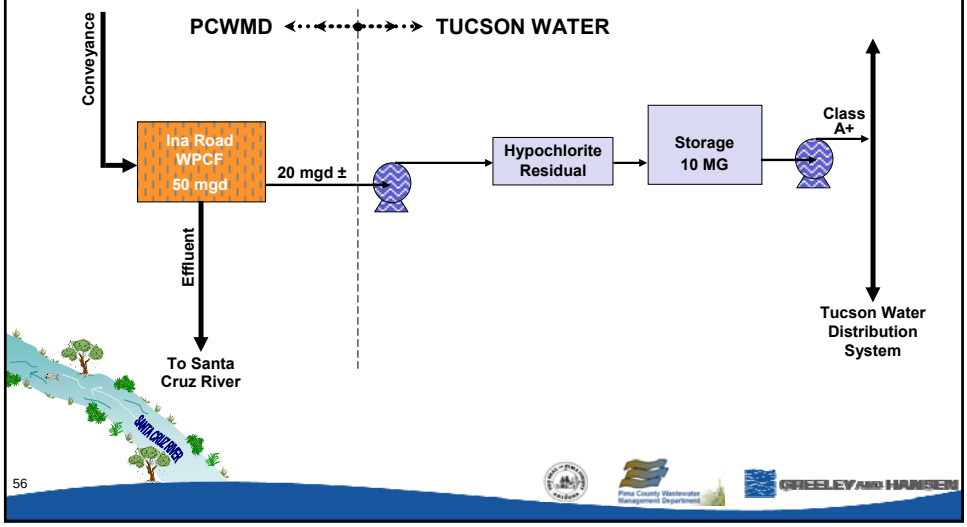
Sweetwater Facilities (Future)



Ina Road Facilities (Future)



Riparian Habitat Allocation – Roger Road to Ina Road

- Tres Rios Del Norte Project
  - Ecosystem restoration
  - Flood damage reduction
  - Groundwater recharge
  - Recreation
  - Cultural resource preservation

- Q ranges: 1.4 to 16 mgd

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Riparian Habitat – Roger Road to Ina Road *(continued)*

- Pima County Parks and Recreation
  - Desires "greenway" for environmental and recreational purposes
- Local environmental groups
  - "Greenbelt" with connection to Sweetwater wetlands

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Santa Cruz River Allocation

- Effluent Q to Santa Cruz River
  - Discharge 2 mgd
    - Serves County-owned properties
    - Preserves of existing riparian habitat
  - Discharge 7 mgd
    - Keeps water in channel
    - Allows for some managed recharge

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Plant Interconnect

Jerry Bish

Plant Interconnect

- Current Transfers
  - Tucson Blvd and Craycroft Road
  - 8-inch sludge line
- Future Transfers
  - 28-mgd Roger Road WWTP to Ina Road WPCF
  - 8-inch sludge line

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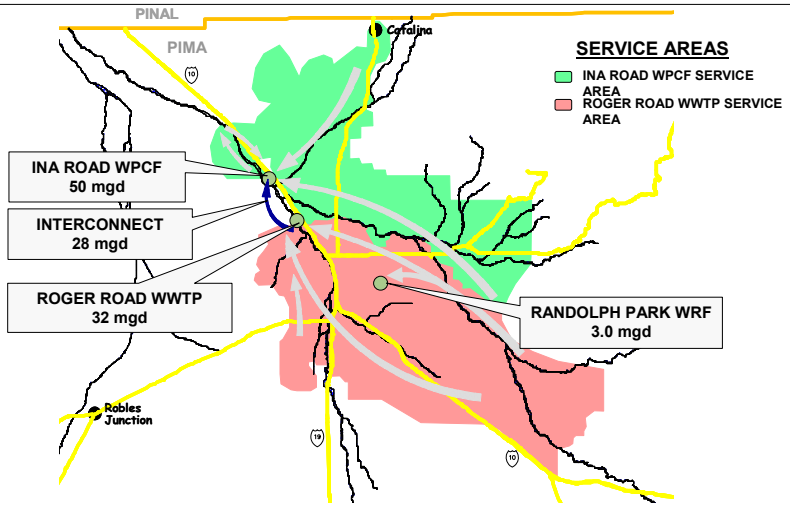
Existing Plan (2030)



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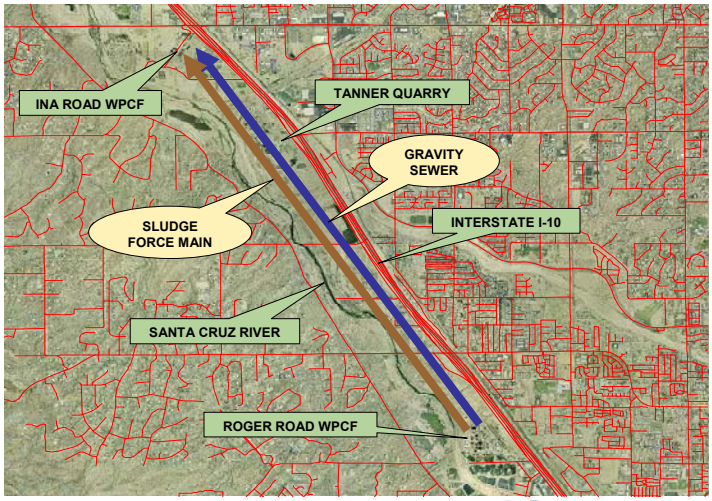
Plant Interconnect



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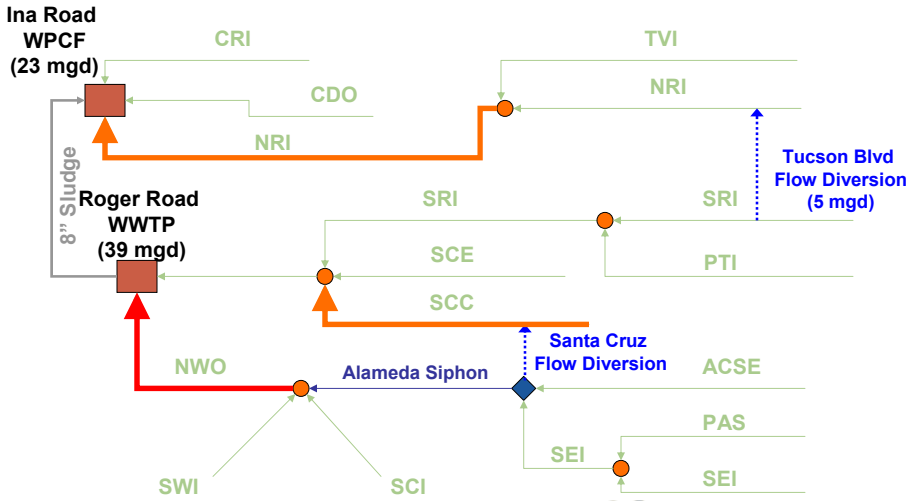
Mass Balance Schematic
(Existing System Configuration and Flows)



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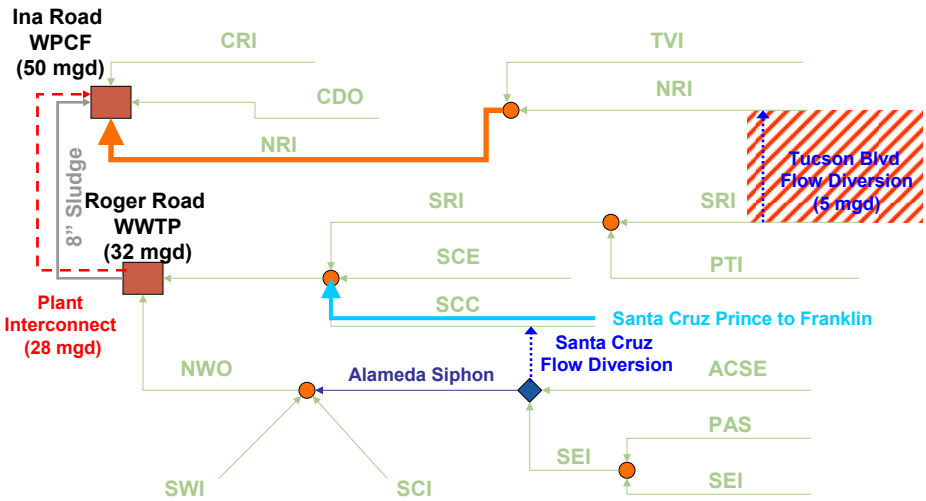
Mass Balance Schematic
(Existing Plan, 2030 Flows)



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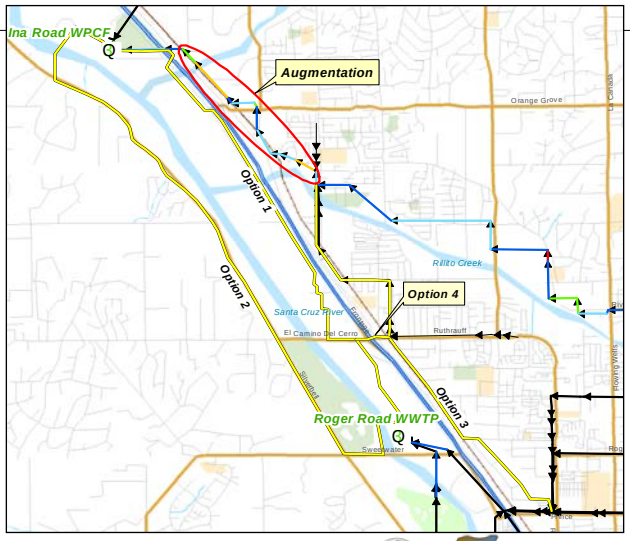
Routing Alternatives



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Steady State/Diurnal Flow

Steady State

	Q_{avg} (mgd)	Q_{min} (mgd)	Q_{max} (mgd)	$Q_{WetWeather}$ (mgd)	Q_{Peak} (mgd)
Roger Road	32	32	32	32	64
Transfer To Ina Road	28	3	50	22	72
Total	60	35	82	54	136

Diurnal Flow

	Q_{avg} (mgd)	Q_{min} (mgd)	Q_{max} (mgd)	$Q_{WetWeather}$ (mgd)	Q_{Peak} (mgd)
Roger Road	32	17.5	41	23	64
Transfer To Ina Road	28	17.5	41	31	72
Total	60	35	82	54	136

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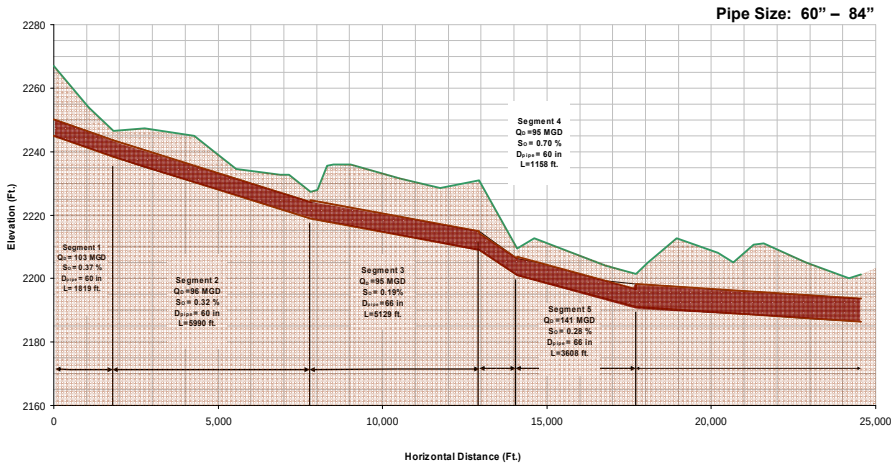
Plant Interconnect – Route 1



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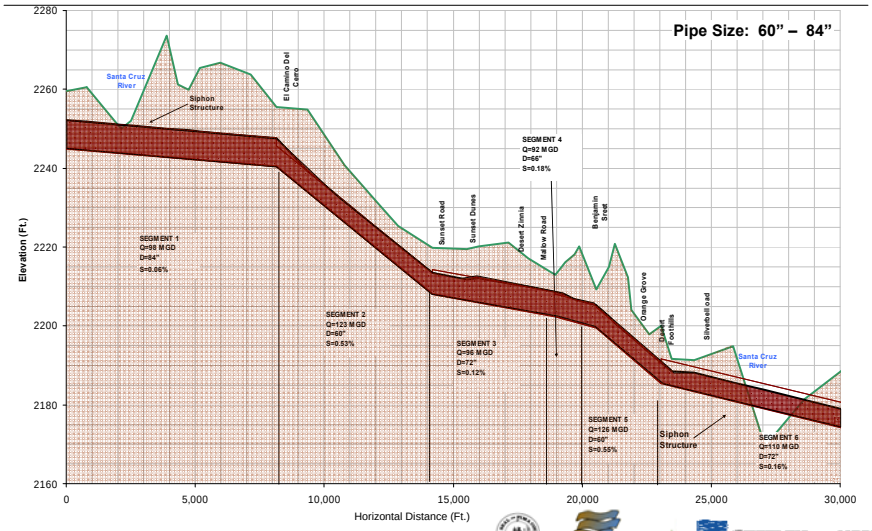
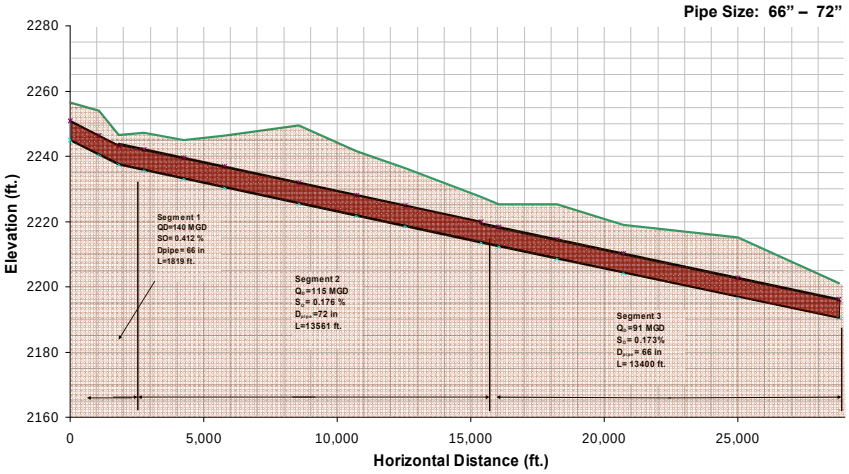
Plant Interconnect – Route 2



69

Plant Interconnect – Route 4



70

Interconnect Options

Route	Pipe Size	Pipe Length	Cost (millions)	Not Included
Route 1	60" - 84"	24,600 lf	$22.3	R.O.W. Acquistion
Route 2	60" - 84"	30,100 lf	$28.3	
Route 3	Eliminated			
Route 4	66" - 72"	28,800 lf	$29.5	

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Site Layouts

Jerry Bish

Roger Road Proposed Sports Park

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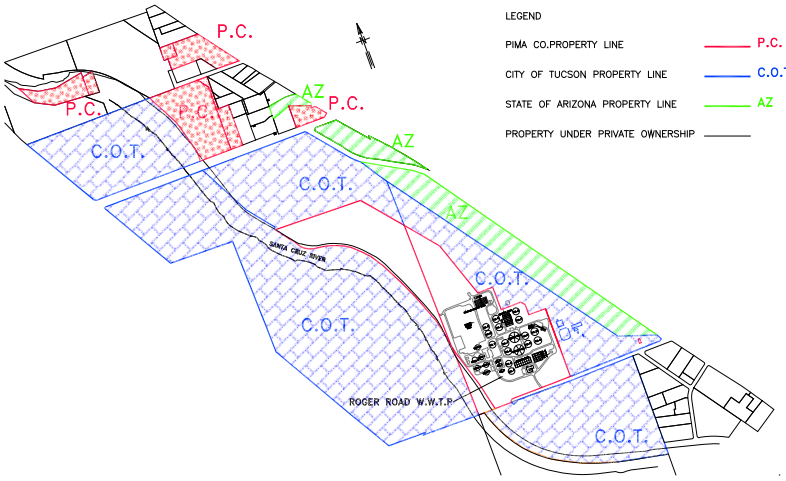
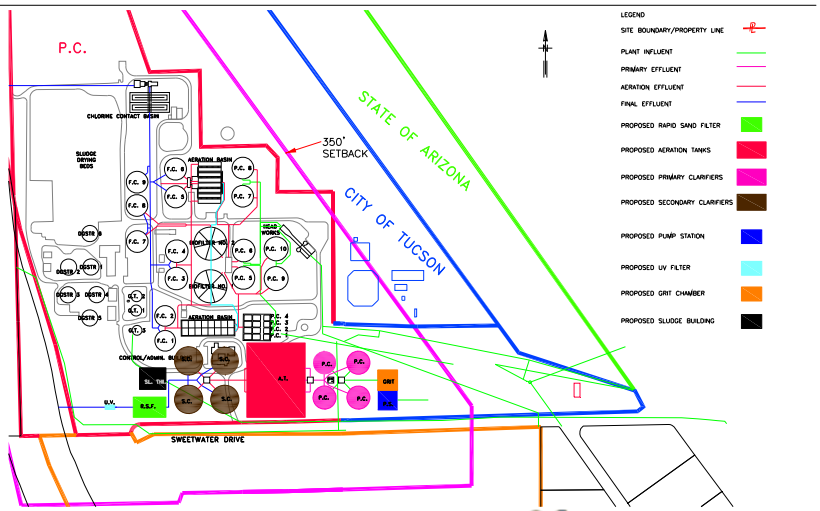
Roger Road Site Ownership



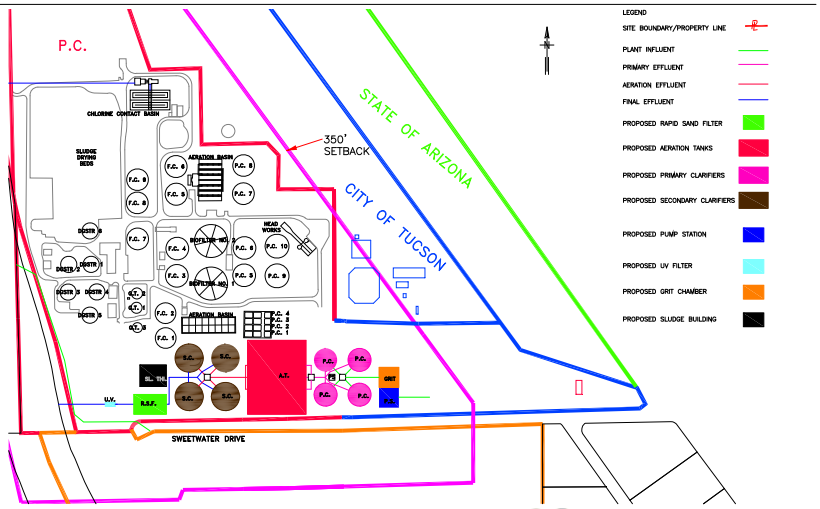
74

RR – 32-mgd Greenfield with Primary Clarifiers Year 2030 – Location of New Plant



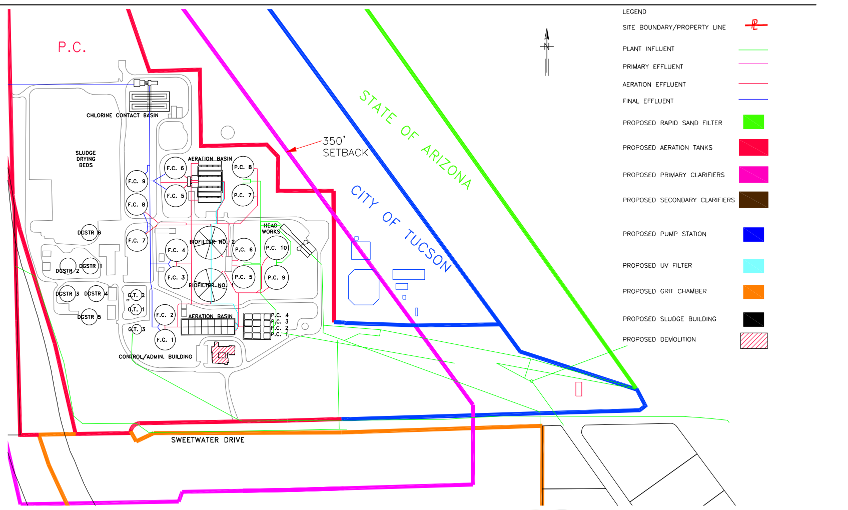
75

RR – 32-mgd Greenfield with Primary Clarifiers Year 2030 – Arrangement for New Plant



76

Roger Road – 32-mgd Greenfield with Primary Clarifiers Year 2030 – Required Demolition for New Plant



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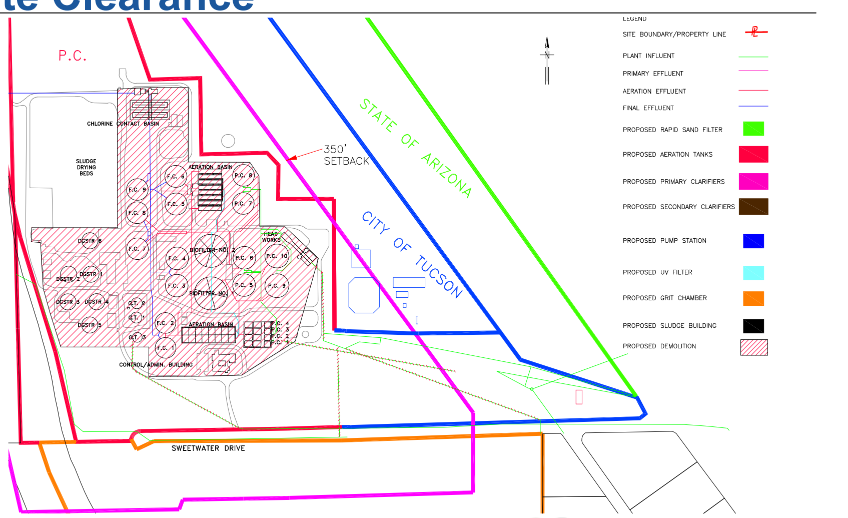
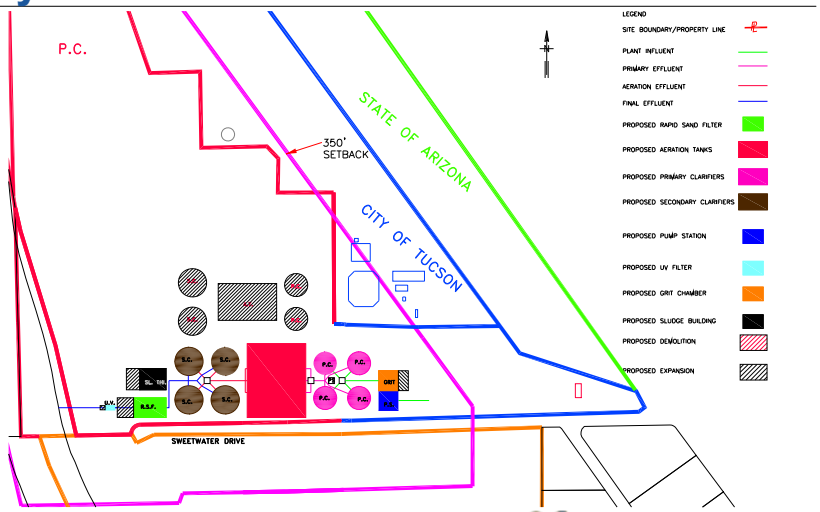
Roger Road – 32-mgd Greenfield with Primary Clarifiers Year 2030 – Required Site Clearance



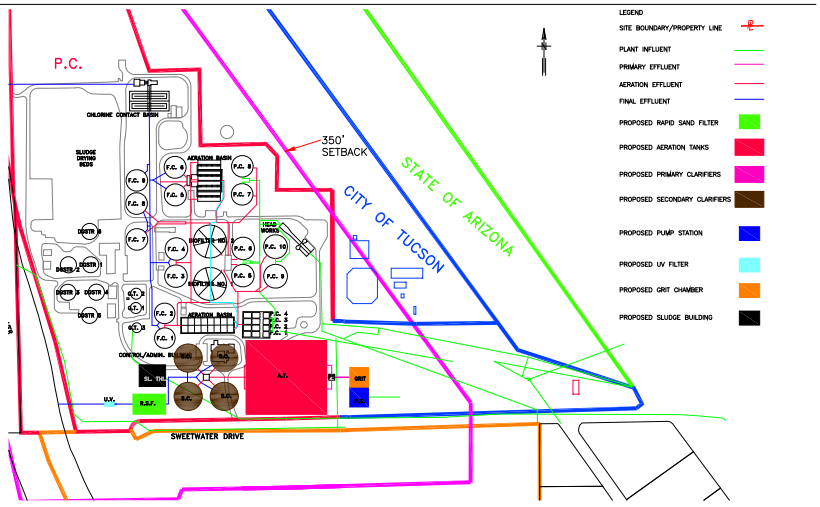
78

Roger Road – 32-mgd Greenfield with Primary Clarifiers – 16-mgd Expansion Beyond Year 2030



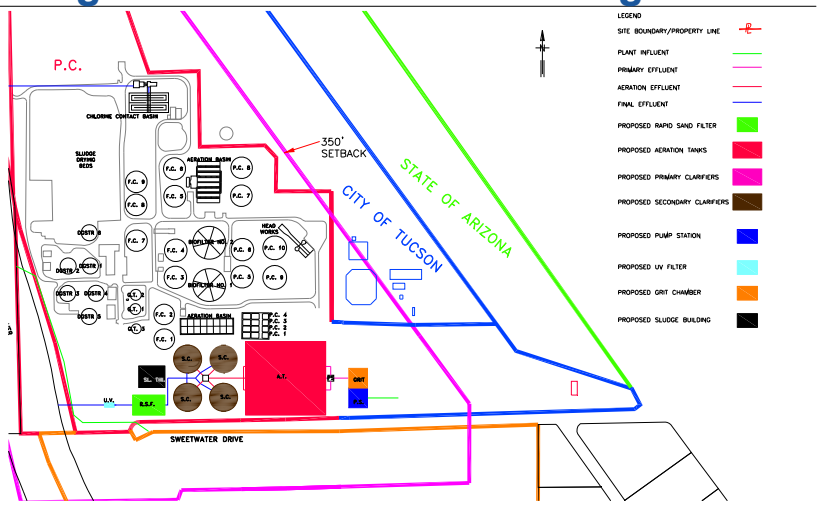
79

Roger Road – 32-mgd Greenfield without Primary Clarifiers Year 2030 – Proposed Location of New Plant



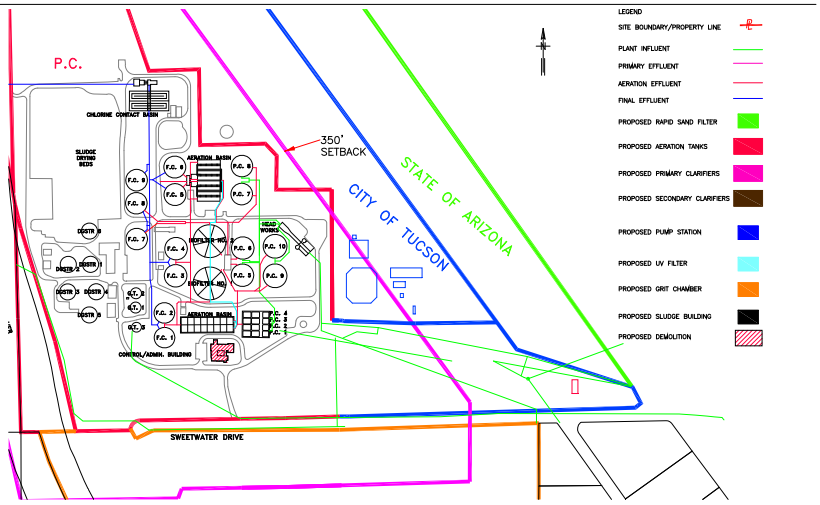
80

Roger Road – 32-mgd Greenfield without Primary Clarifiers Year 2030 – Arrangement of New and Existing Plants



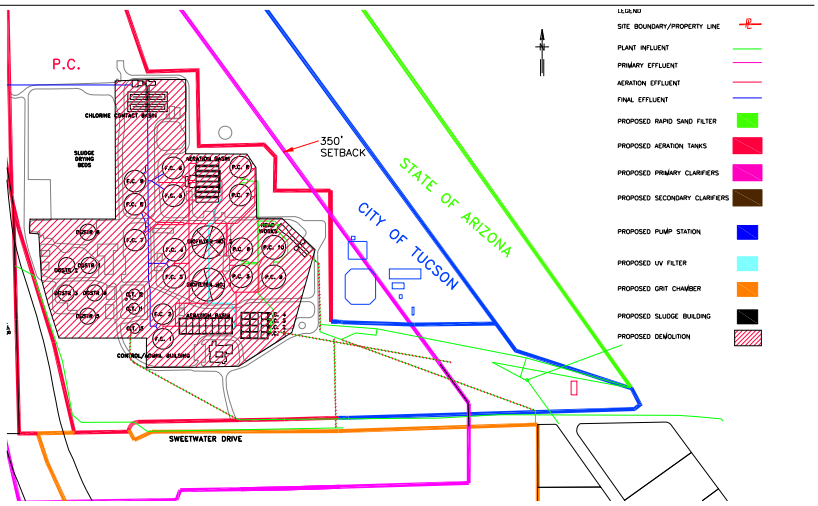
81

Roger Road – 32-mgd Greenfield without Primary Clarifiers Year 2030 – Demolition for New Plant



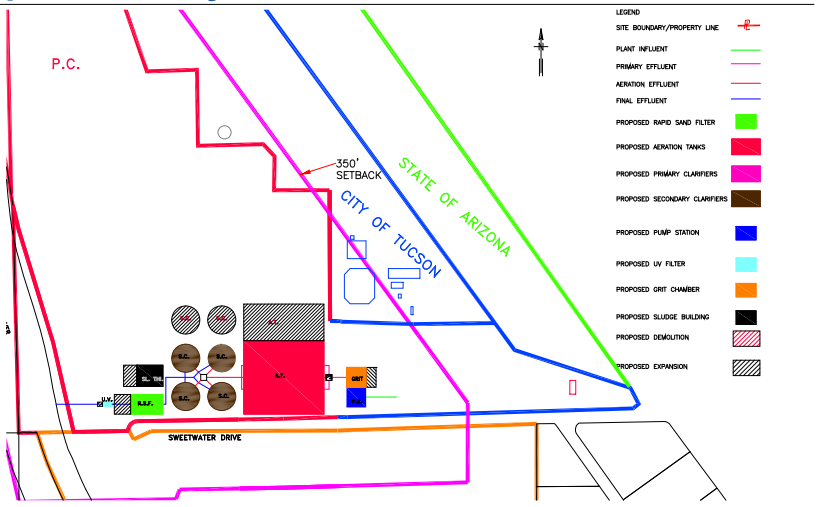
82

Roger Road – 32-mgd Greenfield without Primary Clarifiers Year 2030 – Site Clearance



83

Roger Road – 32-mgd Greenfield without Primary Clarifiers and Possible 16-mgd Expansion Beyond Year 2030



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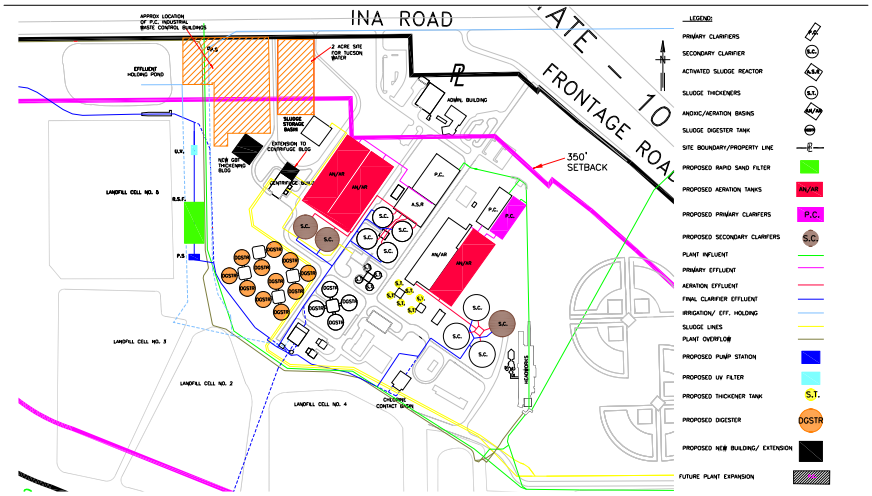
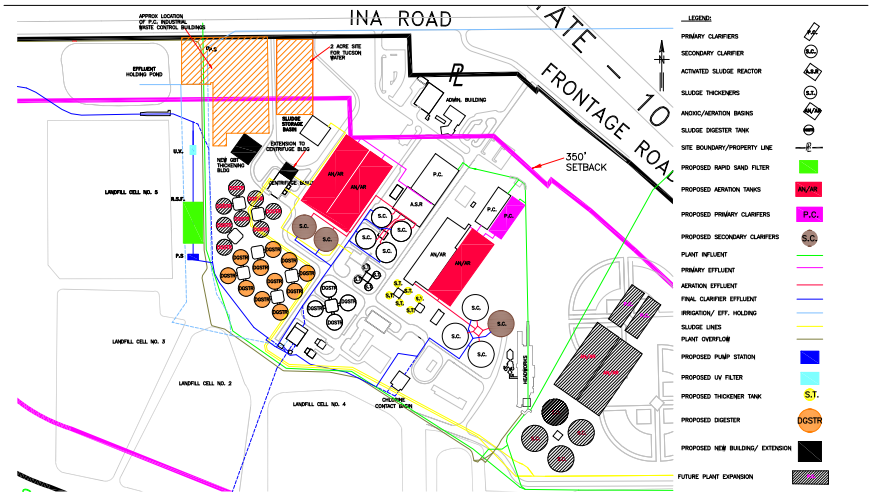
Ina Road – 50 mgd Year 2030



85

Ina Road – 50-mgd and Possible 25-mgd Expansion Beyond Year 2030



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System Costs

Gordon Culp

Workshop 10 Costs

- Purpose was to compare relative cost of various system alternatives based on planning level cost estimates for the major treatment plant components only

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Workshop 10 Costs

- Costs of these comparative plant elements did not include items such as site work, paving, architecture, fencing, irrigation, administration, laboratory and maintenance buildings, yard piping, contractor's field overhead and profit, and other elements common to all alternatives
- It was noted that total costs would be higher

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Post Workshop 10 Cost Evaluation

- California/Arizona contractor (Filanc) that specializes in the construction of water and wastewater systems developed cost estimate for the total construction cost for complete plants for:
  - Greenfield Roger Road (32 mgd)
  - Rehabilitated Roger Road (32 mgd)
  - Ina Road (50 mgd)

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System Construction Costs Based on Contractor's Estimate of Total Cost of Complete Plants

	RR Rehab 32 mgd Ina Road 50 mgd	RR Greenfield 32 mgd Ina Road 50 mgd
Plant Interconnect	$22,300,000	$22,300,000
RR Demolition	$9,125,000	$23,800,000
RR Treatment Plant	$167,200,000	$211,000,000
Ina Road Treatment Plant	$243,900,000	$243,900,000
Reclaimed Water Return	$270,000	$270,000
Tucson Water Booster PS	$810,000	$810,000
Tucson Water Reservoir	$25,000,000	$25,000,000
Total Construction Cost	$468,605,000	$527,080,000

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System Construction Costs

- Estimated total system construction cost of Greenfield option is 12% higher than rehab option based on contractor's estimate of total cost of complete plants (8% higher on present worth)
- Workshop 10 estimated that the construction cost of the comparative elements of the Greenfield option was 11% higher than the rehab option

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System Evaluation Matrix by Workshop Attendees (Cost Factor = 10)

Criteria	Weighting Factor	Unweighted Ranking					Weighted Ranking				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=60
Cost	10	5	4	2	4	3	50	40	20	40	30
Schedule	5	3	3	5	5	5	15	15	25	25	25
Constructability	3	2	2	4	5	4	6	6	12	15	12
Flexibility	4	3	3	5	5	5	12	12	20	20	20
System Reliability	4	4	4	5	5	5	16	16	20	20	20
System Operability	4	3	3	4	4	4	12	12	16	16	16
Environmental Impacts	4	3	3	4	4	4	12	12	16	16	16
Water/Wastewater System Optimization	5	5	4	3	5	4	25	20	15	25	20
Public Acceptance	5	1	2	2	3	2	5	10	10	15	10
Potential for Cost Sharing	3	5	4	3	5	4	15	12	9	15	12
Effects on Financing	3	5	4	2	4	3	15	12	6	12	9
TOTAL		39	36	39	49	43	183	167	169	219	190

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Pima County Wastewater Management Department

GREELEY AND HANSEN

Project Sequencing

Gordon Culp

Potential Sequencing

- Portions of the complete plants can be deferred until after 2015 to reduce initial construction costs
  - One 8-mgd module of the Roger Road Greenfield Plant
  - Demolition of the existing Roger Road Plant
  - Thermophilic digesters at Ina Road
  - Two gravity belt thickeners at Roger Road
  - One mesophilic digester and one centrifuge at Ina Road
- Deferral of these elements may defer construction costs of $70,000,000 – $80,000,000 until after 2015
- Further evaluation may identify other items that could be deferred as a result of phasing Roger Road

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Potential Sequencing-Ina Road

- Design 50 mgd July 2007 - July 2009
- Construct 50 mgd (with mesophilic digestion) Jan. 2010 - July 2013
- Startup/Acceptance Aug. 2013 - Jan. 2014
- Design/Construct thermophilic digestion – when decision to produce Class A sludge is made

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Potential Sequencing-Roger Road

- Design 24 mgd + 8 mgd — Jan. 2008 - Jul. 2010
- Construct 24 mgd — Jan. 2011 - July 2014
- Startup/Acceptance — Aug. 2014 - Jan. 2015
- Demolish existing plant — Feb. 2015 - Nov. 2015
- Construct 8 mgd — Nov. 2015 - June 2018

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Potential Sequencing – Interconnect

- Design — May 2007 - Aug. 2008
- Construct — Jan. 2009 - Dec. 2010

(Based on flow projections there is a need to transfer flow from Roger Road service area to Ina Road plant in 2011 to maintain flow to Roger Road plant at rated capacity of 41 mgd. Current transfer rate is 5.35 mgd.)

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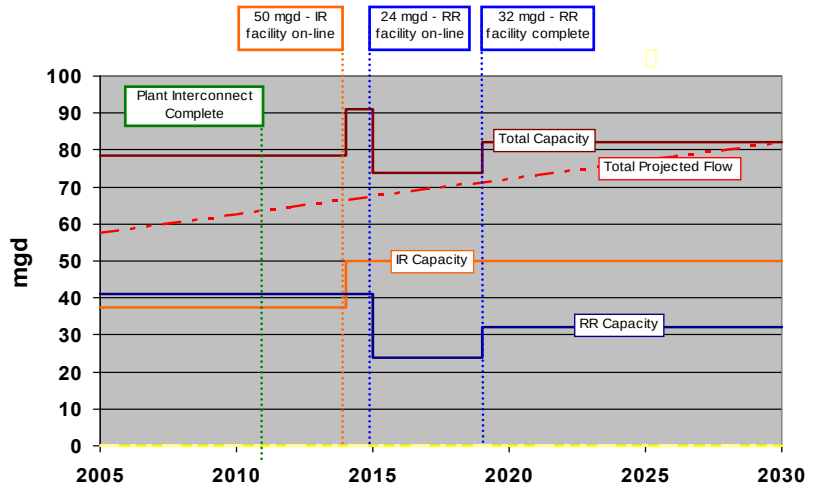
Plant Capacity Analysis



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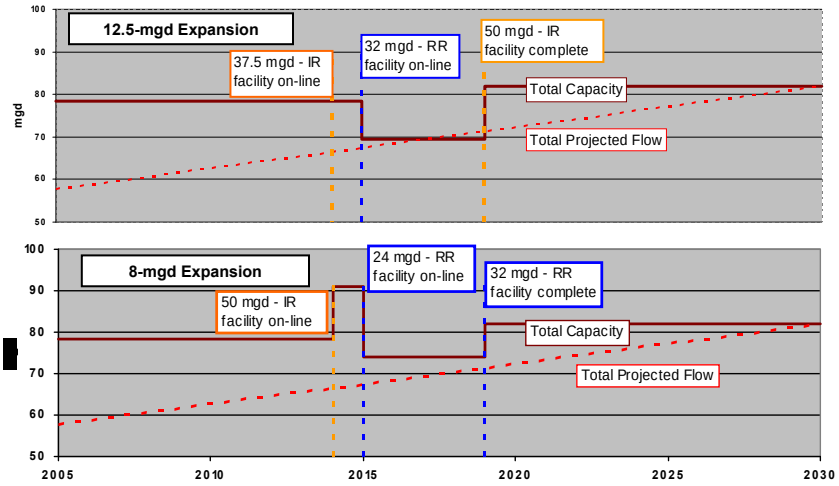
Plant Expansion Analysis



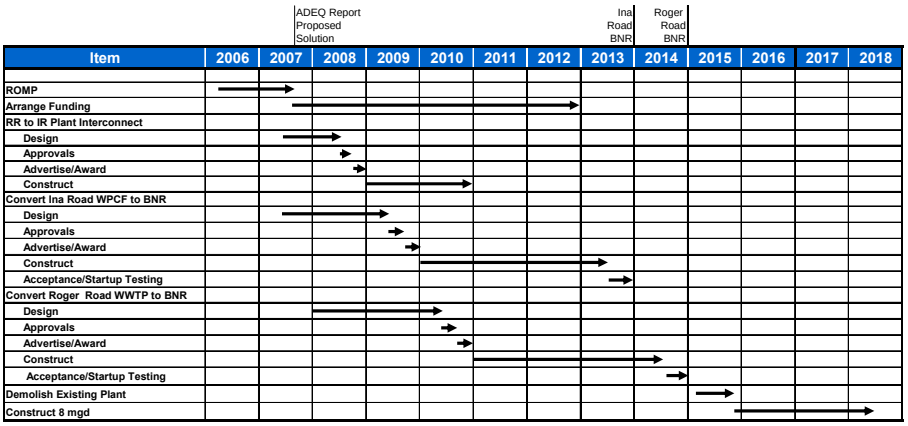
100

Potential Sequencing – Reclaimed Water

- Construct additional reclaimed water facilities at Ina Road in parallel with new plant construction
- Coordinate new reclaimed water tie-in connection at Roger Road with new facilities

101

Project Implementation Schedule



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Capital Plan Financing Issues

Harold Smith

Purpose of Funding Options Analysis

- To determine the capital planning alternative that will:
  - Meet Pima County's current and future wastewater treatment needs

    AND
  - Minimize impact on Pima County's wastewater rates

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Status of Analysis

- Working with County staff and engineers to develop optimal phasing and sequencing of projects
- Developed preliminary financing plan
- Developed annual capital and O&M costs associated with preliminary capital plan
- Developed annual unit costs associated with preliminary capital plan

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Key Assumptions

- Plan including Greenfield plant at Roger Road is the preferred capital plan
- Growth related projects are funded with System Development Fees
- Other projects are funded with existing cash reserves, rate revenues and revenue bonds
- Term of revenue bonds is 20 years

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Key Variables

- Project timing and sequencing
- Growth in wastewater flows
- Inflation of O&M costs
- Inflation of construction costs
- Interest rate on bonds
- PV discount rate

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Project Schedule & Costs

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Interconnect	**$22,300,000**															
Design		$1,338,000														
Construct				$20,962,000												
Ina Rd	**$243,900,000**															
Design 50 mgd		$14,634,000														
Construct 50 mgd						$212,193,000										
Construct Thermophilic Digestion														$17,073,000		
Roger Rd	**$234,800,000**															
Design 32 mgd			$12,660,000													
Construct 24 mgd							$148,755,000									
Demo Existing Plant									$23,800,000							
Construct 8 mgd											$49,585,000					

Total ROMP Projects Cost $501,000,000

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Preliminary Financing Plan

1997 Bonds	**$4.1 M**
Other CIP	*$4.1 M*
2004 Bonds	**$132.6 M**
Design Ina 50 MGD	*$14.6 M*
Interconnect	*$22.3 M*
Other CIP	*$95.7 M*
SDF's	**$92.3 M**
Other CIP	*$92.3 M*
2008 Bonds	**$345.0 M**
Construct Ina 50 MGD Ph I	*$127.3 M*
Design Roger 32 MGD	*$12.7 M*
Other CIP	*$205.0 M*
2010 Bonds	**$307.1 M**
Construct Ina 50 MGD Ph II	*$84.9 M*
Construct Roger 24 MGD	*$148.8 M*
Demo Existing Roger	*$23.8 M*
Final 8 MGD Roger	*$49.6 M*
2012 Bonds	**$17.1 M**
Thermophilic Digestion-Ina	*$17.1 M*

Preliminary Annual Costs

	2007	2008	2009	2010	2011	2012	2013
Annual Project Costs	**$ 47.8**	**$ 74.3**	**$ 79.2**	**$ 73.4**	**$ 78.3**	**$ 103.5**	**$ 130.5**
Existing Annual Debt Service	$ 15.5	$ 16.2	$ 16.2	$ 16.3	$ 16.4	$ 16.4	$ 15.9
Proposed Annual Debt Service	$ 2.6	$ 7.6	$ 12.2	$ 16.9	$ 24.0	$ 33.4	$ 45.2
Total Debt Service	**$ 18.0**	**$ 23.8**	**$ 28.5**	**$ 33.2**	**$ 40.4**	**$ 49.8**	**$ 61.0**
Annual O&M Costs	$ 70.0	$ 72.6	$ 75.4	$ 78.3	$ 81.3	$ 84.4	$ 87.7
Annual Capital Outlay	$ 5.4	$ 6.1	$ 7.8	$ 10.0	$ 12.2	$ 14.4	$ 15.7
Total O&M and Capital Outlay	**$ 75.4**	**$ 78.8**	**$ 83.2**	**$ 88.3**	**$ 93.5**	**$ 98.9**	**$ 103.3**
Total Annual Costs	**$ 93.4**	**$ 102.6**	**$ 111.7**	**$ 121.5**	**$ 133.9**	**$ 148.7**	**$ 164.4**
% Annual Increse/(Decrease)		10%	9%	9%	10%	11%	11%

	2014	2015	2016	2017	2018	2019	2020
Annual Project Costs	**$ 81.6**	**$ 64.4**	**$ 72.0**	**$ 66.1**	**$ 9.9**	**$ -**	**$ 8.5**
Existing Annual Debt Service	$ 13.8	$ 14.5	$ 15.3	$ 7.1	$ 1.3	$ 1.3	$ 1.3
Proposed Annual Debt Service	$ 52.5	$ 58.2	$ 64.7	$ 70.6	$ 71.5	$ 71.5	$ 72.3
Total Debt Service	**$ 66.3**	**$ 72.7**	**$ 80.0**	**$ 77.7**	**$ 72.8**	**$ 72.8**	**$ 73.6**
Annual O&M Costs	$ 91.9	$ 96.1	$ 99.1	$ 102.3	$ 105.5	$ 108.9	$ 112.4
Annual Capital Outlay	$ 16.9	$ 19.1	$ 20.4	$ 19.6	$ 19.8	$ 20.0	$ 20.3
Total O&M and Capital Outlay	**$ 108.8**	**$ 115.2**	**$ 119.5**	**$ 121.8**	**$ 125.3**	**$ 128.9**	**$ 132.7**
Total Annual Costs	**$ 175.1**	**$ 187.9**	**$ 199.5**	**$ 199.5**	**$ 198.2**	**$ 201.8**	**$ 206.3**
% Annual Increse/(Decrease)	7%	7%	6%	0%	(1%)	2%	2%

Preliminary Unit Cost

	2007	2008	2009	2010	2011	2012	2013
Annual Unit Cost							
($/CCF)	$2.94	$3.08	$3.19	$3.32	$3.58	$3.89	$4.22
% Increase/(Decrease)		4.4%	3.8%	3.9%	7.9%	8.7%	8.4%

	2014	2015	2016	2017	2018	2019	2020
Annual Unit Cost							
($/CCF)	$4.40	$4.64	$4.83	$4.74	$4.62	$4.62	$4.64
% Increase/(Decrease)	4.4%	5.2%	4.1%	(1.8%)	(2.5%)	(0.0%)	0.4%

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Next Steps

- Refine project phasing and sequencing
- Refine the matching of annual capital costs with funding sources
- Explore alternative funding sources
- Generate data necessary to assess actual impact on wastewater rates

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System Recommendation

Andy Richardson

System Recommendation

- Bardenpho process
- 32-mgd Greenfield at Roger Road WWTP
- 50 mgd at Ina Road WPCF
- Plant interconnect 28 mgd average (72-mgd peak)

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System Recommendation *(continued)*

- Biosolids – mesophilic to TPAD
- Reclaimed water – 30 mgd at Roger Road and 20 mgd at Ina Road
- Riparian habitat – discharge allocation of 7 mgd at Roger Road

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Pima County Wastewater Management Department

GREELEY AND HANSEN

ADEQ Presentation and Permit Response

Andy Richardson

Current AZPDES Permit – Roger Road WWTP

- Variances
  - Ammonia toxicity
    Variance until January 30, 2015

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AZPDES Permit – Roger Road WWTP

- Ammonia toxicity terms/conditions
  - By January 30, 2007
    - Complete engineering design review
      - Upgrade or replace
    - Document selected construction option
    - Submit documenting letter to ADEQ
  - By January 30, 2011
    - Award contract for construction
  - By January 30, 2015
    - Treatment of effluent to non-toxic ammonia levels

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Current AZPDES Permit – Ina Road WPCF

- Variances
  - Ammonia toxicity
    Variance until January 30, 2014

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AZPDES Permit – Ina Road WPCF

- Ammonia toxicity terms/conditions
  - By February 1, 2007
    - Complete initial engineering study
    - Recommendation for upgrading Ina Road WPCF
    - Submit documenting letter to ADEQ
  - By December 31, 2010
    - Award contract for construction
  - By January 30, 2014
    - Treatment of effluent to non-toxic ammonia levels

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ADEQ Response – Ina Road

- System Configuration
  - Expand and Modify to accommodate treatment up to 50 mgd
- Process
  - Bardenpho

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ADEQ Response – Ina Road

- Schedule
  - Complete Regional Optimization Master Plan ….. July 2007
  - Arrange Funding for Capital Improvements …….. July 2007 thru Dec 2012
  - Design Plant Interconnect ……. May 2007 thru Aug. 2008
  - Construct Plant Interconnect …… Jan. 2009 thru Dec. 2010
  - Design Ina Road WPCF Improvements …….. July 2007 thru July 2009
  - Construct Ina Road WPCF Improvements …….. Jan. 2010 thru July 2013
  - Startup/Testing of Ina Road WPCF Improvements …….. Aug. 2013 thru Jan. 2014

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ADEQ Response – Roger Road

- System Configuration
  - Construct New Water Campus to treat up to 32 mgd
  - Demolish Existing WWTP
- Process
  - Bardenpho

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ADEQ Response – Roger Road

- Schedule
  - Complete Regional Optimization Master Plan ….. July 2007
  - Arrange Funding for Capital Improvements ……... July 2007 thru Dec. 2012
  - Design Plant Interconnect ……. May 2007 thru Aug. 2008
  - Construct Plant Interconnect ……Jan. 2009 thru Dec. 2010
  - Design New Roger Road Water Campus …… Jan. 2008 thru July 2010
  - Construct New Roger Road Water Campus …… Jan. 2011 thru July 2014
  - Startup/Testing of New Roger Road Water Campus …….. Aug. 2014 thru Jan. 2015

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Summary

Andy Richardson

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Workshop #10 vs. Contractor Construction Cost Estimates – Roger Road 32 mgd

	Roger Road Rehab-Comparative Plant Elements	Roger Road Greenfield - Comparative Plant Elements	Incremental Cost of Greenfield Plant Approach as % of Total System Cost
Workshop 10	$85,600,000	$118,260,000	$32,720,000 10.9%
Contractor	$156,600,000	$193,300,000	$36,700,000 8.5%

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Workshop #10 vs. Contractor Cost Estimates – Ina Road 50 mgd

	Comparative Plant Elements – Estimated Cost
Workshop 10	$167,500,000
Contractor	$225,700,000

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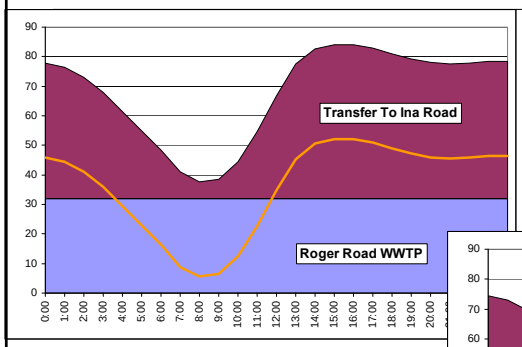
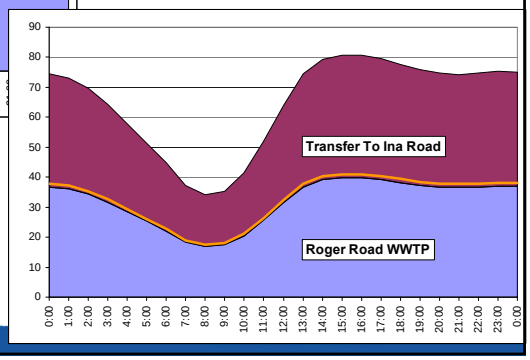
Transfer Options (Dry Weather)





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Preliminary Financing Plan

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SDF's	**$92.3 M**
Other CIP	*$92.3 M*
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Demo Existing Roger	*$23.8 M*
Final 8 MGD Roger	*$49.6 M*
2012 Bonds	**$17.1 M**
Thermophilic Digestion-Ina	*$17.1 M*

131

Preliminary Annual Costs

	2007	2008	2009	2010	2011	2012	2013
Annual Project Costs	**$ 47.8**	**$ 74.3**	**$ 79.2**	**$ 73.4**	**$ 78.3**	**$ 103.5**	**$ 130.5**
Existing Annual Debt Service	$ 15.5	$ 16.2	$ 16.2	$ 16.3	$ 16.4	$ 16.4	$ 15.9
Proposed Annual Debt Service	$ 2.6	$ 7.6	$ 12.2	$ 16.9	$ 24.0	$ 33.4	$ 45.2
Total Debt Service	**$ 18.0**	**$ 23.8**	**$ 28.5**	**$ 33.2**	**$ 40.4**	**$ 49.8**	**$ 61.0**
Annual O&M Costs	$ 70.0	$ 72.6	$ 75.4	$ 78.3	$ 81.3	$ 84.4	$ 87.7
Annual Capital Outlay	$ 5.4	$ 6.1	$ 7.8	$ 10.0	$ 12.2	$ 14.4	$ 15.7
Total O&M and Capital Outlay	**$ 75.4**	**$ 78.8**	**$ 83.2**	**$ 88.3**	**$ 93.5**	**$ 98.9**	**$ 103.3**
Total Annual Costs	**$ 93.4**	**$ 102.6**	**$ 111.7**	**$ 121.5**	**$ 133.9**	**$ 148.7**	**$ 164.4**
% Annual Increse/(Decrease)		10%	9%	9%	10%	11%	11%

	2014	2015	2016	2017	2018	2019	2020
Annual Project Costs	**$ 81.6**	**$ 64.4**	**$ 72.0**	**$ 66.1**	**$ 9.9**	**$ -**	**$ 8.5**
Existing Annual Debt Service	$ 13.8	$ 14.5	$ 15.3	$ 7.1	$ 1.3	$ 1.3	$ 1.3
Proposed Annual Debt Service	$ 52.5	$ 58.2	$ 64.7	$ 70.6	$ 71.5	$ 71.5	$ 72.3
Total Debt Service	**$ 66.3**	**$ 72.7**	**$ 80.0**	**$ 77.7**	**$ 72.8**	**$ 72.8**	**$ 73.6**
Annual O&M Costs	$ 91.9	$ 96.1	$ 99.1	$ 102.3	$ 105.5	$ 108.9	$ 112.4
Annual Capital Outlay	$ 16.9	$ 19.1	$ 20.4	$ 19.6	$ 19.8	$ 20.0	$ 20.3
Total O&M and Capital Outlay	**$ 108.8**	**$ 115.2**	**$ 119.5**	**$ 121.8**	**$ 125.3**	**$ 128.9**	**$ 132.7**
Total Annual Costs	**$ 175.1**	**$ 187.9**	**$ 199.5**	**$ 199.5**	**$ 198.2**	**$ 201.8**	**$ 206.3**
% Annual Increse/(Decrease)	7%	7%	6%	0%	(1%)	2%	2%

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Preliminary Unit Cost

	2007	2008	2009	2010	2011	2012	2013
Annual Unit Cost							
($/CCF)	$2.94	$3.08	$3.19	$3.32	$3.58	$3.89	$4.22
% Increase/(Decrease)		4.4%	3.8%	3.9%	7.9%	8.7%	8.4%

	2014	2015	2016	2017	2018	2019	2020
Annual Unit Cost							
($/CCF)	$4.40	$4.64	$4.83	$4.74	$4.62	$4.62	$4.64
% Increase/(Decrease)	4.4%	5.2%	4.1%	(1.8%)	(2.5%)	(0.0%)	0.4%

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Sewer Bill Comparison

	Average Bill (10 ccf)				
Utility	**Current**	**2008**	**2010**	**2015**	**2020**
Austin, TX	**$40.14**	**$41.91**	**$45.68**	**$56.65**	**$70.26**
Santa Barbara, CA	**$26.99**	**$28.18**	**$30.71**	**$38.09**	**$47.24**
Flagstaff, AZ	**$26.90**	**$28.08**	**$30.61**	**$37.96**	**$47.08**
Dallas, TX	**$26.87**	**$28.05**	**$30.58**	**$37.92**	**$47.03**
Fort Worth, TX	**$26.80**	**$27.98**	**$30.50**	**$37.82**	**$46.91**
Santa Monica, CA	**$22.62**	**$23.62**	**$25.74**	**$31.92**	**$39.59**
Los Angeles, CA	**$20.97**	**$21.89**	**$23.86**	**$29.59**	**$36.70**
Boulder, CO	**$19.67**	**$20.54**	**$22.38**	**$27.76**	**$34.43**
Pima County	**$18.98**	**$19.82**	**$21.39**	**$29.87**	**$29.90**
San Antonio, TX	**$18.96**	**$19.79**	**$21.57**	**$26.76**	**$33.19**
Peoria, AZ	**$18.05**	**$18.84**	**$20.54**	**$25.47**	**$31.59**
Albuquerque, NM	**$16.15**	**$16.86**	**$18.38**	**$22.79**	**$28.27**
Phoenix, AZ	**$15.34**	**$16.01**	**$17.46**	**$21.65**	**$26.85**
Denver, CO	**$14.59**	**$15.23**	**$16.60**	**$20.59**	**$25.54**
Scottsdale, AZ	**$14.53**	**$15.17**	**$16.53**	**$20.51**	**$25.43**
Oakland, CA	**$12.45**	**$13.00**	**$14.17**	**$17.57**	**$21.79**
Salt Lake City, UT	**$12.40**	**$12.95**	**$14.11**	**$17.50**	**$21.70**
Mesa, AZ	**$9.20**	**$9.60**	**$10.47**	**$12.98**	**$16.10**
Average	**$20.09**	**$20.97**	**$22.85**	**$28.52**	**$34.98**

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Workshop #12 Meeting Notes
Plant Interconnect/Conveyance System

1. The Plant Interconnect/Conveyance System Workshop for Pima County Regional Optimization Master Plan was held on October 11, 2006. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
PCWMD Staff
Bob Buecher
Ed Curley
Bob Decker
Ben Fyock
Mary Hamilton
Jackson Jenkins
Michael Kostrzewski
Mike Lueken
Byron McMillan
John Munden
Steve Munsell
Karen Ramage
Bill Richardson
Ron Riska, Project Manager
Robert Shay
Jon Simms
John Warner
Mike Willet
Legal
Harlan Agnew

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Tim Thomure
Dean Trammel

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Gordon Culp
Anne Smith
Steve Sticklen

2. Major topics of the workshop were:

- Workshop #12: Plant Interconnect/Conveyance System
  - Wet Weather Approach
  - In-System Storage
  - Tucson Blvd. Capacity Tests
  - Hydraulic Analysis-Existing Conditions
  - Hydraulic Analysis-Y2030
  - Plant Interconnect
  - Evaluation Criteria

A set of handouts were provided to each attendee in advance of the workshop. Additional information was presented during the workshop. The additional information on diurnal flows, in-system storage and 2030 total flows is provided at the end of this summary of meeting notes.

Throughout the workshop a set of notes were recorded on "flip-charts." Those notes summarize questions, comments and notes to be utilized by the project team while conducting the study. The flip chart notes are incorporated into the following items.

3. Mike Gritzuk welcomed the attendees to the conveyance system workshop. The goals of the workshop are to address the capacity issues and the plant interconnect between Roger Road WWTP and Ina Road WPCF for the 2030 facilities.

4. Anne Smith outlined her role as facilitator and encouraged all to participate, but remind all that she will move the workshop along to meet the established schedule. After reviewing the ground rules there are several goals outlined to be achieved during the workshop including agreement on the wet weather approach and route of the plant interconnect. In addition, previous workshop decisions on conveyance were reviewed.

   Agenda, ground rules, previous decisions and goals were covered on pages 2 through 4 of the handout.

5. Steve Sticklen reviewed the 2006 Facility Plan issues and the master plan activities to date. The master plan includes getting flow to the Roger Road WWTP and Ina Road WPCF based on flows of 32 mgd at Roger Road WWTP and 50 mgd to Ina Road WPCF. The previous condition assessment of the interceptor system indicated significant rehabilitation needs throughout the system. PCWMD is active in addressing those needs. Further, the previous sewer hydraulic evaluations indicated that sewer capacity may be limited in certain areas to serve the community for future capacity. The capacity evaluation undertaken by the project team confirms most of those limitations which are discussed later.

   The 2006 Facility Plan issues were covered on pages 5 and 6 of the handout.

6. Steve Sticklen began the wet weather evaluation explaining the probabilistic approach and why it was chosen for analysis including why a 10-year storm event chosen. The 10-year storm was chosen because it is specified in CMOM regulations. Although CMOM not mandatory at this time it will most likely be adopted by all wastewater agencies at some future date.

   Mike Bunch suggested that graphs be color-coded by season, because there is a seasonal effect from "snow birds." Bob Buecher indicated that statistically the chosen method was not a good method of analysis because there are so few days within the one year data set which include rain, (maybe 12 of the 365 points on the graph are days with rain), therefore extrapolating one year to ten years is not a good approach. It is recognized that there are limitations to the method, and rainfall vs. flow is the preferred approach, which is included in a pending study now under negotiation by Pima County with a consultant. Results of that study are two years away. The effort described in the workshop was to provide a bridge between assuming a 15% allowance for

wet weather flow and the pending study. Bob Buecher believes that it is not logical in Tucson to see little difference between a 1 year and 10 year peak flow as suggested by the analysis of the probabilistic approach. Data analyzed was from June 2005 to June 2006, a relatively dry period which did not include the significant wet weather events in July and August, 2006. By example, John Warner reported that the NWO overflowed in the big storm in July. There were no overflows in the data set used in the hydraulic analysis. Further, CMOM requires the use in the analysis of a 24 hour storm and not localized, high intensity and short duration storms.

A question was raised why not include additional years of wet weather data in the analysis? Mike Gritzuk suggested that a separate meeting was necessary to come to agreement on the issues of wet weather. In the meantime, additional flow data will be provided to the project team for analysis.

The wet weather analysis and design standards were covered on pages 7 through 12 of the handout.

7. Since the pending conveyance system hydrologic study will not be done in time to provide peak flow data for treatment plant design work that needs to start in early 2007, historic flow data from plant influent meters can be analyzed to refine the peaking factors. Future infiltration and inflow (I/I) improvements could lower peaking factors but historic data should provide a conservative basis. There is no assurance that future peaking factors will be reduced. The project team will be provided with the flow data from the treatment plants for analysis of peaking factors. Further Ron Riska indicated that the data developed in the hydraulic evaluation be used in the negotiations of the pending hydrology based hydraulic study.

8. Steve Sticklen reviewed the opportunities for in-system storage. These areas are in the reaches nearest the treatment plant. There would be a need for 6 million gallons of storage at Roger Road WWTP to store diurnal variations in the year 2030. From the hydraulic analysis there may be 3.3 million gallons available within 2 miles of Roger Road WWTP. Of that 3.3 million gallons, 2.9 million gallons is available in new Santa Cruz Interceptor. Upon further examination of the need and availability of in-system capacity it is not recommended, but will reviewed further relative to costs. Bob Buecher suggested over sizing the plant interconnect and use it for storage.

9. For the hydraulic model it was conservatively assumed that all septic tanks would be removed from service and be served by the conveyance system. However, this was viewed as too conservative and it was agreed that septic tanks will be assumed to stay off the system, but that all growth would assumed to be connected to the conveyance system. The hydraulic model assumed that Randolph Park could be off line for short times due to emergencies and that conveyance capacity for Randolph Park flows should be provided. This was agreed as an appropriate assumption.

10. Steve Sticklen reported on the hydraulic model evaluation of the capacity testing at Tucson Blvd. The hydraulic testing and modeling confirm that the system can transfer 12 to14 mgd, although close to surcharging at these flows. Typically the flows are in the range of 5 to 8 mgd. At higher flows the system becomes surcharged. Mike Kostrzewski asked that the locations of surchaging be shown on the hydraulic profiles.

11. The hydraulic modeling analysis under existing conditions does not exhibit surcharging conditions, contrary to findings of the 2006 Facility Plan. The hydraulic model findings were confirmed with the flow monitoring stations within the conveyance system. Bob Decker stated that video work in the NWO interceptor showed that d/D greater than 85% before the line was rehabilitated. After rehabilitation, which removed significant quantities of debris, the d/D was running about 60%. Therefore, after rehabilitation field observations agree with model results. In general, the location of capacity issues is in good agreement with facility plan.

12. For the hydraulic analysis for the year 2030 the following flow assumptions need to be modified. 1) Don't assume that existing septic tanks will be sewered. 2) Assume that Randolph Park WRF will be in service except for emergencies, but need to provide conveyance capacity for those emergencies. And 3) 85 gpcd assumption is conservative but okay to use. Before these assumptions are incorporated into the model the hydraulic results are similar to the 2006 Facility Plan. In general there are seven (7) reaches that will need improvement. Some additional evaluation will be conducted on the timing of those needs.

    Bob Decker offered that the SEI system was originally designed with two pipelines in mind so extra easements are already available to increase capacity. On costs table for the areas of future improvements there appears to be incorrect or missing cost information. The project team is to review and correct accordingly.

    The hydraulic model was covered on pages 12 through 20 of the handout.

13. Steve Sticklen presented the four plant interconnect route options: 1) sludge line route, 2) Silver Bell Avenue route, 3) east of interstate I-10 route, and 4) combination of sludge line and east of interstate I-10 route. From the group discussion it was determined that there would be few sewer connects along Route 2, because of the low density and the current use of septic tanks in the area. There was discussion by John Warner on the original intent of route 3. The intent was to have two lines – one line down route #1 and one line along the east side of the interstate I-10. The goal was to provide greater reliability by having two lines. This is different than the option 3 evaluated to date. After further discussion, both versions of option 3 were eliminated.

    For Route 1 the survey is not complete, but current information is that the sludge line wanders around quite a bit through and maybe even outside of the existing easement. Other projects have found that the sludge line is not always in the location shown on the plans. It has been off by 20 feet in some cases. It was further noted that none of the interconnect profiles showed river (wash) crossings nor did they include costs for the crossings. These will be added to the profiles and costs tables.

    The plant interconnect was covered on pages 20 through 25 of the handout.

14. Gordon Culp presented the evaluation criteria to be considered for the plant interconnect route options. This led to discussion of the negatives associated with each route related to these criteria. Comments included:

- #1 – Constructability, size and location of sludge line, archaeology, right of way (survey under way), does not address augmentation capacity of NRI.
- #2 – Utility conflicts, traffic control, right of way, archaeology, public acceptance (closer to housing), environmental impacts, constructability, odor control.
- #4 – Right-of-way, business disruption, public acceptance, traffic control, odor control, railroad and highway crossings, permits, utility conflicts.

Additional comments included checking with ADOT regarding routes #2 and #4, to see if coordination with any DOT projects may be possible.

After discussion by the group, it was concluded that Option #1 is the preferred route with the least cost and least impacts, if the right-of-way and archaeological concerns can be addressed successfully. However, evaluation of Options 2 and 4 will be developed for comparison.

The evaluation criteria and costs comparisons for the route options were covered on pages 25 through 27 of the handout.

15. In the general discussion at the end of the workshop several comments were offered and included. Rehabilitation of sludge line manholes and valves is under contract. The line has been inspected by video and found to be in good shape. Concern about how long the County can live without having the interconnect being in service. Design and construction will take several years. Flow is being pushed from the Roger Road WWTP service area to Ina Road WPCF because the Roger Road WWTP is reaching capacity. Current rate of capacity increase is 3/4 to 1 mgd per year. Depending on timing, some interim way of getting flow to IR – involving temporary pumping station and plastic line next to the sludge line or fix the bottlenecks that are limiting flow transfer in the existing system maybe required. Subsequent analysis in this study will evaluate the timing of the need for added conveyance capacity to Ina Road WPCF.

    Concern was expressed that the flow line is lowering in the rivers (washes) s some degrading of the river bottoms at the river crossings that needs to be considered.

16. There needs to be a meeting of the minds on the wet weather approach. A meeting between the project team and PCWMD is to be held in early November to work out the details. In addition, the plant flow data needs to be analyzed to determine peaking factors. The project team will review the plant influent flow records to determine an appropriate peaking factor.

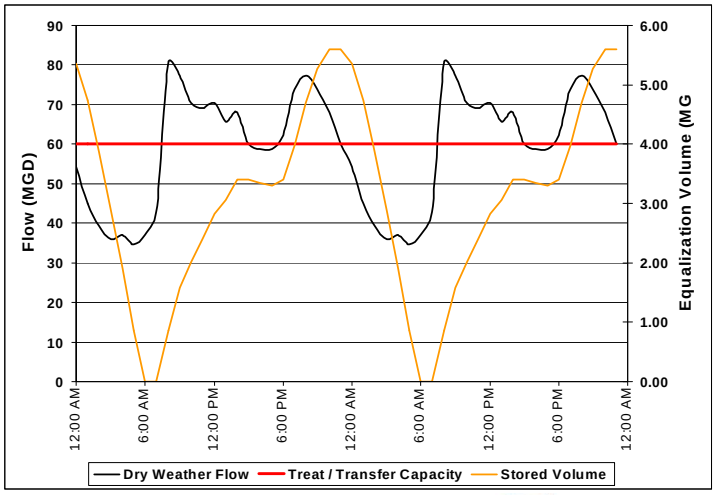
17. Workshop 11 will include a review of the plant interconnect and will include an analysis of whether Roger Road WWTP is operated at a fixed rate of 32 mgd with peaks sent to Ina Road WPCF, or whether Roger Road WWTP will treat diurnal flow variations. Sending peaks to Ina Road WPCF will substantially increase the peak flows at Ina Road WPCF but will simplify operation at Roger Road WWTP.

18. Mike Gritzuk closed the meeting and looked forward to the wet weather flow and plant interconnect issues being settled by Workshop # 11.

Agenda
Workshop #12 – Conveyance System Alternatives/
Recommended Flow Management Plan
October 11, 2006

Time	*Topic*	*Presenter*
12:30 pm	Public Works Building at 201 North Stone, Conference Room C (Basement)	
12:45 pm	Opening Session	
	• Welcoming Remarks	Mike Gritzuk
	• Review Agenda	Anne Smith
	• Workshop Goals	
1:00 pm	Summary of Key 2006 Facility Plan Issues	Steve Sticklen
1:10 pm	Peak Wet Weather Flow Analysis	Steve Sticklen
2:00 pm	Design Parameters	Steve Sticklen
	• Regulatory	
	• Peaking Factors	
	• Wet Weather Flow Allowance	
2:15 pm	Hydraulic Model Development / Calibration	Steve Sticklen
2:30 pm	Tucson Boulevard Capacity Test	Steve Sticklen
2:40 pm	Planned System Upgrades – Santa Cruz Central Interceptor	Steve Sticklen
2:50 pm	Break	
3:00 pm	Hydraulic Analysis – Existing Conditions	Steve Sticklen
3:20 pm	Hydraulic Analysis – 2030 Conditions	Steve Sticklen
3:40 pm	Plant Interconnect	Steve Sticklen
	• Routing Alternatives	
	• Transfer Alternatives	
4:30 pm	Evaluation Criteria/Cost Comparisons	Gordon Culp/Steve Sticklen
4:50 pm	Summary Wrap-Up	Anne Smith
	• Comments by Group	
	• Closing Remarks	Mike Gritzuk
5:00 pm	Adjourn	

Diurnal Flow



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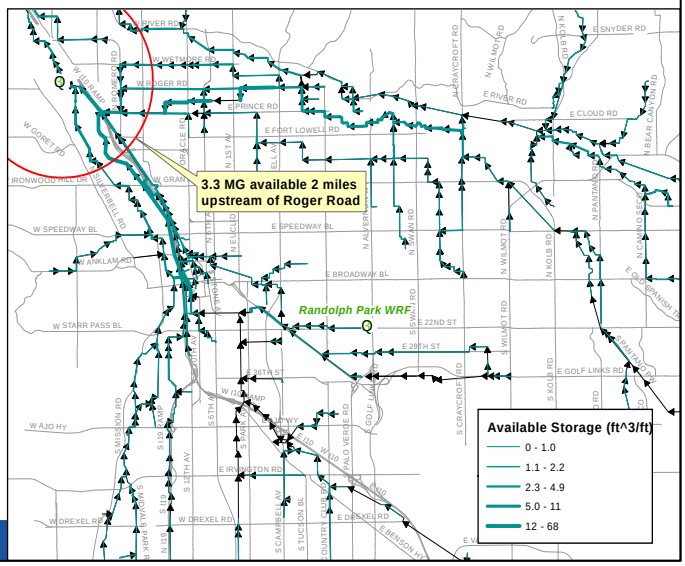
In-System Storage

- 3.3 MG available within 2 miles of Roger Road WWTP
- 2.9 MG available in new Santa Cruz Central
- Requires complex system of gates to utilize



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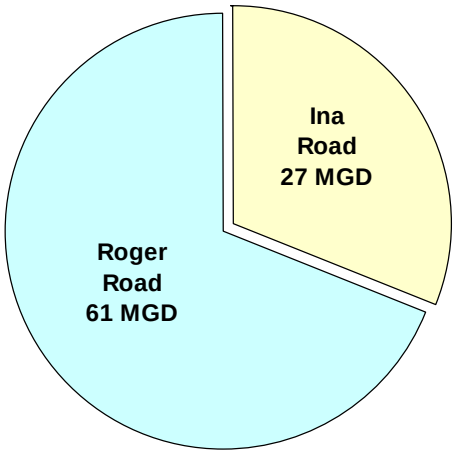
2030 Total Flows



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Pima County
Regional Optimization
Master Plan

Workshop #12
Plant Interconnect / Conveyance System

October 11, 2006

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Anne Smith	Facilitator
Steve Sticklen	Conveyance
Gordon Culp	Evaluation

2

Welcoming Remarks

Mike Gritzuk

Overview

Anne Smith

Agenda

- Key Issues
- Peak Wet Weather Flow Analysis
- Design Parameters
- Hydraulic Model Development / Calibration
- Tucson Blvd Capacity Test
- Planned System Upgrades
- Hydraulic Analysis – Existing Conditions
- Hydraulic Analysis – 2030 Conditions
- Plant Interconnect

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in "parking lot"

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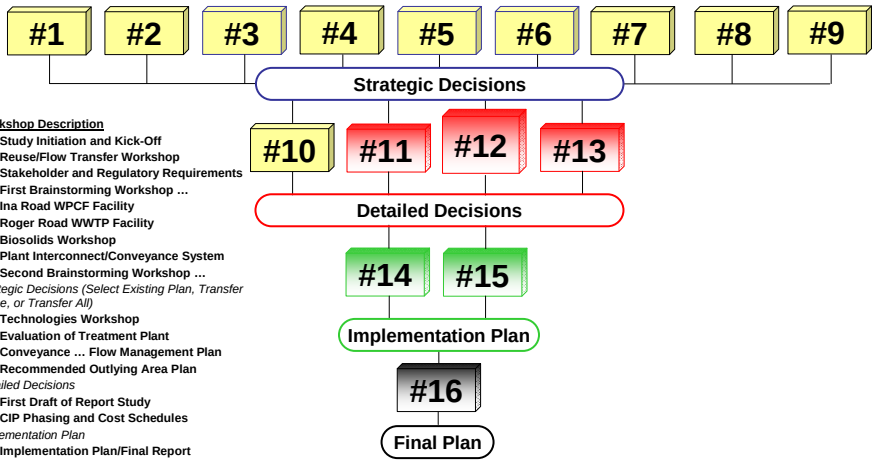
Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Previous Workshop Decisions

- Use Model-Lite" for analysis
- Conduct sensitivity on Peaking Factor
- Investigate four plant interconnect options
- Look for opportunities for in-system storage

11

Workshop Goals

- Agree on wet weather approach
- Present findings / recommendations
- Agree on interconnect route
- Discuss other considerations

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Summary of 2006 Facility Plan Issues

Steve Sticklen

2006 Facility Plan Summary

- Condition assessment
- Hydraulic evaluation
- Plant interconnect

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Condition Assessment Summary

- $4.5M to rehab manholes
- Siphons and pump stations
- $13.5M to rehab pipes in poor condition
- $162M to rehab pipes in fair condition

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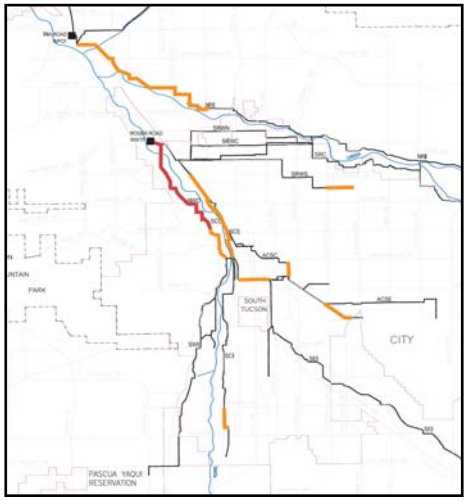
Existing Capacity Issues



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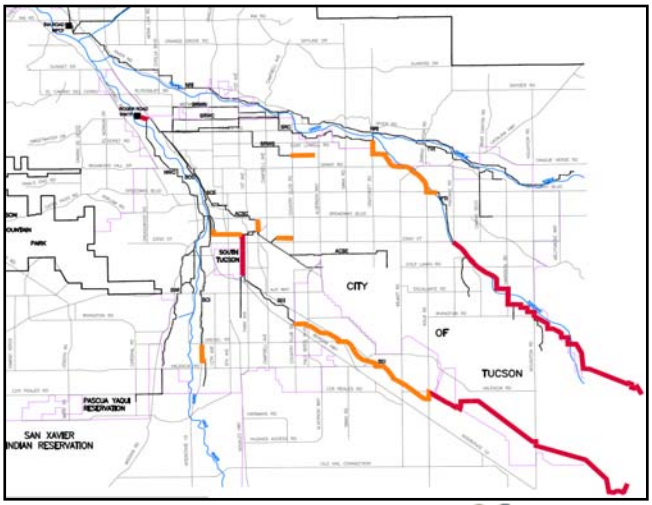
2030 Capacity Issues



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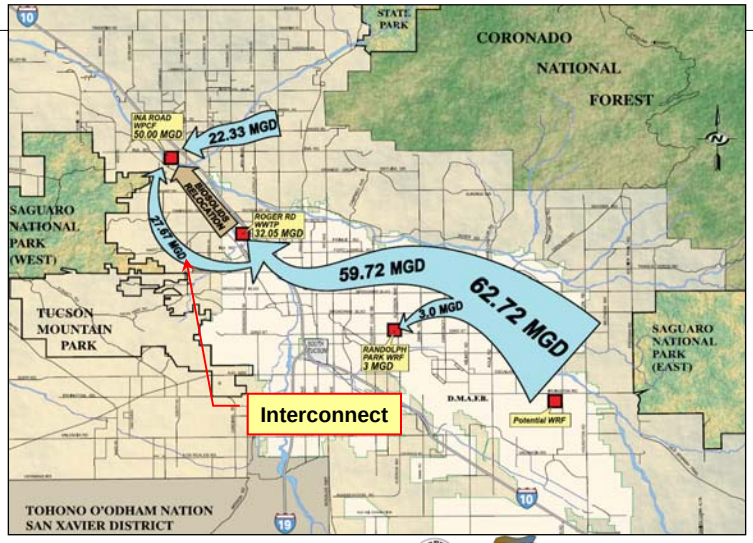
Plant Interconnect



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Wet Weather Flow Analysis

Steve Sticklen

Objectives

- Identify system elements impacted by wet weather
- Estimate peak flows and water levels to 10-year rainfall event
- Develop strategy for accounting for wet weather flows during hydraulic analyses

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Probabalistic Method

- 12 months flow data from 27 sites
- 15-minute average values
- Frequency distribution of peak daily flows and water levels
- Regression analysis
- 10-year flows and water levels

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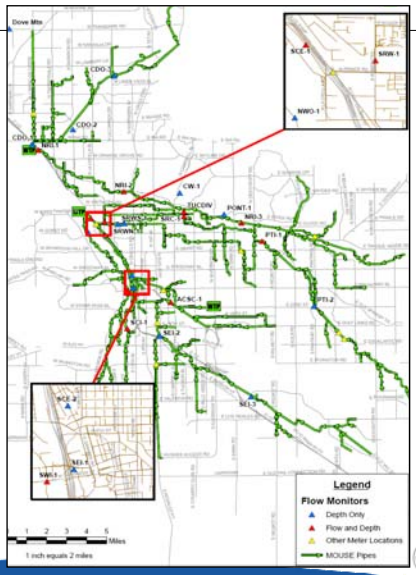
Flow Monitoring Sites



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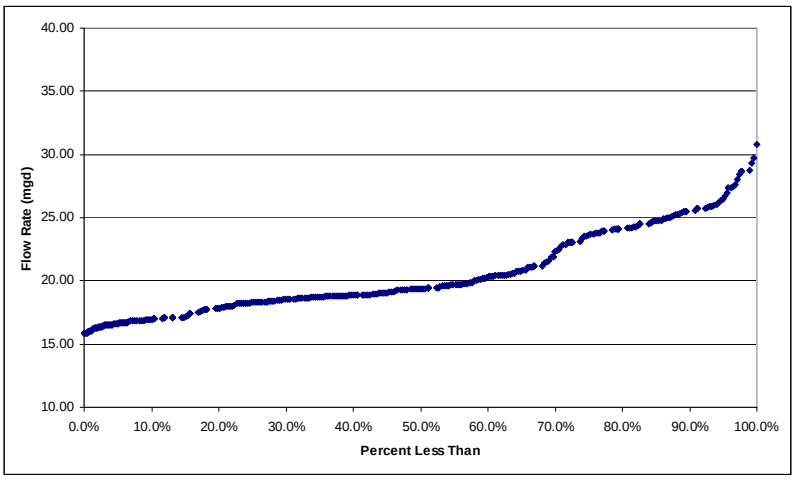
Flow Frequency Distribution



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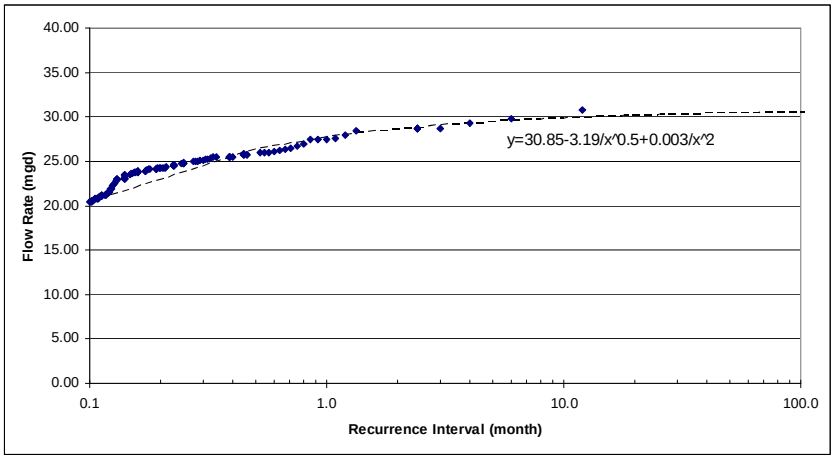
Regression Analysis



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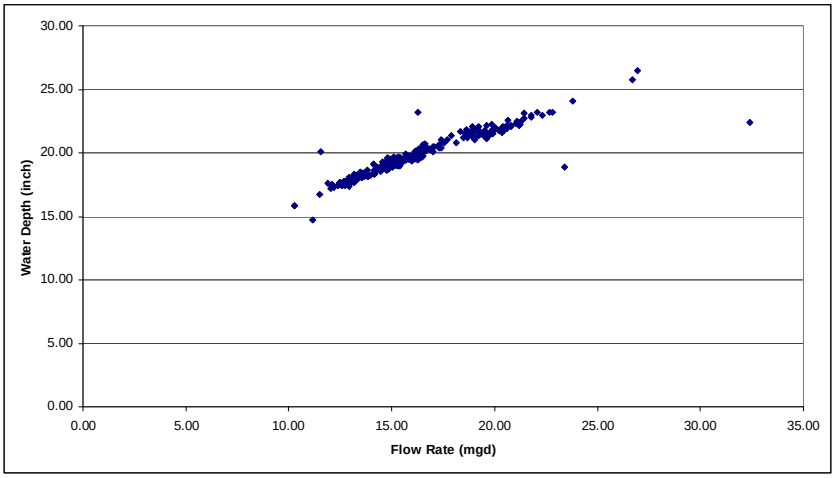
Depth vs. Flow



Summary of Results

Site	Flow Rate, mgd					Design Capacity(2), mgd	Wet Weather Flow(3)	PF(4)	Water Depth/Pipe Diameter					Pipe Diameter, inch
	Historical(1)				Calculated				Historical(1)				Calculated	
	10%	50%	90%	100%	10-year				10%	50%	90%	100%	10-year	
ACSC-1	2.69	3.56	4.60	8.77	10.19	19.2	6.63	4.00	0.22	0.26	0.29	0.42	0.51	42
AV-1	1.10	1.45	1.87	3.28	3.93	9.1	2.48	3.80	0.30	0.34	0.38	0.53	0.57	24
CDO-1	-	-	-	-	-	94.8	-	-	0.29	0.32	0.36	0.39	0.43	48
CDO-2	-	-	-	-	-	31.1	-	-	0.24	0.25	0.28	0.33	0.38	36
CDO-3	-	-	-	-	-	-	-	-	0.27	0.31	0.33	0.48	0.49	24
CW-1	-	-	-	-	-	-	-	-	0.19	0.20	0.21	0.31	0.25	12
Dove Mtn	-	-	-	-	-	-	-	-	0.16	0.17	0.20	0.21	0.22	15
GV-1	1.26	1.69	2.34	2.82	3.21	-	1.52	2.66	0.34	0.39	0.46	0.51	0.50	21
NRI-1	16.96	19.40	25.54	30.82	30.56	38.3	11.16	2.21	0.54	0.56	0.66	0.74	0.76	42
NRI-2	12.82	15.32	20.04	32.40	33.29	-	17.97	3.04	0.45	0.50	0.56	0.68	0.73	39
NRI-3	8.19	9.49	10.10	11.93	11.78	20.1	2.29	1.74	0.33	0.36	0.37	0.41	0.46	33
NWO-1	-	-	-	-	-	28.7	-	-	0.48	0.52	0.55	0.60	0.63	48
PONT-1	-	-	-	-	-	16.18	-	-	0.27	0.31	0.33	0.44	0.35	12
PTI-1	9.37	10.57	11.66	14.44	12.87	29.8	2.30	1.71	0.36	0.38	0.40	0.44	0.46	36

(1) Based on data recorded from July 1, 2005 to June 30, 2006
(2) From previous study: 2006 Metropolitan Area Facility Plan Update. Included here for reference only
(3) Wet weather flow, estimated as the difference between the calculated 10-year flow and historical 50-percentile flow
(4) PF: Peaking factor, estimated as 1.4 x (calculated 10-year flow/ historical 50-percentile flow)

Summary of Results *(continued)*

Site	Flow Rate, mgd					Design Capacity(2), mgd	Wet Weather Flow(3)	PF(4)	Water Depth/Pipe Diameter					Pipe Diameter, inch
	Historical(1)				Calculated				Historical(1)				Calculated	
	10%	50%	90%	100%	10-year				10%	50%	90%	100%	10-year	
PTI-2	-	-	-	-	-	13.5	-	-	0.35	0.38	0.41	0.45	0.48	30
SCE-1	25.23	28.33	34.05	44.32	49.52	148.1	21.19	2.45	0.28	0.30	0.31	0.37	0.36	78
SCE-2	-	-	-	-	-	7.8	-	-	0.30	0.38	0.42	0.62	0.58	30
SCI-1	4.19	4.51	4.97	8.34	7.29	12.1	2.78	2.26	0.38	0.40	0.42	0.62	0.57	30
SEI-1	-	-	-	-	-	92.8	-	-	0.36	0.37	0.38	0.46	0.47	60
SEI-2	-	-	-	-	-	-	-	-	0.30	0.31	0.33	0.98	0.52	36
SEI-3	-	-	-	-	-	21.4	-	-	0.33	0.36	0.39	0.57	0.53	30
SRC-1	14.93	16.17	18.03	26.26	28.53	11.8	12.36	2.47	0.35	0.37	0.38	0.45	0.48	54
SRW-1	2.22	2.42	2.69	3.90	4.23	7.8	1.81	2.45	0.30	0.32	0.33	0.51	0.51	30
SRWN-1	-	-	-	-	-	127.9	-	-	0.20	0.24	0.25	0.28	0.28	66
SRWS-1	-	-	-	-	-	9.7	-	-	0.48	0.50	0.53	0.71	0.77	27
SWI-1	5.48	6.39	7.10	9.46	8.52	43.9	2.13	1.87	0.28	0.31	0.33	0.89	0.35	33
TUCDIV	1.37	3.13	7.61	11.98	14.92	30.2	11.79	6.67	0.20	0.30	0.40	0.96	0.70	33

(1)Based on data recorded from July 1, 2005 to June 30, 2006
(2)From previous study: 2006 Metropolitan Area Facility Plan Update. Included here for reference only
(3)Wet weather flow, estimated as the difference between the calculated 10-year flow and historical 50-percentile flow
(4)PF: Peaking factor, estimated as 1.4 x (calculated 10-year flow/ historical 50-percentile flow)

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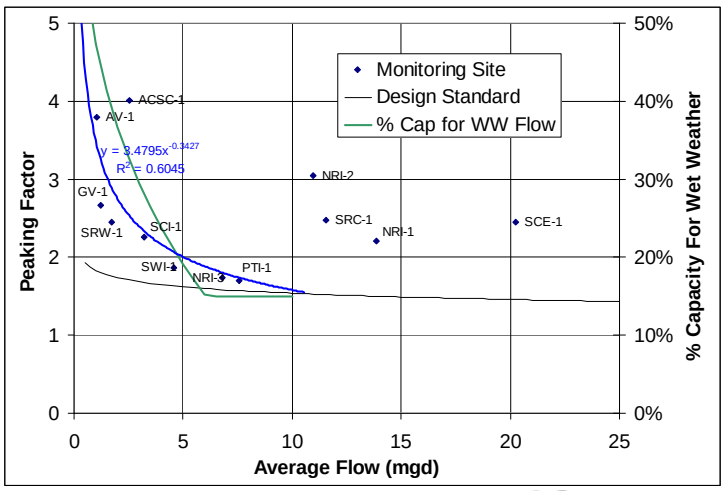
Modified Peaking Factor



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Per Acre Wet Weather Flows

Meter Site	Service Area (acres)	10-Year Wet Weather Flow (MGD)	GPD/acre
NRI-1	110,190	11.16	101
NRI-2	101,249	17.97	177
SRC-1	41,880	12.36	295
Weighted Average			**164**

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Summary and Conclusions

- Flows increase during wet weather
- System has adequate excess capacity to accommodate 10-year flows
- Probabilistic method does not correlate rainfall and flow
- Only predicts flow rates, <u>not</u> volumes
- Recommend comprehensive wet weather study including hydrologic modeling

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Design Standards

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Regulatory Standards – CMOM

- 2008 – Standardized Rule
- Convey peak dry and wet weather flows
- Convey 10-year-24-hour event
- Upgrade deficient system elements within 10 years
- Prevent SSOs
- Capital Improvement Plan

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Regulatory Standards - Other

- Max Dry Weather d/D = 0.75
- Appropriate peaking factor
- Wet weather allowance based on:
  - Percentage of peak dry weather flow
  - Gallons per acre
- Minimum depth of cover = 3 feet
- V_d = 2 – 10 feet/second

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Standard Peaking Factor

Upstream Population	Dry Weather Peaking Factor
1,001 – 10,000	$PF = (6.330 * p^{-0.231}) + 1.094$
10,001 – 100,000	$PF = (6.177 * p^{-0.233}) + 1.128$
More than 100,000	$PF = (4.500 * p^{-0.174}) + 0.945$

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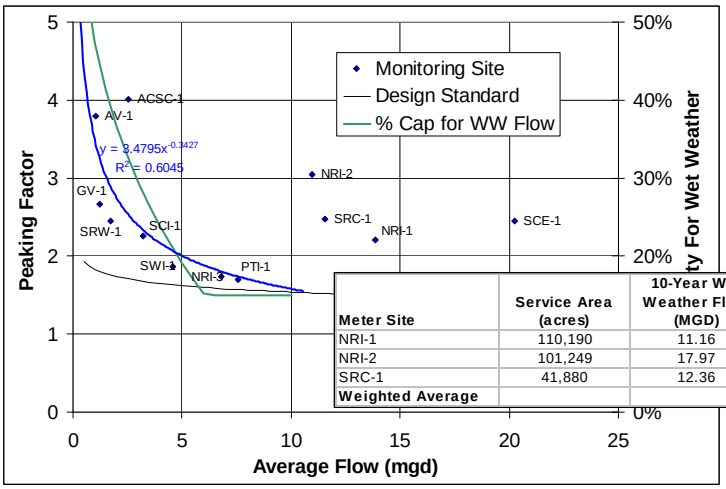
Wet Weather Allowance



Meter Site	Service Area (acres)	10-Year Wet Weather Flow (MGD)	GPD/acre
NRI-1	110,190	11.16	101
NRI-2	101,249	17.97	177
SRC-1	41,880	12.36	295
Weighted Average			**164**

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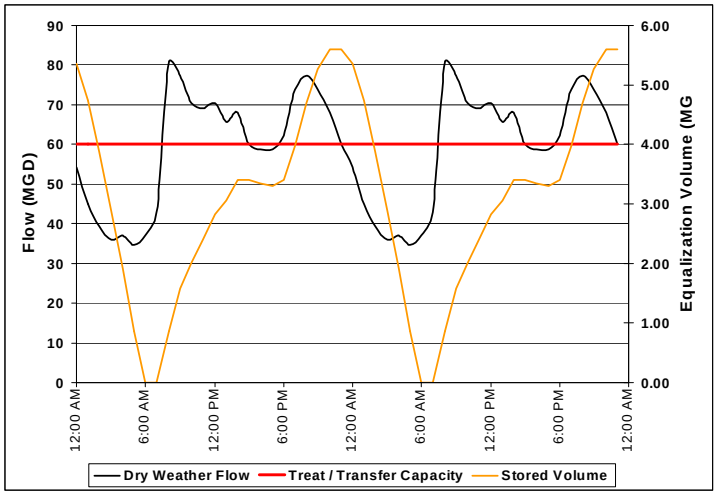
Diurnal Flow



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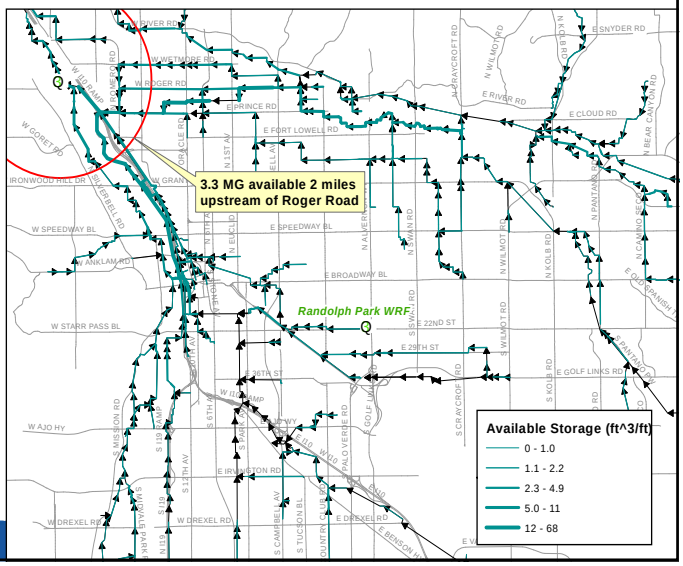
In-System Storage

- 3.3 MG available within 2 miles of Roger Road WWTP
- 2.9 MG available in new Santa Cruz Central
- Requires complex system of gates to utilize



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Pima County Wastewater Management Department

GREELEY AND HANSEN

Hydraulic Model

Steve Sticklen

MOUSE Hydraulic Model

- Pipes ≥ 15 inches
- Diversion Structures
  - Craycroft
  - Tucson Boulevard
  - Aviation Corridor
  - Alameda Siphon
  - 18th & Vine
  - 18th & I-10

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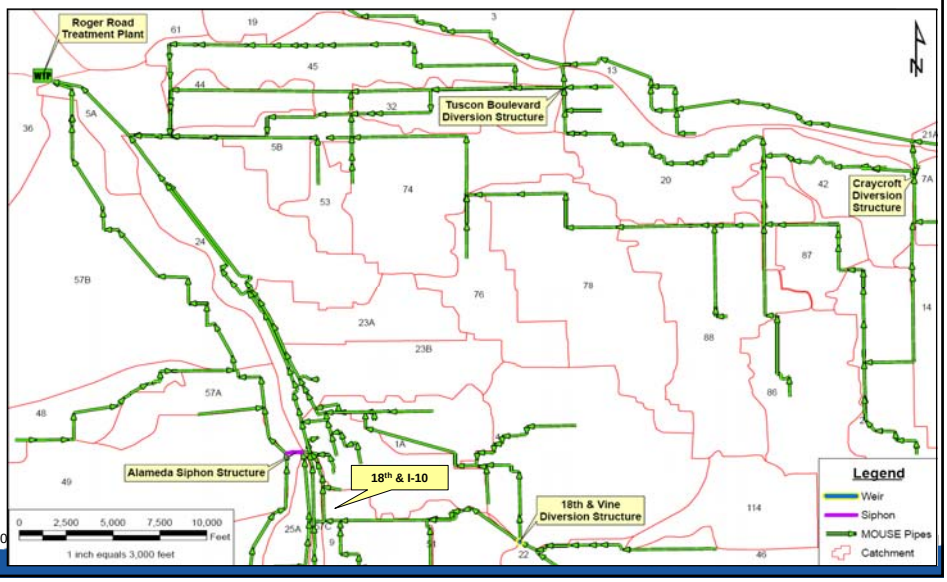
Diversion Structure Locations



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Model Capabilities

- Open channel flow
- Pressurized / surcharged flow
- Backwater conditions
- Diversion structures (gates / weirs)
- Pump stations

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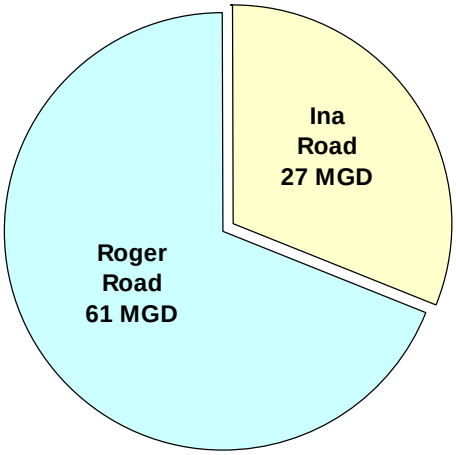
2030 Total Flows



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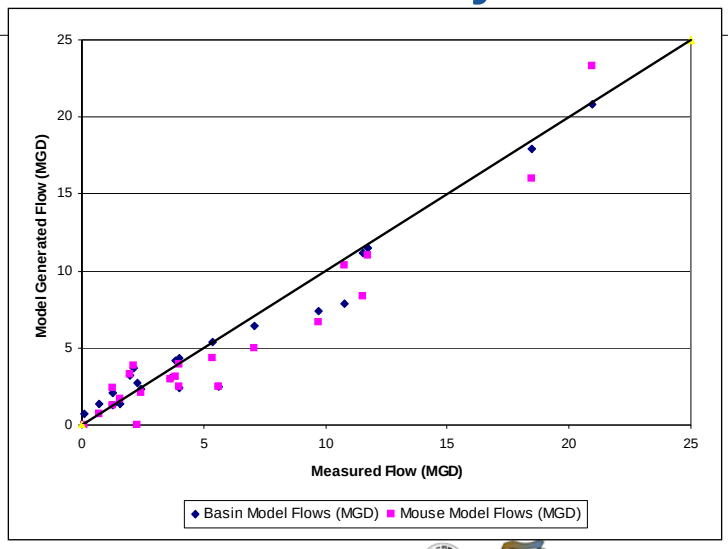
Calibration Summary



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Tucson Blvd Capacity Test

- July 28, 2005
- Diverted <u>all</u> flow to NRI
- Diverted flow rate = 12 MGD
- Flow data confirmed diversion rate
- Simulated same conditions

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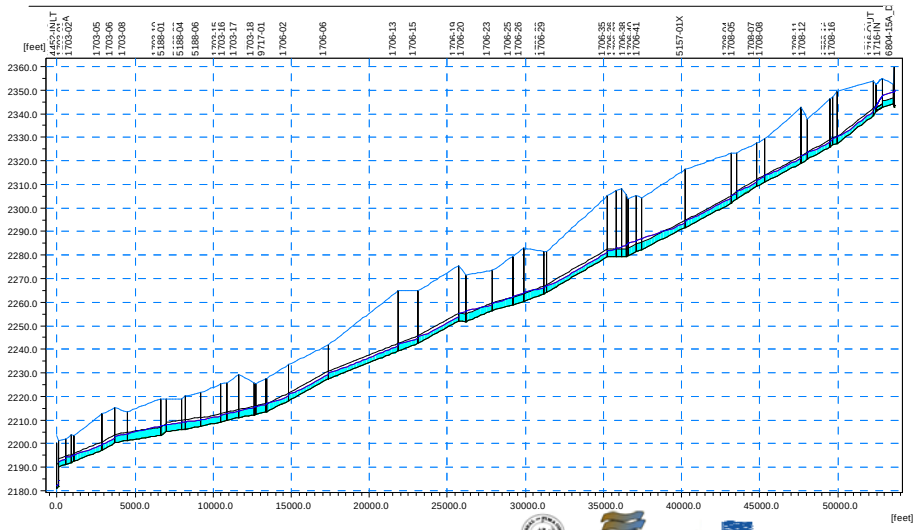
NRI Profile – Tucson Blvd Test



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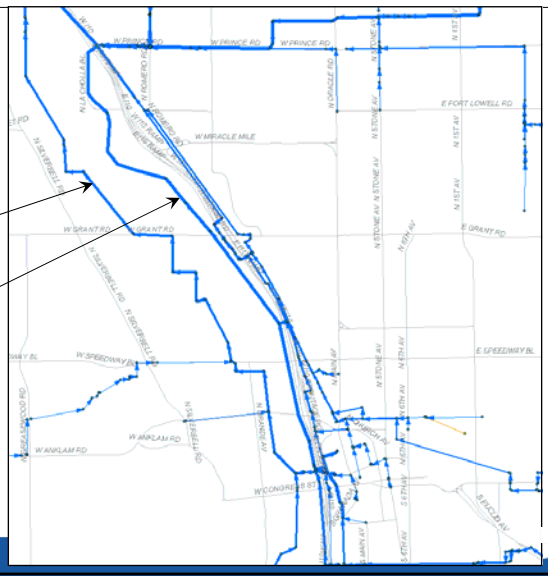
Planned Upgrade – Santa Cruz



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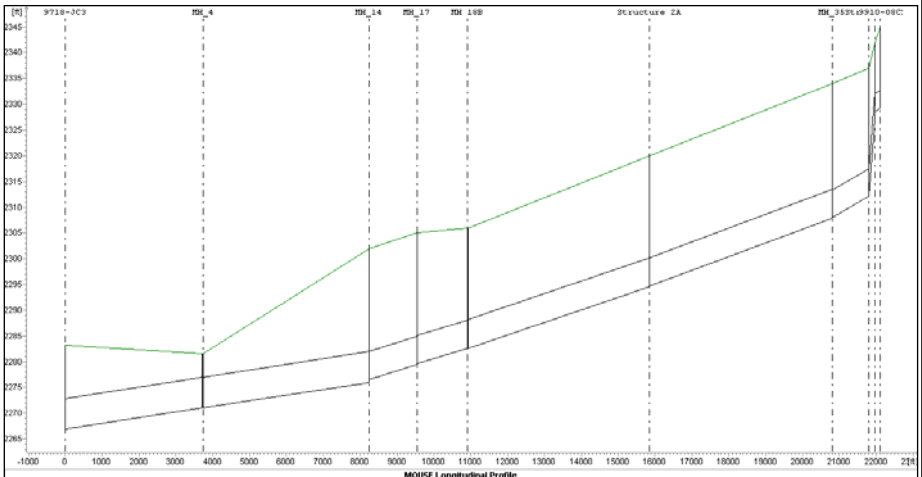
New Santa Cruz Profile



Link ID	Link_15	Link_5	Link_3	Link_13	Link_12	Link_11	Link_10
Link Diameter	6.0000		5.5000				5.3330
Shaft ID	9718-JC3	MH_4	MH_14	MH_17	MH 18B	Structure 2A	MH_35	36A
Shaft Diameter	4.0000						
Ground Level	2283.20	2281.50	2302.00	2305.00	2306.00	2320.00	2334.00
Invert Level	2266.40	2271.02	2275.99	2279.50	2282.54	2294.62	2307.92

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Hydraulic Analysis – Existing Conditions

- Flow data and model indicate no system surcharging
- NWO has adequate capacity
  - Measured median peak d/D = 0.52
  - Modeled peak d/D = 0.56 (8% diff.)
  - Peak 10-year d/D = 0.63
- Portions of NRI near capacity
- Portions of SCC near capacity

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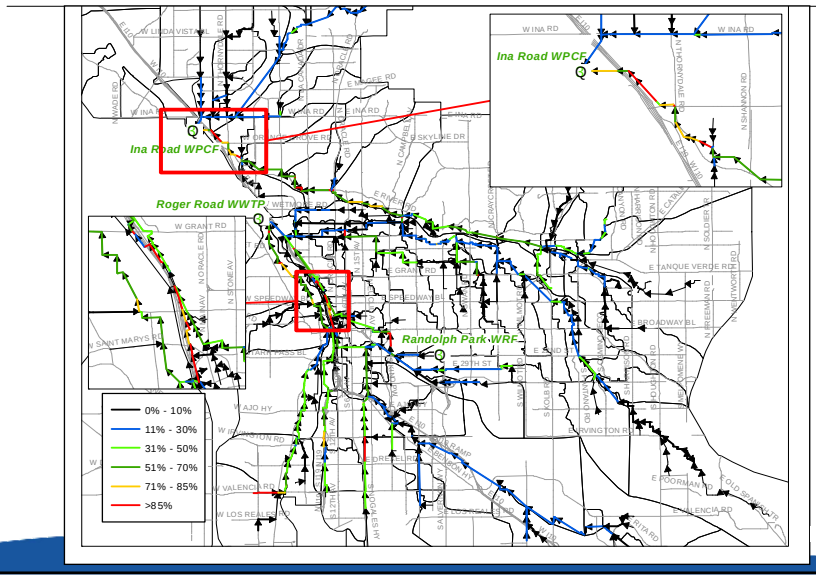
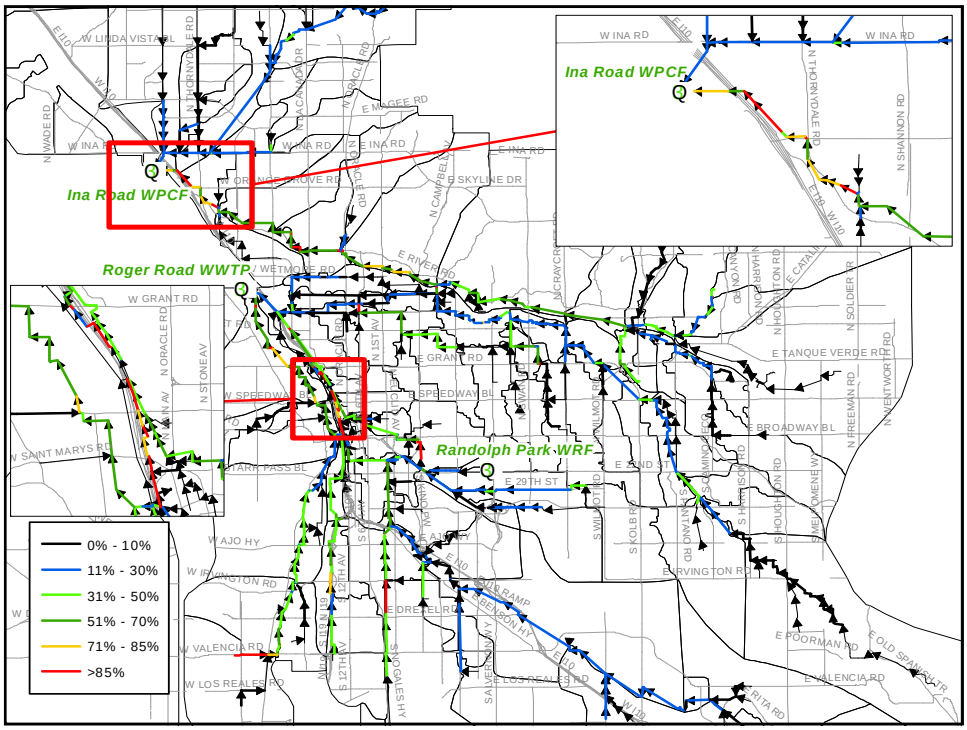
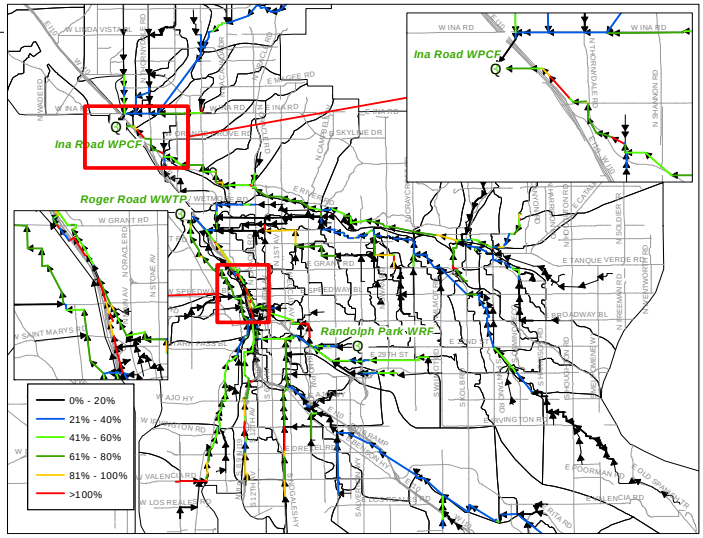
Existing Hydraulic Deficiencies





Wet Weather Flow Allowance



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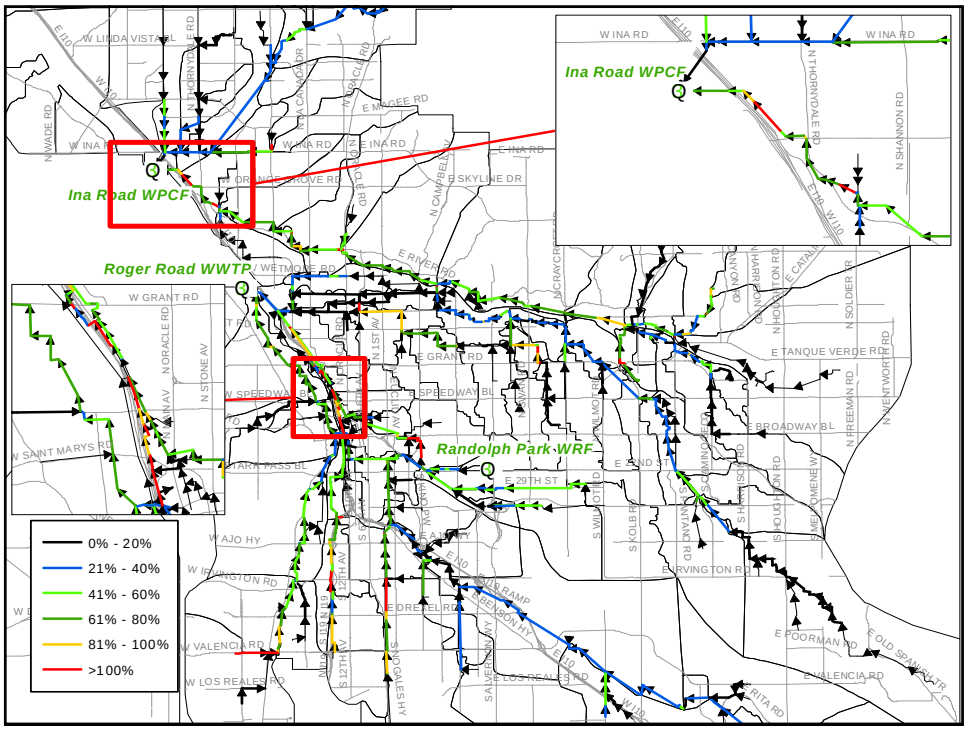
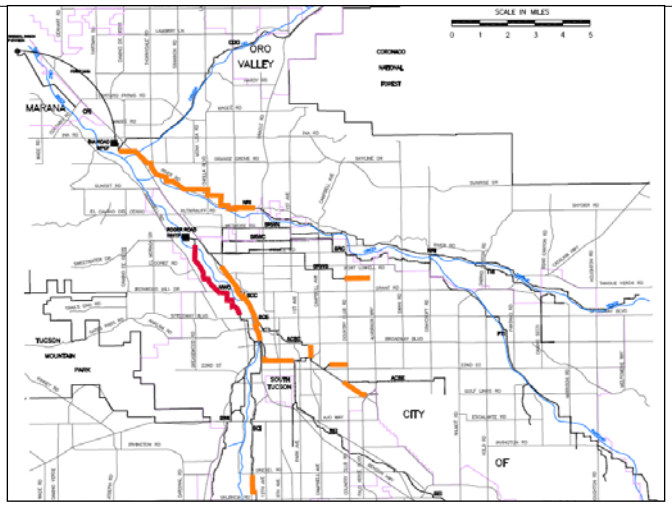


2005 Capacity Issues - Facility Plan



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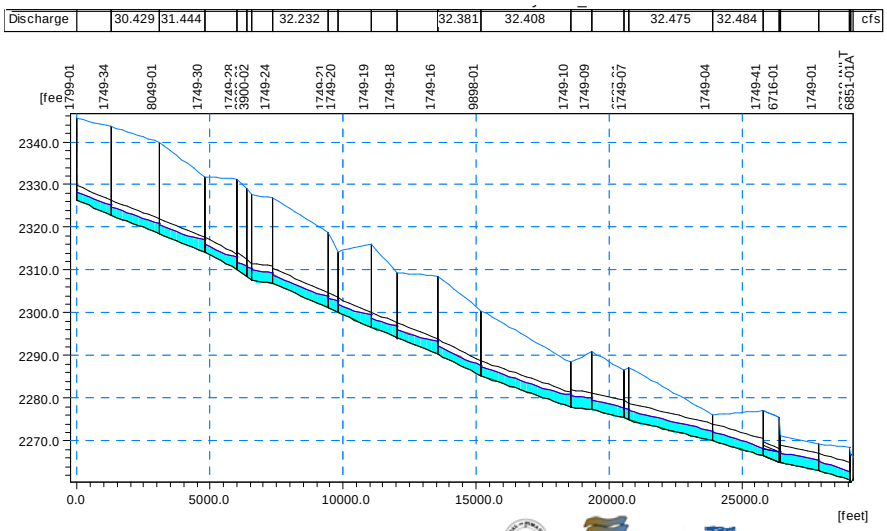
NWO Profile



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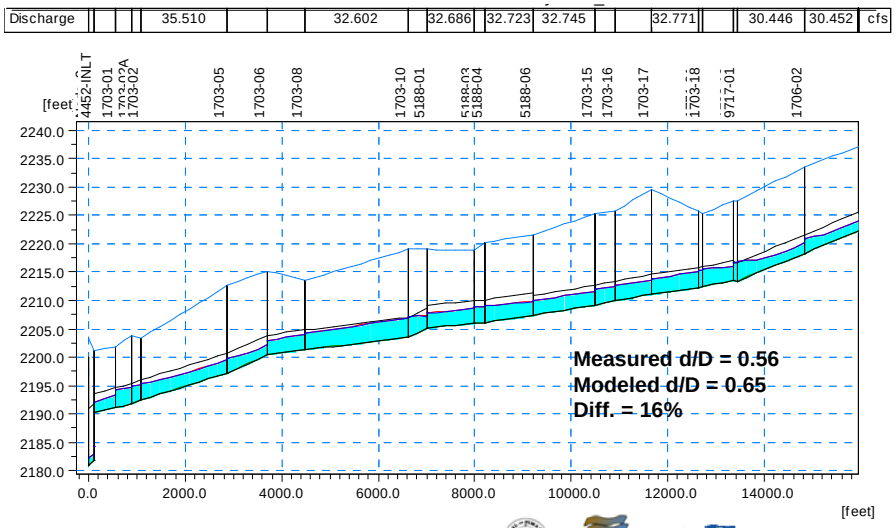
NRI Profile



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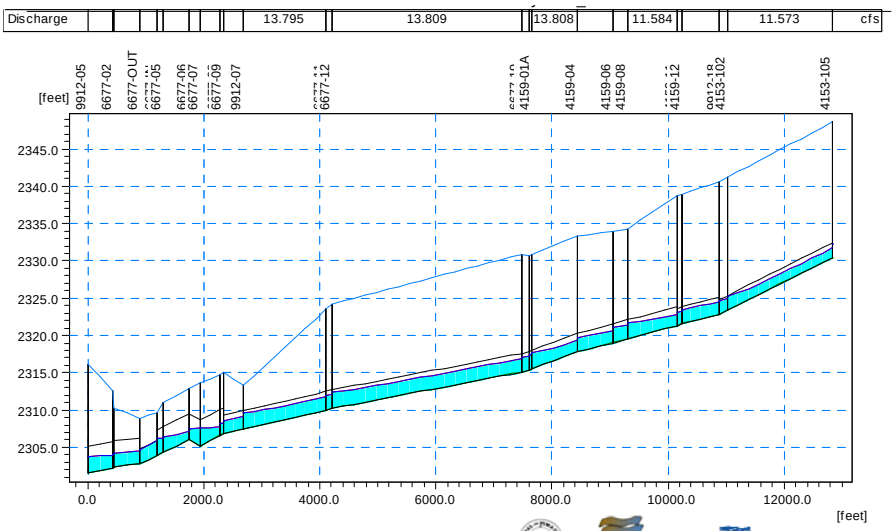
SCC Profile



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2030 Hydraulic Analysis

- All septic customers served
- 85 GPCD used for all sewersheds
- Randolph Park assumed to be offline

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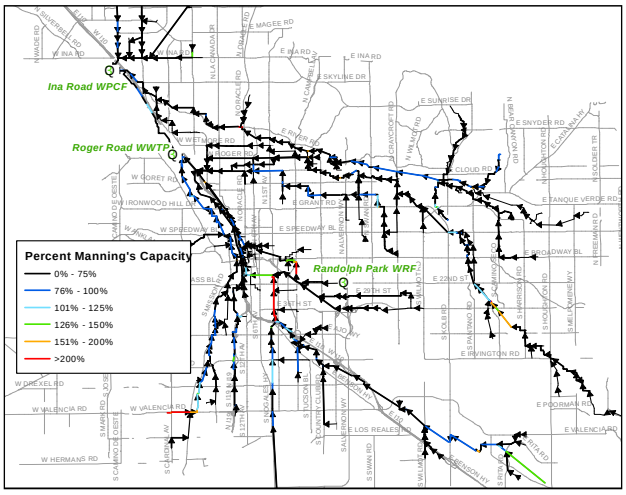
2030 Hydraulic Analysis



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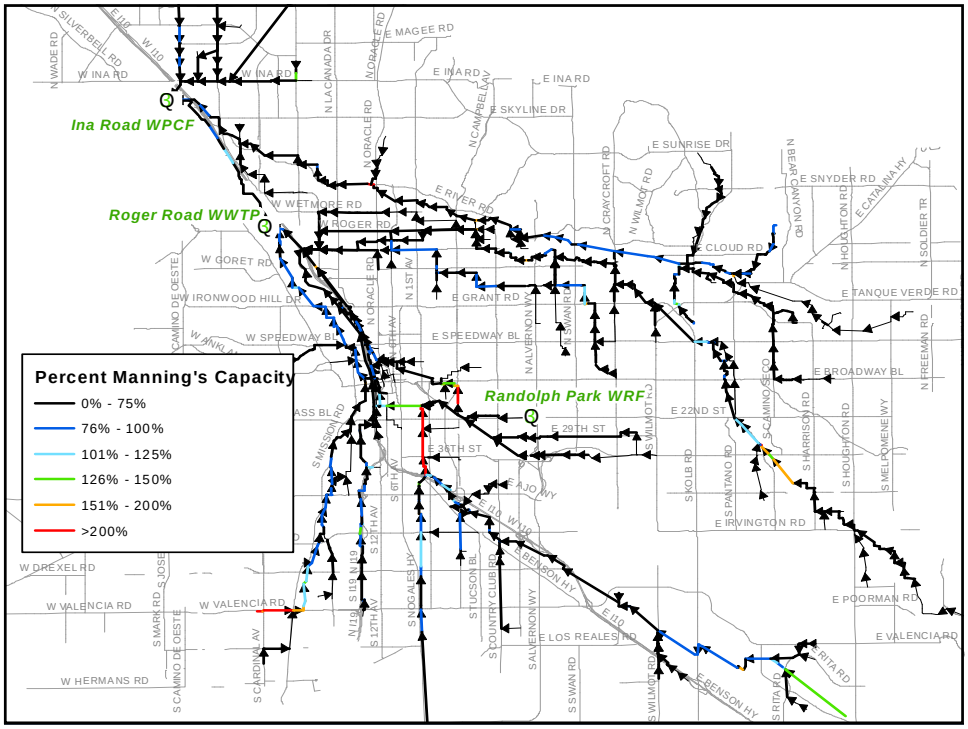
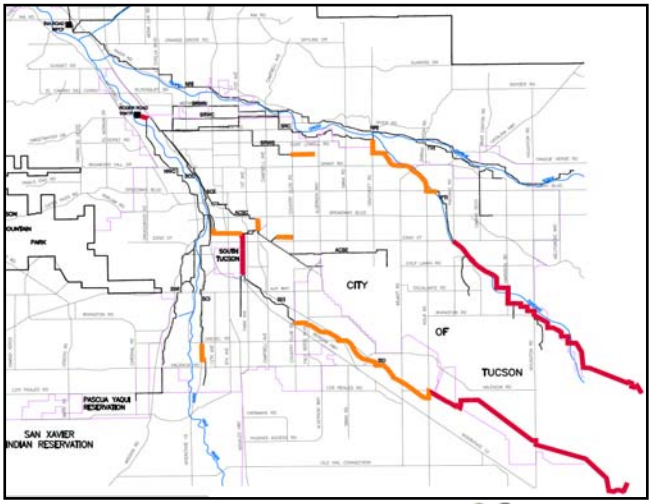
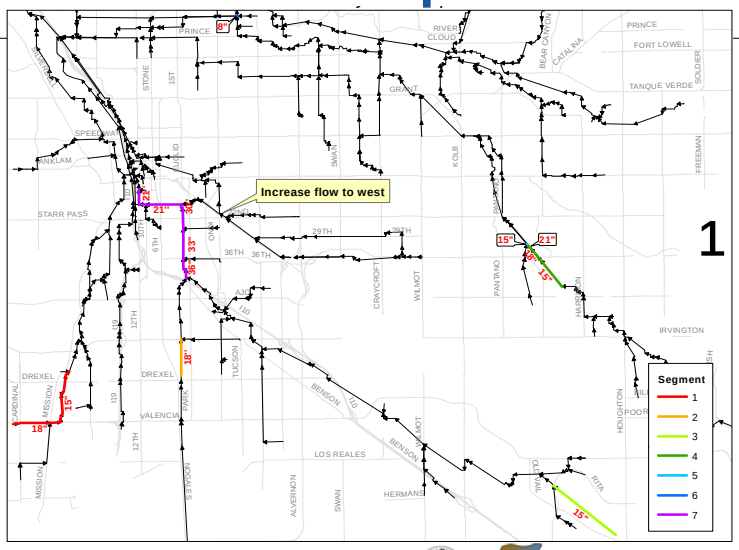


2030 Capacity Issues - Facility Plan



Recommended Improvements



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Estimated Construction Costs

Segment	Item	Qty	Units	Unit Cost	Cost	Type
1	New Parallel Pipe (18" diameter)	4,828	FT	$127.08	$613,571	Open Area
	New Parallel Pipe (15" diameter)	705	FT	$268.95	$189,610	Congested Road
	New Parallel Pipe (15" diameter)	2,150	FT	$0.00	$0	Congested
	New Parallel Pipe (15" diameter)	5,636	FT	$0.00	$0	Open Area
	Segment 1 Subtotal				*$189,610*	
2	New Parallel Pipe (18" diameter)	4,712	FT	$127.08	$598,748	Open Area
	Segment 2 Subtotal				*$598,748*	
3	New Parallel Pipe (15" diameter)	10,327	FT	$105.90	$1,093,638	Open Area
	New Parallel Pipe (15" diameter)	110	FT	$105.90	$11,689	Open Area
	Segment 3 Subtotal				*$1,105,327*	
4	New Parallel Pipe (15" diameter)	83	FT	$105.90	$8,818	Open Area
	New Parallel Pipe (15" diameter)	4,373	FT	$105.90	$463,098	Open Area
	New Parallel Pipe (15" diameter)	606	FT	$105.90	$64,169	Open Area
	New Parallel Pipe (15" diameter)	223	FT	$105.90	$23,591	Open Area
	New Parallel Pipe (18" diameter)	1,183	FT	$127.08	$150,347	Open Area
	New Parallel Pipe (21" diameter)	258	FT	$148.26	$38,309	Open Area
	New Parallel Pipe (21" diameter)	203	FT	$148.26	$30,062	Open Area
	New Parallel Pipe (21" diameter)	53	FT	$148.26	$7,801	Open Area
	Segment 4 Subtotal				*$250,111*	
5	New Parallel Pipe (15" diameter)	76	FT	$229.20	$17,426	Semi-Congested Road
	Segment 5 Subtotal				*$17,426*	
6	New Parallel Pipe (8" diameter)	100	FT	$56.48	$5,647	Open Area
	Segment 6 Subtotal				*$5,647*	
7	New Parallel Pipe (36" diameter)	1,153	FT	$254.16	$293,025	Open Area
	New Parallel Pipe (36" diameter)	295	FT	$254.16	$75,060	Open Area
	New Parallel Pipe (33" diameter)	1,415	FT	$504.24	$713,468	Semi-Congested Road
	New Parallel Pipe (33" diameter)	3,875	FT	$504.24	$1,953,684	Semi-Congested Road
	New Parallel Pipe (33" diameter)	2,783	FT	$504.24	$1,403,515	Semi-Congested Road
	New Parallel Pipe (33" diameter)	151	FT	$504.24	$75,936	Semi-Congested Road
	New Parallel Pipe (30" diameter)	420	FT	$458.40	$192,677	Semi-Congested Road
	New Parallel Pipe (21" diameter)	4,597	FT	$320.88	$1,474,931	Semi-Congested Road
	New Parallel Pipe (21" diameter)	1,906	FT	$148.68	$283,421	Open Area
	Segment 7 Subtotal				*$6,097,632*	
	Fully Open Gate at Manhole 9910-21 Diversion	1	EA	$0.00	$0	
	Grand Total				***$8,264,500***	

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Estimated Construction Costs

Segment	Item	Qty	Units	Unit Cost	Cost	Type
1	New Parallel Pipe (18" diameter)	4,828	FT	$127.08	$613,571	Open Area
	New Parallel Pipe (15" diameter)	705	FT	$268.95	$189,610	Congested Road
	New Parallel Pipe (15" diameter)	2,150	FT	$0.00	$0	Congested
	New Parallel Pipe (15" diameter)	5,636	FT	$0.00	$0	Open Area
	Segment 1 Subtotal				*$803,180*	
2	New Parallel Pipe (18" diameter)	4,712	FT	$127.08	$598,748	Open Area
	Segment 2 Subtotal				*$598,748*	
3	New Parallel Pipe (15" diameter)	10,327	FT	$105.90	$1,093,638	Open Area
	New Parallel Pipe (15" diameter)	110	FT	$105.90	$11,689	Open Area
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	New Parallel Pipe (21" diameter)	258	FT	$148.26	$38,309	Open Area
	New Parallel Pipe (21" diameter)	203	FT	$148.26	$30,062	Open Area
	New Parallel Pipe (21" diameter)	53	FT	$148.26	$7,801	Open Area
	Segment 4 Subtotal				*$786,196*	
5	New Parallel Pipe (15" diameter)	76	FT	$229.20	$17,426	Semi-Congested Road
	Segment 5 Subtotal				*$17,426*	
6	New Parallel Pipe (8" diameter)	100	FT	$56.48	$5,647	Open Area
	Segment 6 Subtotal				*$5,647*	
7	New Parallel Pipe (36" diameter)	1,153	FT	$254.16	$293,025	Open Area
	New Parallel Pipe (36" diameter)	295	FT	$254.16	$75,060	Open Area
	New Parallel Pipe (33" diameter)	1,415	FT	$504.24	$713,468	Semi-Congested Road
	New Parallel Pipe (33" diameter)	3,875	FT	$504.24	$1,953,684	Semi-Congested Road
	New Parallel Pipe (33" diameter)	2,783	FT	$504.24	$1,403,515	Semi-Congested Road
	New Parallel Pipe (33" diameter)	151	FT	$504.24	$75,936	Semi-Congested Road
	New Parallel Pipe (30" diameter)	420	FT	$458.40	$192,677	Semi-Congested Road
	New Parallel Pipe (21" diameter)	4,597	FT	$320.88	$1,474,931	Semi-Congested Road
	New Parallel Pipe (21" diameter)	1,906	FT	$148.68	$283,421	Open Area
	Segment 7 Subtotal				*$6,465,718*	
	Fully Open Gate at Manhole 9910-21 Diversion	1	EA	$0.00	$0	
	Grand Total				***$9,782,242***	

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GREELEY AND HANSEN

Pima County Wastewater Management Department

GREELEY AND HANSEN

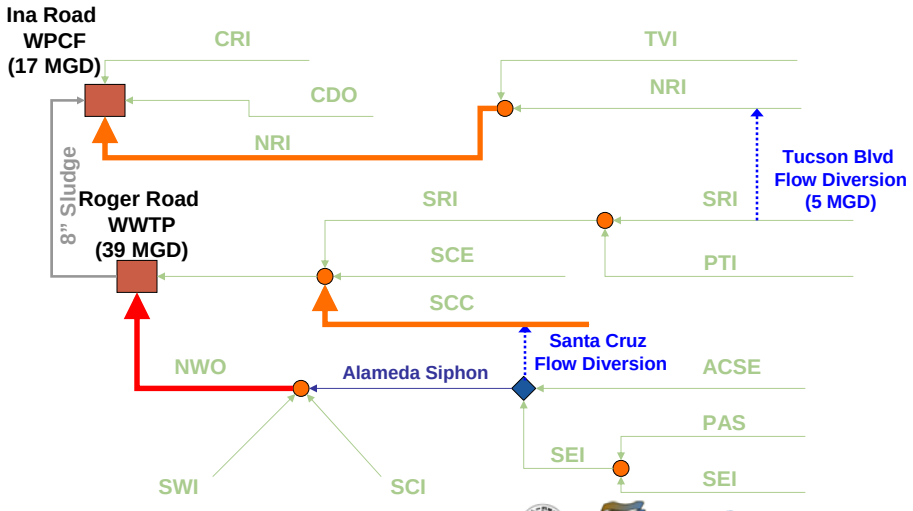
Plant Interconnect

Steve Sticklen

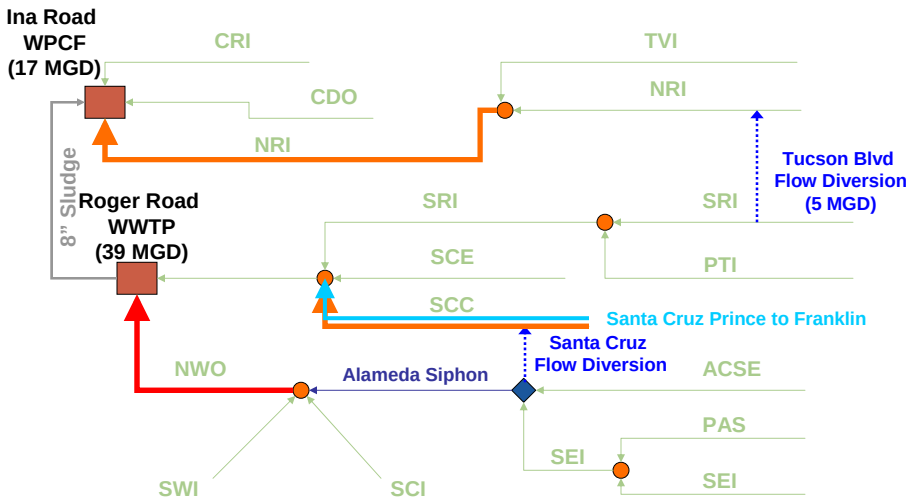
Plant Interconnect

- Current Transfer Options
  - Tucson Blvd and Craycroft Road
  - 8-inch sludge line
- Future Transfer Options
  - Existing Plan
  - Transfer Some
  - Transfer All

Mass Balance Schematic
(Existing System Configuration and Flows)



Mass Balance Schematic
(New Santa Cruz Interceptor)



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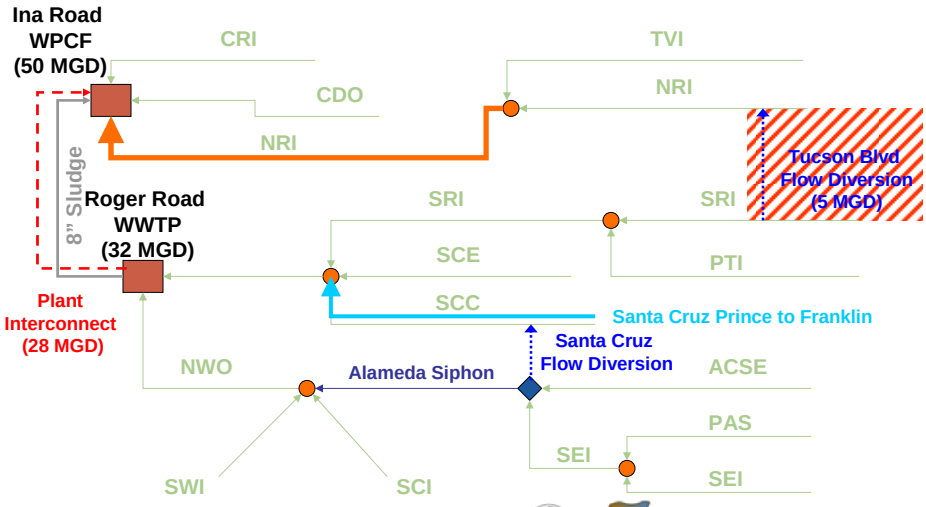
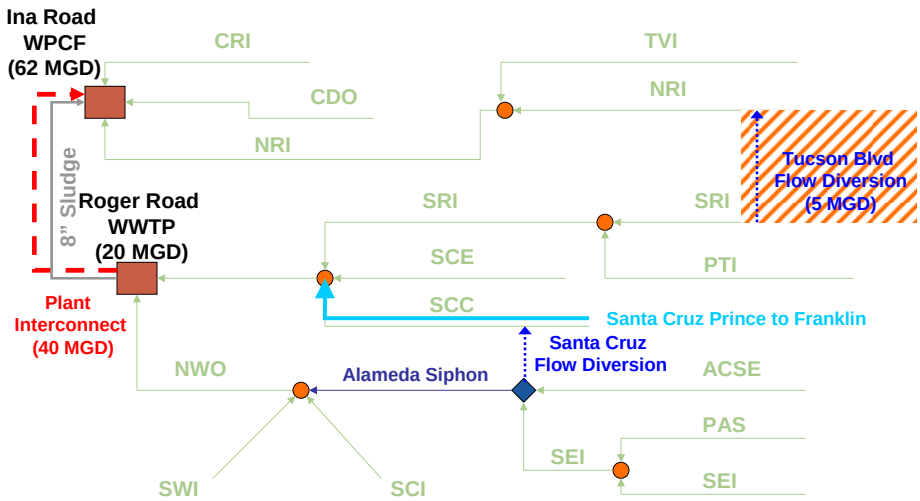
Mass Balance Schematic
(Existing Plan, 2030 Flows)



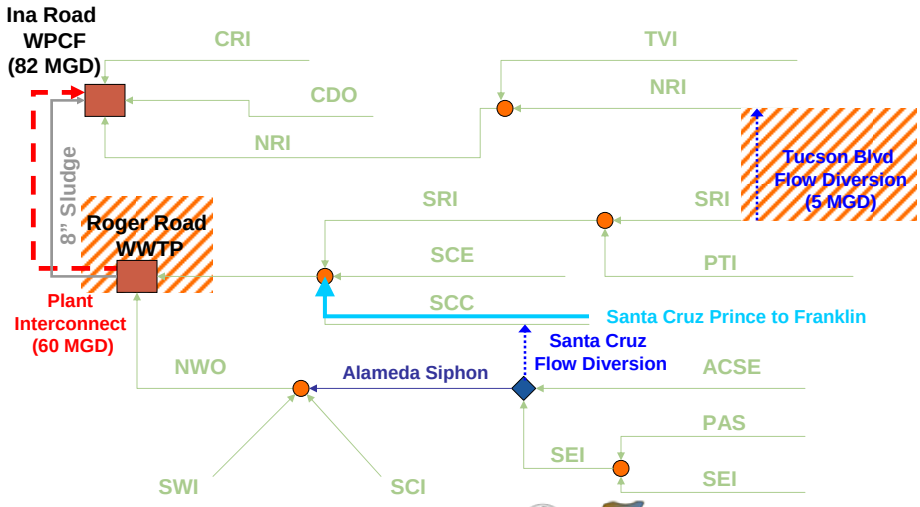
68

Mass Balance Schematic
(Transfer Some)



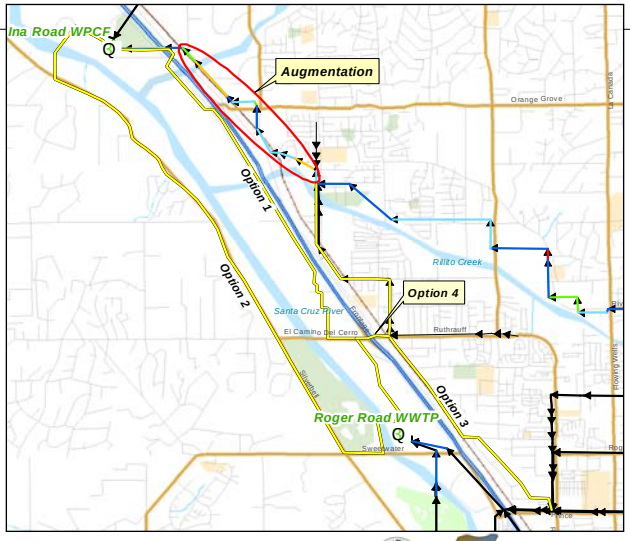
69

Mass Balance Schematic
(Transfer All)



70

Routing Alternatives



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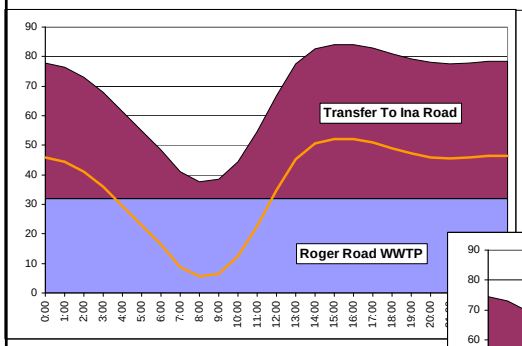
Summary of Interconnect Options

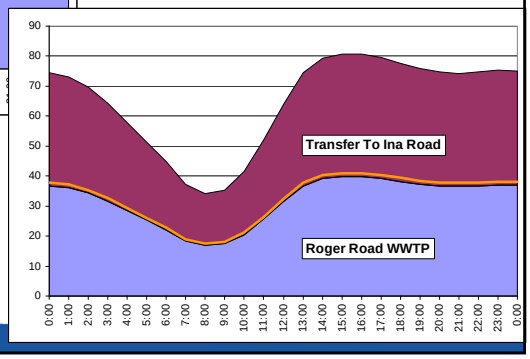
Option	Roger Road (MGD)	Transfer (MGD)	Ina Road (MGD)
Existing	32	28	50
Transfer Some	20	40	62
Transfer All	0	60	82

Does not consider diurnal variability or wet weather flows

72

Transfer Options (Dry Weather)





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Transfer Options – "Existing" Plan

	Q_{avg} (MGD)	Q_{min} (MGD)	Q_{max} (MGD)	$Q_{WetWeather}$ (MGD)	Q_{Peak} (MGD)
Roger Road	32	32	32	29	61
Transfer To Ina Road	28	3	50	0	50
Total	60	35	82	29	111

	Q_{avg} (MGD)	Q_{min} (MGD)	Q_{max} (MGD)	$Q_{WetWeather}$ (MGD)	Q_{Peak} (MGD)
Roger Road	32	17.5	41	23	64
Transfer To Ina Road	28	17.5	41	6	47
Total	60	35	82	29	111

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Transfer Options – "Existing" Plan

Steady State

	Q_{avg} (MGD)	Q_{min} (MGD)	Q_{max} (MGD)	$Q_{WetWeather}$ (MGD)	Q_{Peak} (MGD)
Roger Road	32	32	32	32	64
Transfer To Ina Road	28	3	50	22	72
Total	60	35	82	54	136

Diurnal Flow

	Q_{avg} (MGD)	Q_{min} (MGD)	Q_{max} (MGD)	$Q_{WetWeather}$ (MGD)	Q_{Peak} (MGD)
Roger Road	32	17.5	41	23	64
Transfer To Ina Road	28	17.5	41	31	72
Total	60	35	82	54	136

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Interconnect Options

	Route	Pipe Size	Cost (millions)	Not Included
Existing Plan	Route 1	54" - 72"	$15.60	R.O.W. acquistion Return pumping of 5 MGD
	Route 4	54" - 60"	$21.20	Return pumping of 5 MGD
Transfer Some	Route 1	48" - 66"	$15.30	R.O.W. acquistion Return pumping of 17 MGD
	Route 4	?	$20.80	Return pumping of 17 MGD
Transfer All	Route 1	66" - 96"	$21.30	R.O.W. acquistion Return pumping of 37 MGD
	Route 4	72" - 84"	$29.60	Return pumping of 37 MGD

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Interconnect Options

	Route	Pipe Size	Cost (millions)	Not Included
Existing Plan	Route 1	60" - 84"	$22.30	R.O.W. acquistion
	Route 2	T.B.D.		
	Route 3	Eliminated		
	Route 4	66" - 72"	$29.50	Return pumping of 5 MGD

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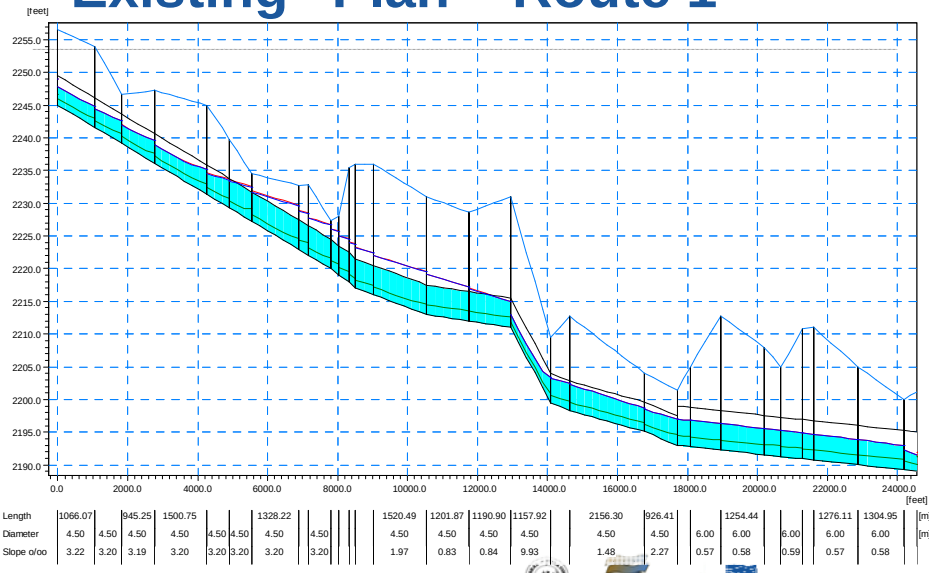
"Existing" Plan – Route 1



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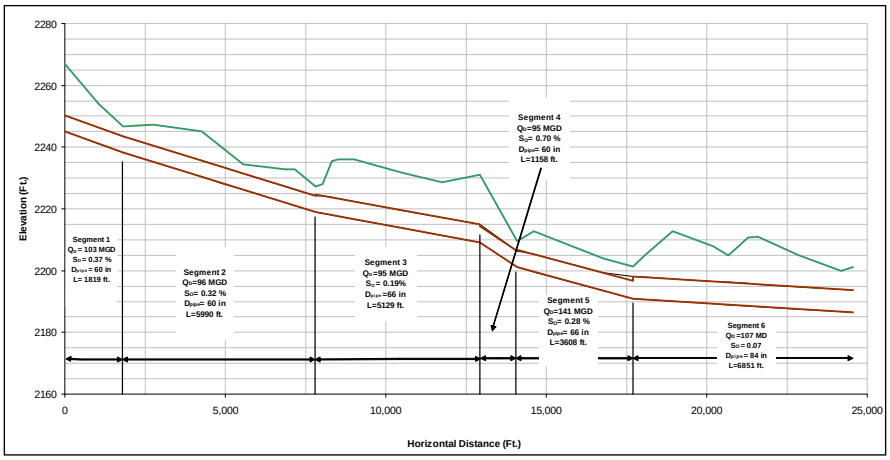
“Existing” Plan – Route 1



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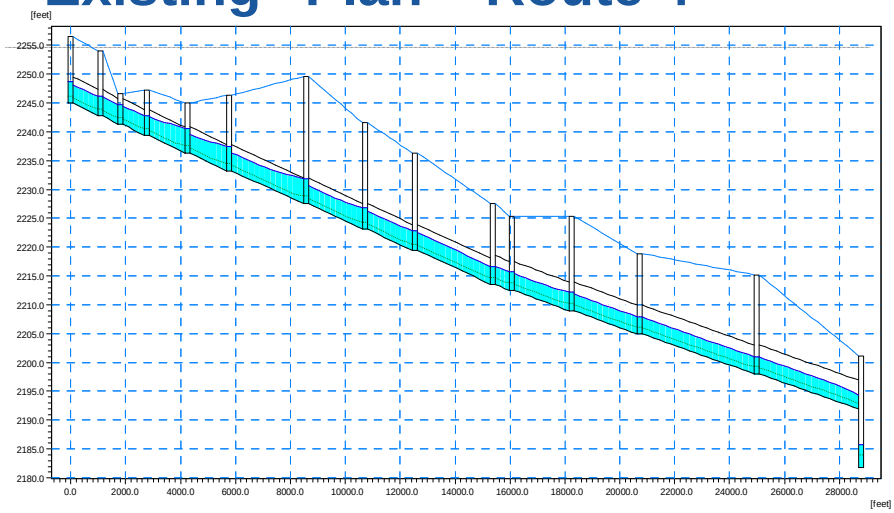
“Existing” Plan – Route 4



Length			1500.75	1496.00	2798.00	2153.00	1822.00	2847.00	2182.00	2473.00	4275.00	3790.00	[m]
Diameter	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	5.00	5.00	5.00	5.00	[m]
Slope o/oo	2.04	2.04	2.05	2.04	2.04	2.04	2.04	2.04	1.62	1.62	1.62	1.62	

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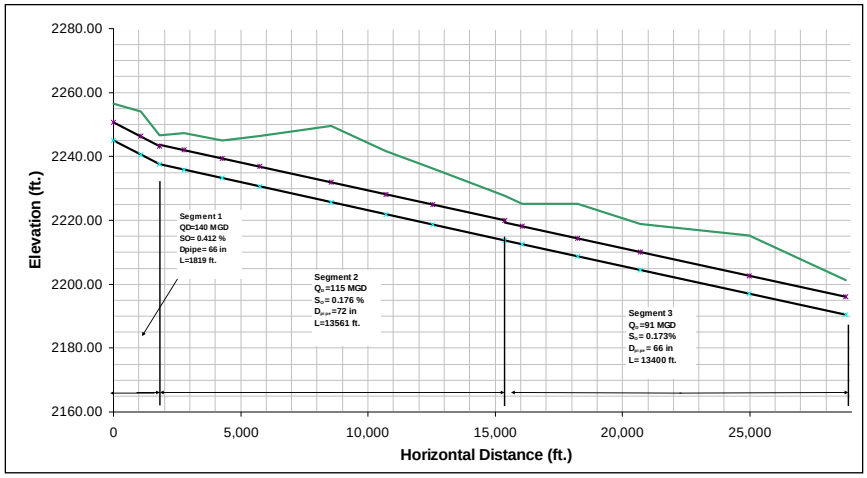
“Existing” Plan – Route 4



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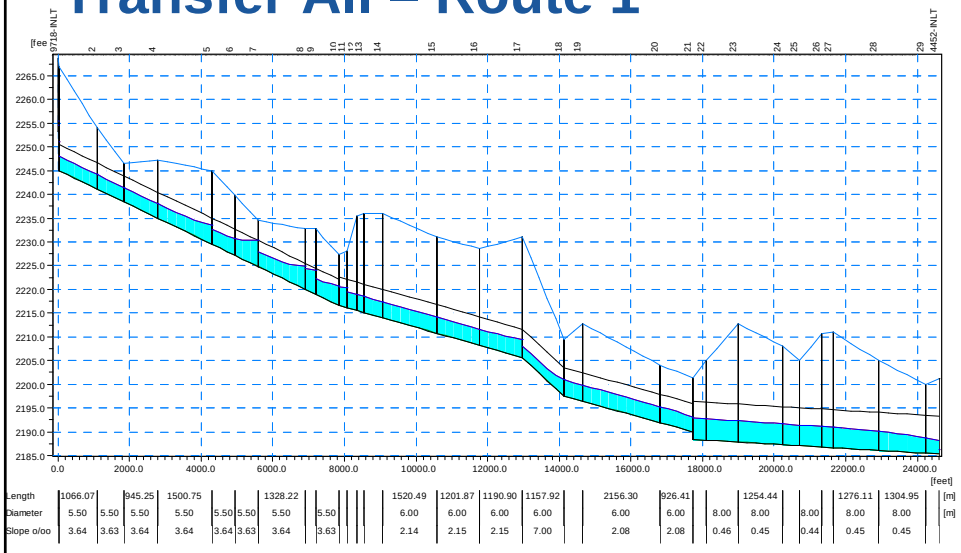
Transfer All – Route 1



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Evaluation Criteria / Cost Comparisons

Gordon Culp/Steve Sticklen

Evaluation Criteria

- Present worth cost
- Non-monetary considerations
  - Constructability
  - Long-range planning
  - Safety
  - Public acceptance
  - Maintenance
  - Rights-of-way
  - Pump stations
  - Utility conflicts
  - Traffic control
  - Environmental impacts
  - Business disruption
  - Archeological / historic sites
  - Permitting

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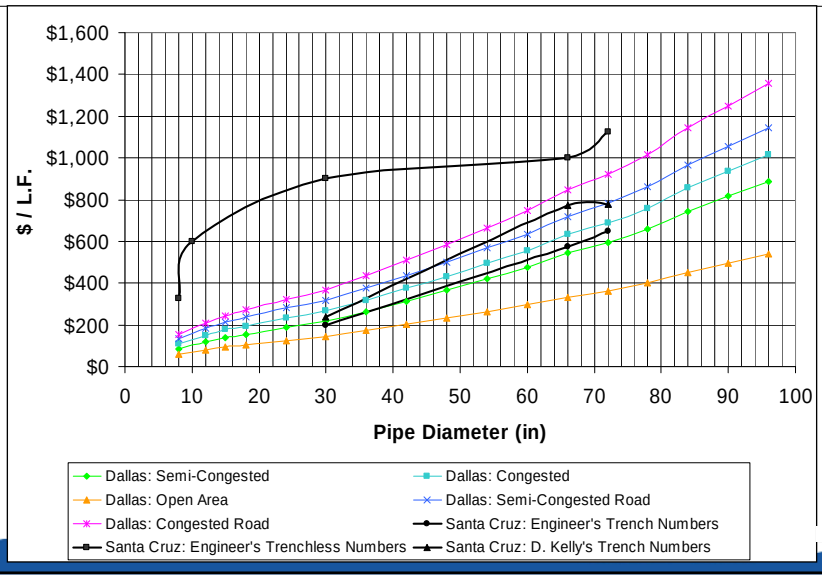
Cost Comparisons - Dallas



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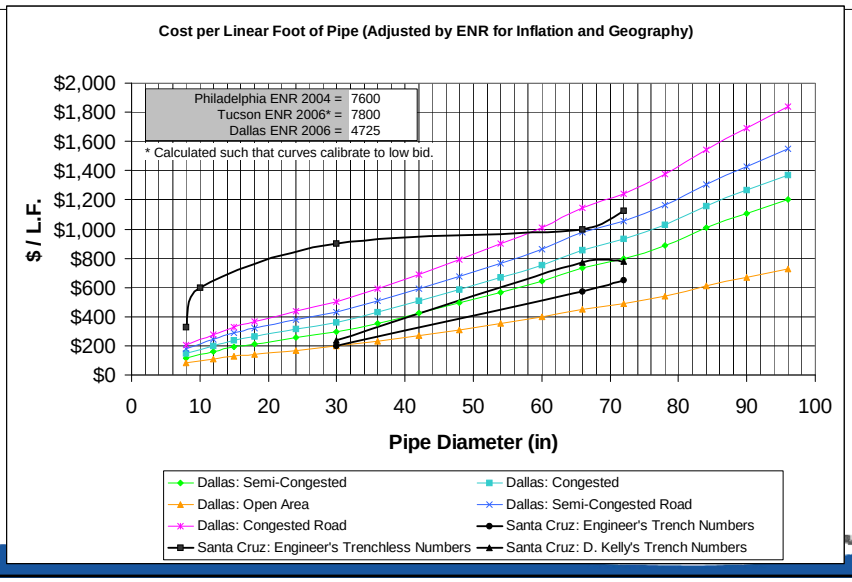
Cost Comparisons - Recalibrated



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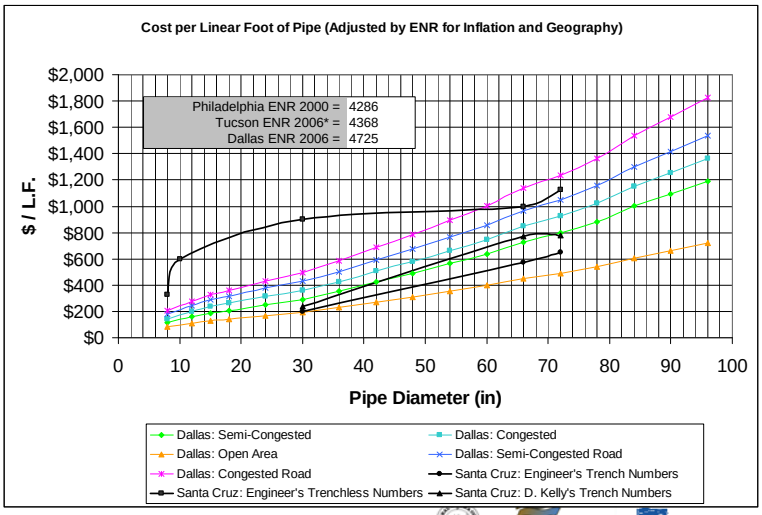
Cost Comparisons - Recalibrated



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Sewer Unit Costs

	$ / (inch*ft)				
D_{pipe} (in)	Semi-Congested	Congested	Open Area	Semi-Congested Rd.	Congested Road
8	14.42	18.19	10.29	22.68	25.61
12	13.47	16.88	8.98	20.43	23.24
15	12.66	15.99	8.48	19.30	22.00
18	11.63	14.67	7.83	17.76	20.31
24	10.60	13.17	6.98	15.81	18.19
30	9.81	12.07	6.58	14.38	16.63
36	9.84	11.94	6.48	14.11	16.40
42	10.12	12.13	6.50	14.11	16.44
48	10.27	12.21	6.49	14.10	16.48
54	10.50	12.39	6.57	14.23	16.67
60	10.68	12.53	6.65	14.35	16.85
66	11.14	12.97	6.82	14.76	17.37
72	11.12	12.91	6.80	14.66	17.28
78	11.41	13.18	6.95	14.93	17.63
84	12.00	13.80	7.24	15.57	18.41
90	12.26	14.06	7.42	15.85	18.77
96	12.50	14.29	7.58	16.13	19.13
Weighted Average =	**$11.33**	**$13.31**	**$7.06**	**$15.28**	**$17.93**

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Sewer Unit Costs

	$ / (inch*ft)				
D_{pipe} (in)	Semi-Congested	Congested	Open Area	Semi-Congested Rd.	Congested Road
8	14.32	18.06	10.22	22.52	25.44
12	13.37	16.76	8.92	20.29	23.08
15	12.58	15.88	8.42	19.17	21.84
18	11.55	14.56	7.78	17.64	20.17
24	10.53	13.08	6.93	15.70	18.07
30	9.74	11.98	6.53	14.28	16.51
36	9.77	11.86	6.43	14.01	16.28
42	10.05	12.05	6.46	14.02	16.33
48	10.20	12.12	6.45	14.00	16.36
54	10.43	12.30	6.53	14.13	16.56
60	10.61	12.44	6.60	14.25	16.74
66	11.06	12.88	6.78	14.66	17.25
72	11.04	12.82	6.75	14.56	17.16
78	11.33	13.09	6.90	14.83	17.50
84	11.91	13.70	7.19	15.46	18.28
90	12.17	13.96	7.36	15.74	18.64
96	12.41	14.19	7.53	16.02	19.00
Weighted Average =	**$11.26**	**$13.22**	**$7.01**	**$15.18**	**$17.81**

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Interconnect Options

	Route	Pipe Size	Cost (millions)	Not Included
Existing Plan	Route 1	54" - 72"	$15.60	R.O.W. acquisition Return pumping of 5 MGD
	Route 4	54" - 60"	$21.20	Return pumping of 5 MGD
Transfer Some	Route 1	48" - 66"	$15.30	R.O.W. acquisition Return pumping of 17 MGD
	Route 4	?	$20.80	Return pumping of 17 MGD
Transfer All	Route 1	66" - 96"	$21.30	R.O.W. acquisition Return pumping of 37 MGD
	Route 4	72" - 84"	$29.60	Return pumping of 37 MGD

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Interconnect Options

	Route	Pipe Size	Cost (millions)	Not Included
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	Route 2	T.B.D.		
	Route 3	Eliminated		
	Route 4	66" - 72"	$29.50	Return pumping of 5 MGD

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Summary and Wrap-Up

Anne Smith

Pima County Wastewater Management Department

GREELEY AND HANSEN

Closing Remarks

Mike Gritzuk

Workshop #13 Meeting Notes
Non-Metropolitan Facilities/CIP Update/Project Delivery

1. The Non-Metropolitan Facilities/CIP Update/Project Delivery Workshop for Pima County Regional Optimization Master Plan was held on January 31, 2007. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Mike Bunch
Jackson Jenkins
Jeff Nichols
PCWMD Staff
Gary Blomstrom
Ed Curley
Frank Gall
Mary Hamilton
Mike Lueken
Byron McMillan
John Munden
Jeff Prevatt
Karen Ramage
Helen Rhudy
Ron Riska, Project Manager
Mandley Rust
Ken Weber
Eric Wieduwilt
Legal
Harlan Agnew
Chuck Wesselhoff

PIMA COUNTY PROCUREMENT DEPARTMENT
Design and Construction Division
John Carter

WASTEWATER MANAGEMENT ADVISORY COMMITTEE
John Carlson

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Tim Thomure

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Eric Petersen
Andy Richardson
Harold Smith

2. Major topics of the workshop were:

- Workshop #13: Non-Metropolitan Facilities/CIP Update/Project Delivery
  - Existing Non-Metro Facilities
  - 2030 Non-Metro Facilities Configuration
  - CIP Construction Costs (2006)
  - UV Disinfection vs. Chlorination/De-chlorination
  - Plant Electrical Costs
  - Possible Construction Packages
  - Project Delivery Options/Section Criteria

A set of handouts were provided to each attendee at the workshop. Additional information was presented during the workshop and is provided in this meeting summary .

Throughout the workshop a set of notes were recorded on "flip-charts." Those notes summarize questions, comments and notes to be utilized by the project team while conducting the study. The flip chart notes are incorporated into these meeting summary notes.

3. Mike Gritzuk welcomed the attendees to the workshop and invited the workshop to begin.

4. Andy Richardson quickly outlined the meeting topics and objectives. He further elaborated on his role as facilitator and encouraged all to participate, but informed the attendees that some items may have to be placed in the "parking lot" (on the flip charts) for later discussion to meet the established schedule.

   Overview, agenda, meeting objectives, and ground rules were covered on pages 2 through 4 of the handout.

5. Jerry Bish reviewed the current systems and operations at the County owned and operated non-metropolitan wastewater facilities. Pima County has the responsibility for wastewater management for all of Pima County except for a Designated Management Area (DMA) established for the Town of Sahuarita. There are several small communities (Ajo, Why, Lukeville) in the remote parts of western Pima County that are on separate wastewater management systems that are not part of Pima County Wastewater Management Department operations. The existing operations for those areas are not expected to change within the 25-year planning horizon.

   Planning for population growth in the Non-Metro areas includes the Sonoran Desert Conservation Plan, which serves to keep new sewers out of riparian areas and minimizes sewer extensions into conservation land areas. The Sonoran Desert Conservation Plan provides Pima County with access to effluent for riparian projects and includes a framework for negotiating effluent water projects from the Conservation Effluent Pool.

   Each of the eight non-metro facilities under operation by the Pima County Wastewater Management Department were reviewed. Service area, population served, wastewater flows, type of wastewater treatment process, size of land parcel for treatment plant, effluent receiving water/area, discharge permit requirements, reclaimed water permits, biosolids handling/treatment and biosolids disposal were presented for each of the following facilities:

   - Arivaca Junction
   - Avra Valley
   - Corona de Tucson
   - Green Valley
   - Marana
   - Mt. Lemmon
   - Fairgrounds
   - Rillito Vista

   Frank Gall noted that very little is discharged into the Black Wash at Avra Valley. Most of the plant discharge is disposed of through the percolation ponds. New BNROD facilities at Avra Valley are scheduled to be online by April/May 2007.

Frank Gall further indicated that the plant at Green Valley has not discharged into the Santa Cruz River since startup. Effluent is filtered onsite and pumped to the Quail Creek Golf Course recharge basin. The golf course recovers the water from ground wells and waters the course turf. It was noted on the wastewater treatment slide that there was also an operational lagoon at Green Valley.

At Marana a new Aquifer Protection Permit is in place. It was noted that the overflow basin is lined. The pond where the new interim Biolac system is being installed is lined with high density polyethylene. The Biolac system will be placed into operation soon.

For Mt. Lemmon there is a study underway to expand the service area by adding additional lots. The current permit flow is believed to be 12,500 gpd with a maximum flow of 17,000 gpd.

For the effluent discharge from the plants, it was noted that for Marana there was water reuse not aquifer recharge, and at Mt. Lemmon there was a NPDES permit in addition to the spray field disposal.

Under reclaimed water uses, it was noted that Green Valley does not have a riparian restoration program, however, at Canoa Ranch which is upgradient of Green Valley, there is consideration by the Pima County Regional Flood Control to include riparian restoration. Further, it was noted that the ponds at Fairgrounds and Rillito Vista were not being used for groundwater replenishment, but is used for evaporation and percolation. The Green Valley effluent is used for 100% recharge.

The new closed loop reactor system at Corona de Tuscan is scheduled to be online in April/May 2007.

The current non-metro wastewater facilities systems and operations were covered on pages 4 through 12 of the handout.

6. Jerry Bish outlined the projected Pima County wastewater system operations in 2030, based on population growth and service area expansion. By 2030, the Arivaca Junction, Fairgrounds and Rillito Vista will be planned out and incorporated into the service areas of Green Valley, Roger Road and Marana, respectively. Avra Valley will have an expanded population and service area. A portion of the area tributary to Avra Valley will be designated a rural area and will most probably not receive sewers within the planning period. Other areas tributary to Avra Valley that are not currently sewered will receive sewer extensions from the Avra Valley wastewater treatment plant, which will be expanded to meet demand.

   Mt. Lemmon is expected to serve the Summer Haven community, which will be limited in growth by the U.S. Forest Service and is completely surrounded by forest areas.

   The Northwest region will see rapid expansion of the Marana service area as population growth increases in and around Marana. The vision is within the planning period that Rillito Vista service area will be connected to the Marana facilities and will be eliminated from service.

Further, wastewater in the area down gradient from the Marana facilities will be collected at a pump station on the Pima/Pinal County line and be pumped to the Marana facilities.

A question was asked if the Marana plant should make arrangements to serve any communities/areas in Pinal County. The response is that Pinal County is outside the Pima County DMA and any service would be negotiated as a special circumstance. For planning purposes, service to Pinal County will not be considered.

Technically the area served by the Continental Ranch Pump Station can be served by gravity sewers at the Marana wastewater facilities. It was indicated in the long term that the Continental Ranch Pump Station should be eliminated and flow carried by gravity to the Marana facility. This would remove a small portion of flow from the Ina Road WPCF service area.

In the South Region, the Arivaca Junction will be phased out and flow will be carried to Green Valley. The area served by Sahuarita may be increased through ongoing joint planning area negotiations with Sahuarita, Pima Association of Governments and Pima County.

In the Southeast Region, a new facility is projected for the northwest corner of the service area near the Santa Cruz River. This plant is identified as the Southlands. This facility would be down gradient of Green Valley and Corona de Tucson and could serve those areas at some future date with appropriate planning of future sewer networks. However, in the 25-year planning horizon, the Green Valley and Corona de Tucson plants will remain and most probably be expanded over the next 25 years. A question arose at the Corona de Tucson plant as to where was the future water going to be discharged. There was a question as to why the flow from the Southlands would not be taken to the Metro facilities. The answer is that the transport of the wastewater to the Metro facilities would be very costly and is deem infeasible.

The future non-metro wastewater facilities systems and operations were covered on pages 12 through 20 of the handout.

7. Future flows along with current and planned capacity at each of the non-metro facilities was presented by Jerry Bish. Due to some last minute information future flows for each of the non-metro regions presented at the workshop were somewhat different than those presented in the workshop. The revised future flow/capacity charts presented at the workshop are attached. For the Southlands no capacity was shown since this is part of the negotiations with Town of Sahuarita and Pima County over who will serve that region. This is planned to be resolved over the next several weeks to months.

   See the supplemental information on flow and capacity for the non-metro regions at the end of the notes

8. A “first cut” of the future wastewater treatment technology for the non-metro facilities was reviewed. The basis of the evaluation was the standards set forth for the metro facilities, which is equal to or more stringent than the current permit requirements at the non-metro facilities. These are not the effluent standards that are in-place, nor are they viewed as being on the horizon, but it is reasonable to consider treating the wastewater to this level for the non-metro facilities by 2030.

The current biological nutrient removal oxidation ditch (BNROD) operation was looked at against the possible future requirements. With some augmentation to the BNROD systems could successfully meet the future requirements. Other wastewater technologies that would meet the objectives would be 5-stage Bardenpho, moveable bed reactors, and sequencing batch reactors. Although oxidation ditches have been constructed or are currently under construction to serve the non-metro service areas, there is concern that this technology may not best serve the County into the future. Currently, the wastewater facilities are in remote areas, but as the non-metro areas fill-in there will be encroachment by housing near and adjacent the sites, which will make odor control issues more of a concern. Also, there will be significant increases in land value as the non-metro communities grow. Therefore, wastewater treatment technologies with a smaller footprint that are more suitable for odor control than the oxidation ditches are of a better fit for the County's long term needs. More investigation into wastewater technologies is required before the final selection of a process. One consideration for a new technology will be the adaptability of the existing systems into the new technology.

For the future it is envisioned that the current effluent utilization will continue and be expanded. Ownership of the effluent water is being developed between the County and the water purveyors. A comprehensive regional development for the effluent would be beneficial.

For biosolids a similar comprehensive development plan is needed as a strategy to address disposal. A multiple outlet approach is recommended which allows for competition in the market place, or a dedicated disposal site, or both. Will there be a centralized biosolids processing site in the non-metro area, in addition to the Ina Road centralized facility? A centralized facility on the south side would look to mine disposal as a primary outlet versus the agricultural land disposal associated with Ina Road. More work is necessary to develop the ultimate biosolids disposal plan.

The "first cut" of the future non-metro wastewater facilities systems and operations including effluent utilization and biosolids handling and disposal were covered on pages 20 through 23 of the handout.

9. The capital improvement program (CIP) costs in 2006 dollars ($501 million) were reviewed for the metro facilities and the plant interconnect pipeline. The electrical service costs was broken down for each of the metro plants as follows: standby power at Roger Road ($7 million), power generation at Ina Road ($18.4 million) and unification costs for Ina Road ($9.6 million) to serve the future facilities. Other administrative and engineering costs, such as program management, construction management, real property, cultural resources and permits that relate to the plant upgrades and expansion were identified.

   The capital improvement program costs for Roger Road WWTP, Ina Road WPCF and the plant interconnect pipeline were covered on pages 23 through 28 of the handout.

10. Mike Gritzuk reported on a meeting with the Arizona Department of Environmental Quality (ADEQ) in which it was reported that ultraviolet (UV) disinfection with antecedent filtration may not be the way to go fro Pima County because of the expense of providing these facilities. Options such as enhanced chlorination/de-chlorination, or site specific standards in lieu of UV

disinfection were discussed with ADEQ. ADEQ indicated that they would be willing to work with Pima County on this issue in a separate meeting.

11. Jerry Bish presented the schedule for design, construction and startup of facilities to meet the regulatory deadlines set forth in the AZPDES permits. Based on the schedule and sequence of construction there are several project elements that can be delayed until after 2015 to stretch out the cost of the project for rate and bond purposes. These include: construction of 8 mgd of capacity at Roger Road, decommissioning and demolition the existing Roger Road WWTP and some sludge facilities at Ina Road WPCF. The total project can be divided into a number of project packages to take advantage of the various project delivery methods available to the County. A listing of the various project elements was provided for consideration in the subsequent presentation on project delivery. Some considerations are: more contractors involvement, spend more money locally, and cost effectiveness of the project delivery system.

    The project schedule and possible project packages were covered on pages 28 through 30 of the handout.

12. Ed Curley presented a draft 5-year CIP that includes regulatory, capacity and rehabilitation needs throughout the utility. The CIP indicates that most of the money spent over the next five-years is related to the regional optimization program. The projected costs within the CIP will double in year two of the five year plan and nearly double again over the five year span. These numbers are still being developed, but represent the probable costs of the expansion and upgrade costs. After the 5-year CIP is finalized the department will develop a 15-year CIP, to model the cost through the construction and startup period for the new facilities. The CIP will be utilized to develop the capital funding (bond) needs for the department. A need for $400 million in 2008 bonds is most likely not politically achievable.

13. Eric Petersen highlighted the available project delivery systems available in Arizona. The presentation paralleled the written text provided in the handout and covered design/build (D/B), construction-manager-at-risk (CMAR) and design-build-operate (DBO). The presentation did not cover the traditional design-bid-build project delivery, or others that include financing options (sometimes referred to as turnkey). The project delivery systems can be applied to the three major projects or associated sub-projects (project packages), and the non-metro facilities.

    For the alternative delivery systems it is important to pre-qualify the contractors. The design/build and CMAR approaches enable project cost certainty well before the project design is completed and can save time from the beginning of a project to the completion of construction. Melodee Loyer suggested that the time factor for procurement and evaluations are not normally included in the time saved. If those times were taken into account, it is suggested that there would be little time saved over the traditional design-bid-build. John Munden asked if the design needs to be approved by the State, how does that taken into account in the D/B approach. Eric Petersen indicated that the regulatory agencies will need to work with the owner to make these approaches successful.

    Mike Gritzuk indicated that the design/build experience in Arizona is limited, however, design/build has been successful in the State. A project the size of Roger Road or Ina Road

would be considered a big project and would probably be pursued by large national firms. John Carter stated that in Arizona a contractor must lead a design/build project. It was noted that some engineers hold contractor's licenses dn could lead a D/B project . Ron Riska asked that with Bardenpho selected by the County as the treatment process, would this close out D/B as a project delivery approach. The answer is no, there are other parts of the project where innovation and creativity can be integrated to make it a successful D/B project.

Frank Gall asked if there was a service life (period) on design-build-operate contracts. In response there are no state laws that limit the service period, but tax law advantages would most likely limit the period to 20 years. Under a DBO contract the contractor would be held accountable by contract for any permit violation. In all cases the County would hold the operating permit.

Under the CMAR approach there are separate contracts for design and construction. Harlan Agnew observed that depending on the project delivery approach there are different county staffing requirements. This must be considered in the ultimate selection of a project delivery approach.

The alternative project delivery and selection criteria were covered on pages 31 through 44 of the handout. In the interest of time representative projects were not discussed, but are summarized in the presentation slides included in the handout.

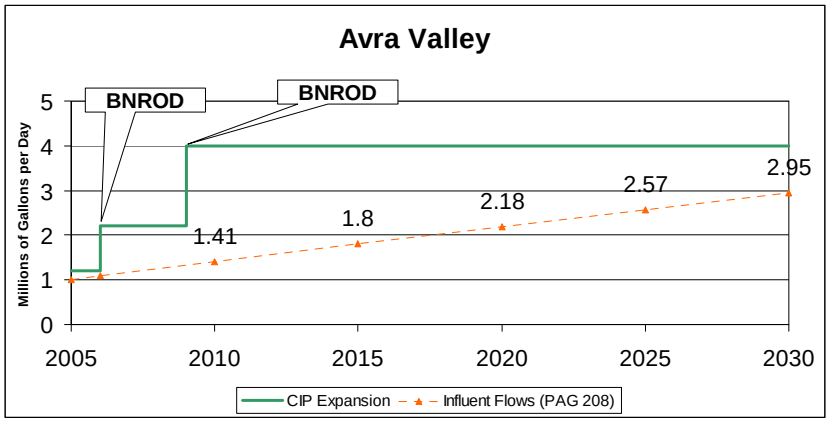
14. Eric Petersen indicated that a letter of expression is a great method to collect information for Pima County from various sources on the interest in the various project delivery approaches, including the interest of private financing to participate in public works projects. This approach was used successfully in Phoenix.

15. Mike Gritzuk closed the meeting and indicated that he looked forward to receiving the draft Regional Optimization Master Plan report and participating in Workshop # 14 to review the draft.

Agenda
Non-Metropolitan Facilities/ CIP Update/Project Delivery Workshop
January 31, 2007

Time	Topic	Presenter
8:15 am	*Pioneer Building, 4th Floor Conference Room*	
8:30 am	Opening Session	Andy Richardson
	• Welcoming Remarks	Mike Gritzuk
	• Overview of Agenda	
	• Groundrules/Role of Facilitator	
	• Confirmation of Agenda	
8:45 am	Non-Metro Existing Systems/Conditions	Jerry Bish
	• Wastewater Facilities	
	• Water Reuse	
	• Biosolids Use and Disposal	
9:30 am	Non-Metro Recommended Systems Configuration	Jerry Bish
	• Systems Configuration	
	• Treatment Processes	
	• Water Reuse	
	• Biosolids Use and Disposal	
10:30 am	Break	
10:45 am	CIP Program	Jerry Bish / Harold Smith
	• Program Cost Update	
	• UV vs. Chlorination	
	• ROMP CIP Schedule/Costs	
	• Construction Packages	
	• CIP/Revenue Requirement/Bonds Status/Issues	Ed Curley
12:15 pm	Lunch	
12:45 pm	Project Delivery Alternatives	Eric Petersen
	• Delivery Method Options	
	• Criteria for Delivery Method Selection	
1:30 pm	Summary Wrap-Up	Andy Richardson
	• Comment by Group	
	• Closing Remarks	Mike Gritzuk
2:00 pm	Adjourn	

Avra Valley – Flow/Capacity



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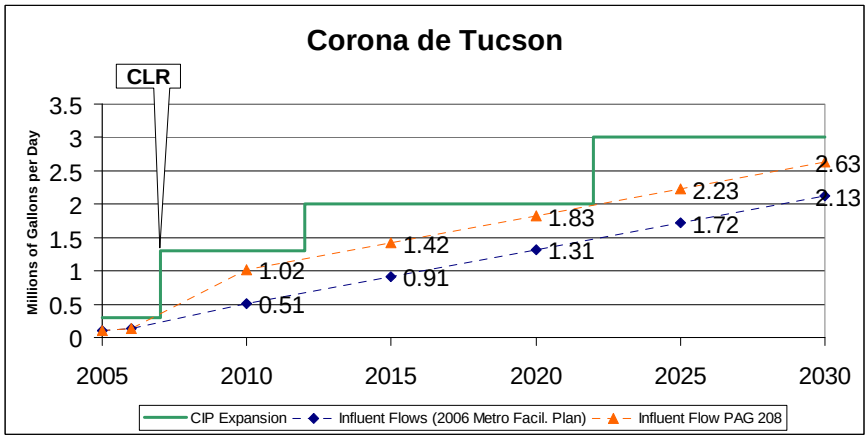
Corona de Tucson – Flow/Capacity



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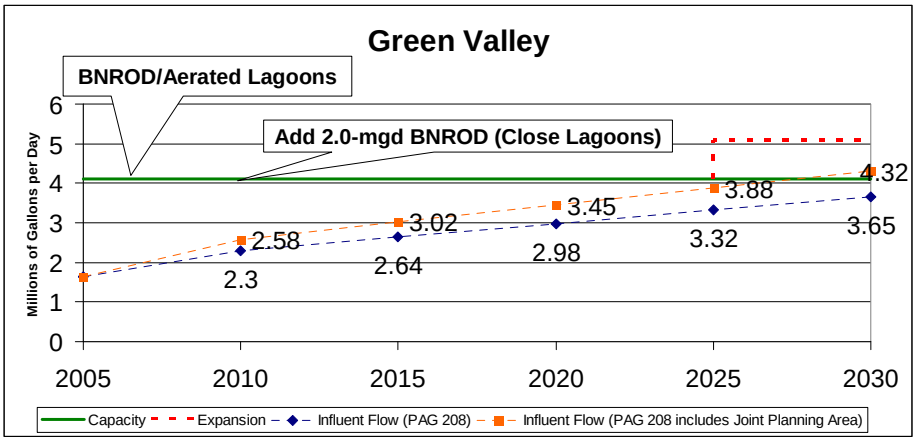
Green Valley - Flow/Capacity



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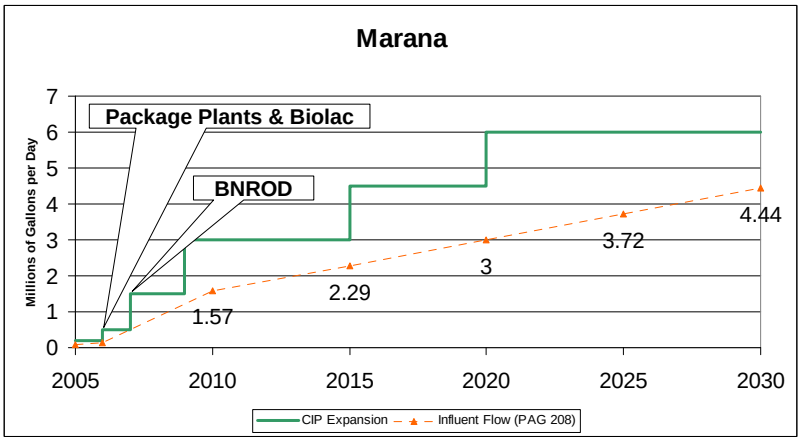
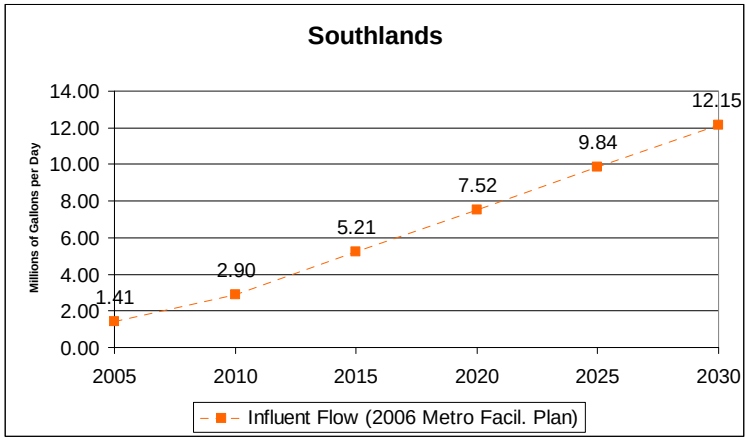
Marana – Flow/Capacity



4

Southlands – Flow/Capacity



5

Pima County Regional Optimization Master Plan

Workshop #13
Non-Metropolitan Facilities / CIP Update / Project Delivery Workshop

January 31, 2007

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator/ Previous WS Decisions
Jerry Bish	Non-Metro Existing Systems/Conditions
Jerry Bish	Recommended 2030 Systems Configuration
Jerry Bish/Harold Smith	CIP Program
Eric Petersen	Project Delivery Alternatives
Andy Richardson	Wrap-Up

2

GREELEY AND HANSEN

Welcoming Remarks

Mike Gritzuk

GREELEY AND HANSEN

Overview

Andy Richardson

Agenda

- Non-metro existing condition
- Non-metro recommended configuration
- CIP issues
- Project delivery alternatives

5

Objective

- Confirm recommended non-metro system configuration
- Confirm recommended non-metro treatment process
- Review construction packages
- Review project delivery alternatives and selection method

6

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

7

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

8

Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

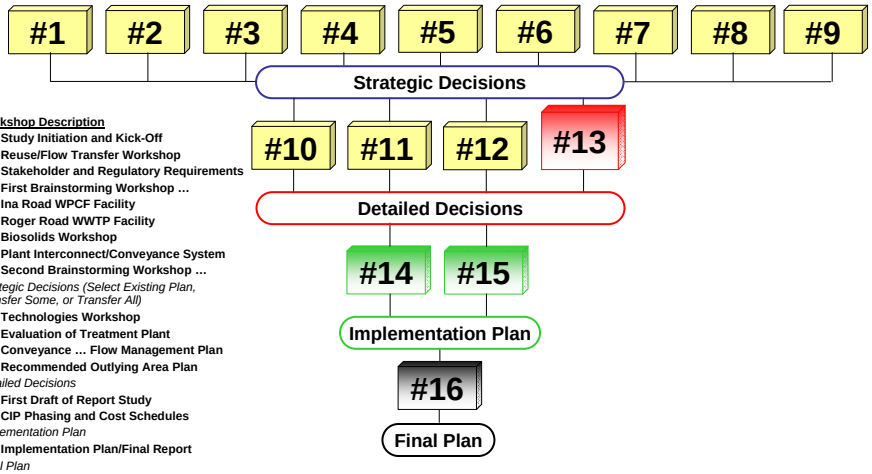
9

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

10

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

11

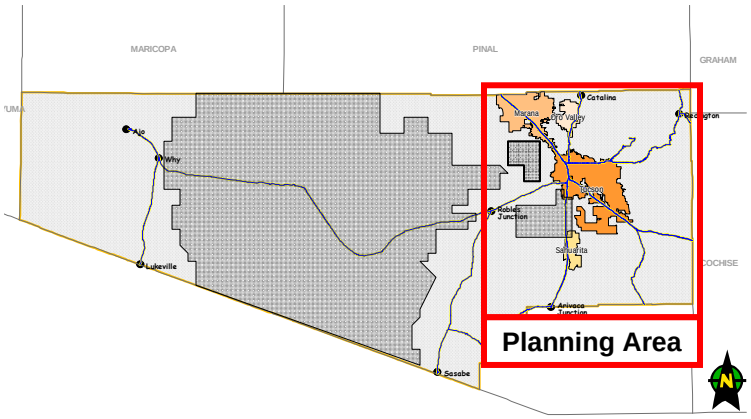
GREELEY AND HANSEN

GREELEY AND HANSEN

Non-Metro Existing Systems / Conditions

Jerry Bish

Designated Management Areas (DMAs)



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Excluded Areas

- Ajo
- Why
- Lukeville
- AZ State Prison
- Sahuarita
- AZ Sonoran Desert Museum

Western Pima County

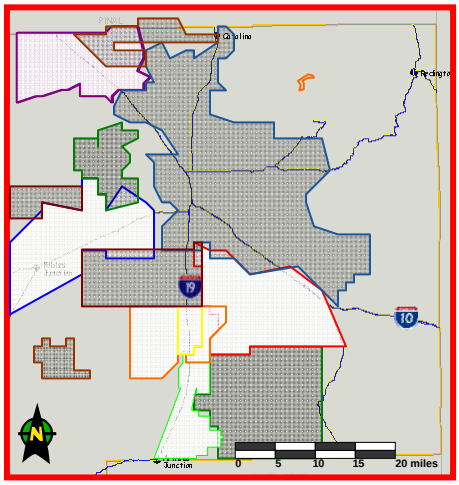
14

Sonoran Desert Conservation Plan

- Keeps new sewer lines out of the riparian areas
- Minimizes sewer system extensions into Conservation Land System
- Negotiates Conservation Effluent Pool with City
- Provides County effluent to riparian projects

15

Planning Areas



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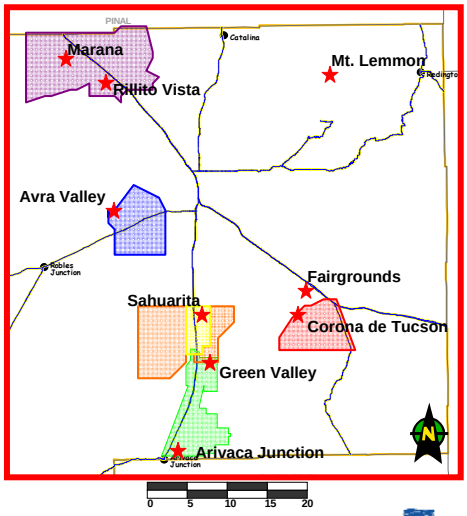
Existing Facilities/Sewer Basins



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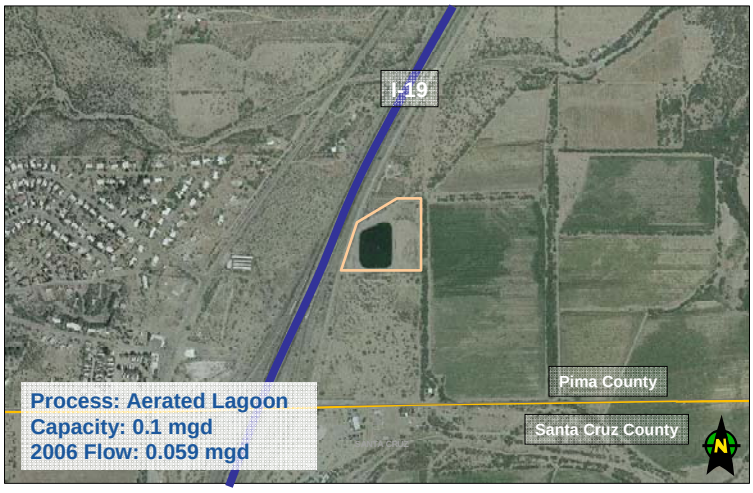
GREELEY AND HANSEN

Arivaca Junction



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GREELEY AND HANSEN

Avra Valley

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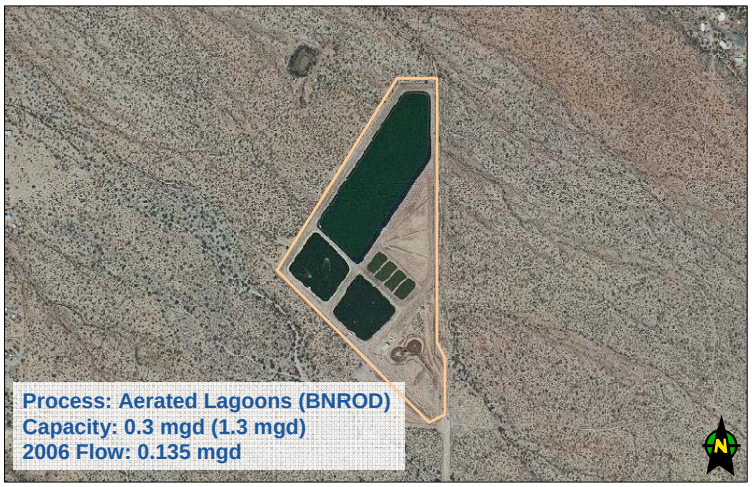
GREELEY AND HANSEN

Corona de Tucson



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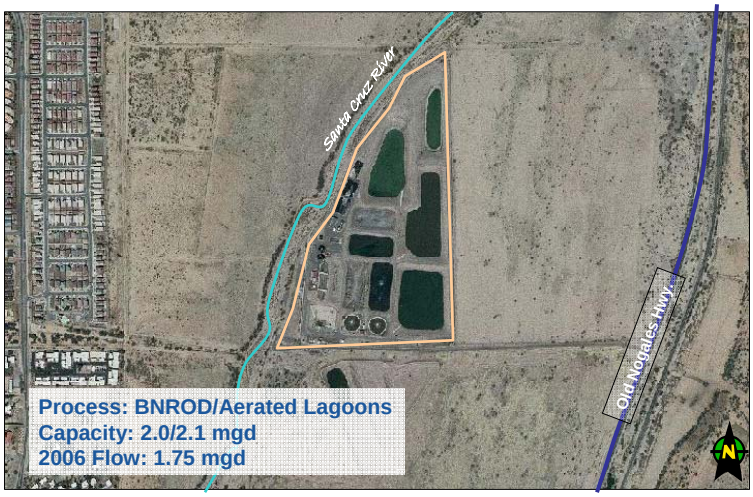
GREELEY AND HANSEN

Green Valley



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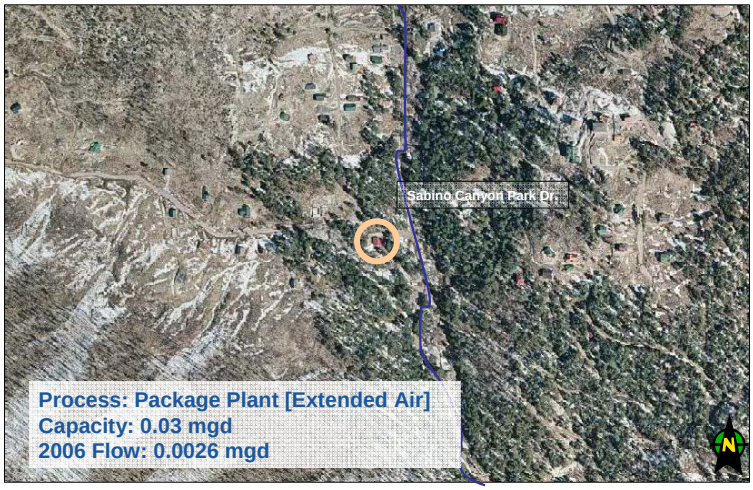
GREELEY AND HANSEN

Marana

22

GREELEY AND HANSEN

Mt. Lemmon



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GREELEY AND HANSEN

Fairgrounds

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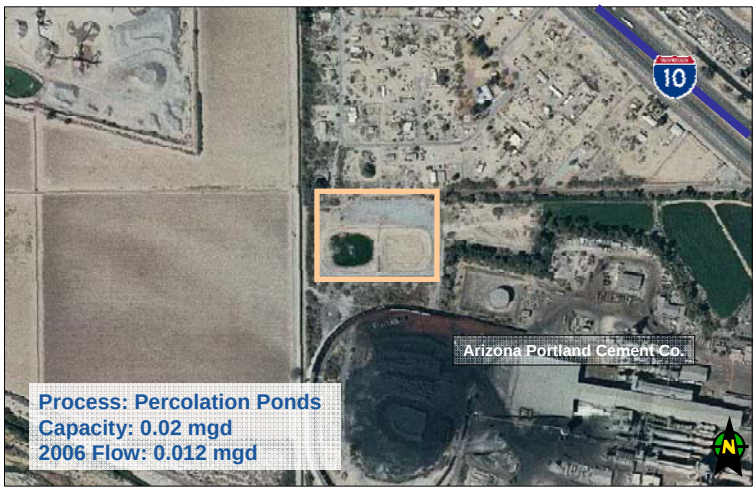
GREELEY AND HANSEN

Rillito Vista



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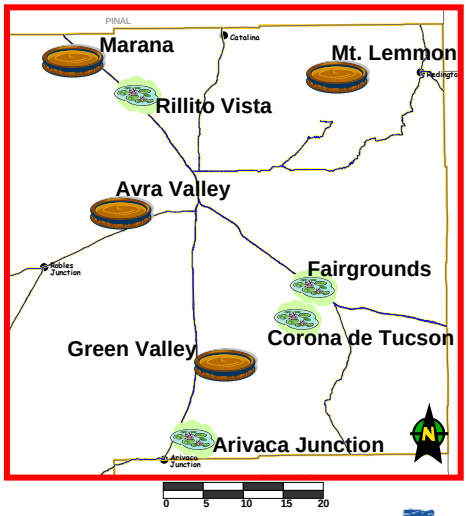
GREELEY AND HANSEN

Wastewater Treatment



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GREELEY AND HANSEN

Effluent Discharges

Facility	Receiving Area
Arivaca Junction	Perc Pond and Reclaimed Water Line
Avra Valley	Perc Pond, Storage Pond, and Spray Fields
Corona de Tucson	Evaporation Pond and SAT Basins*
Green Valley	Perc Ponds, Santa Cruz River and Reclaimed Water Line
Marana	Santa Cruz River and Aquifer Recharge
Mt. Lemmon	Spray Field
Fairgrounds	Perc Ponds
Rillito Vista	Perc Ponds

* Groundwater Recharge, in Near Future

Discharge Requirements

Discharge Location	Treatment Regulations
Percolation/Storage Ponds	Aquifer Protection Permit
Reclaimed Water Line	Reclaimed Water
Spray Fields	AZPDES
Soil Aquifer Treatment Basins	Aquifer Protection Permit
Santa Cruz River	AZPDES

Reclaimed Water Use

Facility	Type of Use
Arivaca Junction	Farm Irrigation
Avra Valley	Plant Irrigation
Corona de Tucson	Evaporation and Groundwater Replenishment
Green Valley	Robson/Quail Creek, Inc. and Riparian Restoration
Marana	Santa Cruz Discharge and Plant Irrigation
Mt. Lemmon	Reforestation
Fairgrounds	Groundwater Replenishment
Rillito Vista	Groundwater Replenishment
Canoa Ranch	Riparian Restoration

Reclaimed Water Permits

Facility	Permit	Produced (gpd)(1)	Percent of Total Treated
Arivaca Junction	Class C	40,000	68
Avra Valley	Class B+	320,000	30
Green Valley	Class A+ (BNROD) Class B (lagoon)	1,500,000	86
Marana	Class B+	57,000	38
Mt. Lemmon	Permit (AZPDES)	2,000	100

(1) 2005 Effluent Generation/Utilization Report

Biosolids Handling/Treatment

Facility	Produced (tpd)[1]	Handling/Treatment
Arivaca Junction	0.08	Dried
Avra Valley	1.51	Storage/Haul
Corona de Tucson	0.189	Dried
Green Valley	2.45	GBTs, Aerobic Dig., BFPs, Drying Beds
Marana	0.21	Storage/Haul
Mt. Lemmon	0.003	Storage/Haul
Fairgrounds	Minimal	Dried
Rillito Vista	0.02	Dried

(1) tpd=tons per day. Calculated using 2,800 dry pounds per day raw biosolids produced per mgd flow treated

GREELEY AND HANSEN

Biosolids Disposal

Facility	Disposal
Arivaca Junction	Scraped and Hauled to Landfill
Avra Valley	Hauled to Roger Road
Corona de Tucson	Scraped and Hauled to Landfill
Green Valley	Mines
Marana	Hauled to Ina Road
Mt. Lemmon	Hauled to Ina Road
Fairgrounds	Scraped and Hauled to Landfill
Rillito Vista	Scraped and Hauled to Landfill

GREELEY AND HANSEN

Current Activities

- Arivaca Junction
  - Lagoon closing once Canoa Ranch connection complete
- Avra Valley
  - 1-mgd BNROD Expansion construction underway

GREELEY AND HANSEN

Current Activities *(continued)*

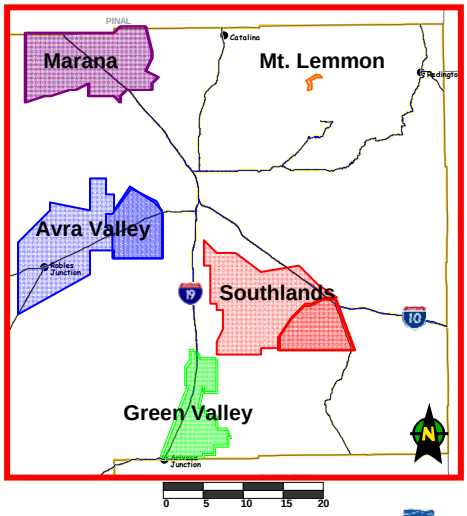
- Corona de Tucson
  - Construction of 1-mgd BNROD nearly complete
- Mt. Lemmon
  - Service area expansion in discussion?

GREELEY AND HANSEN

Recommended 2030 Systems Configuration

Jerry Bish

Service Areas (2030)



Influent Flow

Facility	2006 Flow (mgd)	2030 Flow (mgd)	% Increase
Arivaca Junction	0.059	0	-
Avra Valley	1.079	3.8	350
Corona de Tucson	0.135	2.7	2000
Green Valley	1.75	4.4	250
Marana	0.149	4.9	3300
Mt. Lemmon	0.0026	0.0026	-
Fairgrounds	Minimal	0	-
Rillito Vista	0.012	0	-
Southlands	0	13.7	-

Non-Metro Regional Operations

- Avra Valley
- Mt. Lemmon
- Northwest
- South
- Southeast

Avra Valley Region

- Expanded Avra Valley to match growth
- Expanded service area to match development

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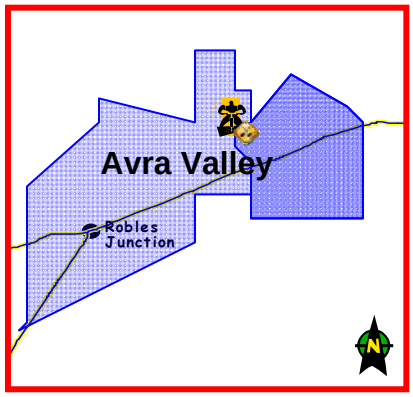
Avra Valley Region



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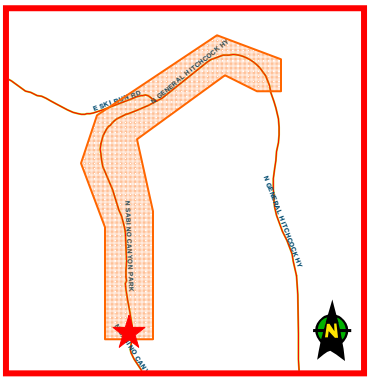
Mt. Lemmon Region

- Service area expansion discussions



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GREELEY AND HANSEN

Northwest Region

- Expanded Marana to match growth
- Conveyed flow downstream of Continental Ranch Pump Station to Marana
- Pumped flow back from areas down-gradient
- Phased out Rillito Vista

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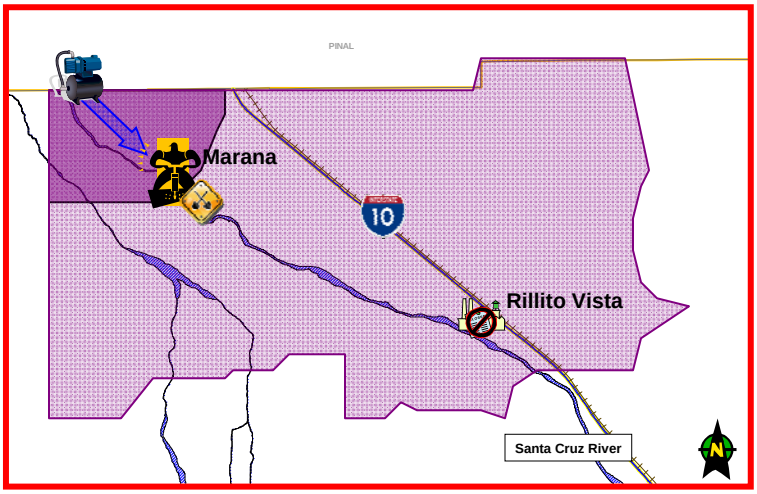
GREELEY AND HANSEN

Northwest Region



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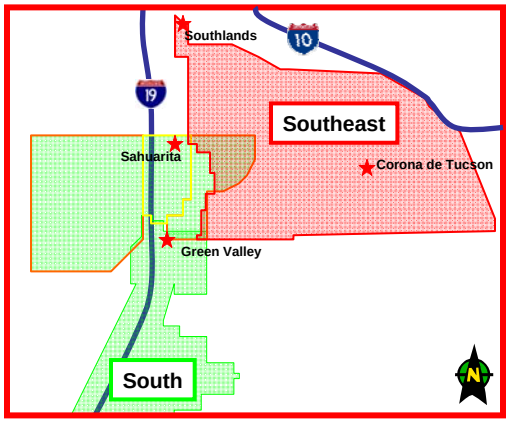
GREELEY AND HANSEN

South/Southeast Regions



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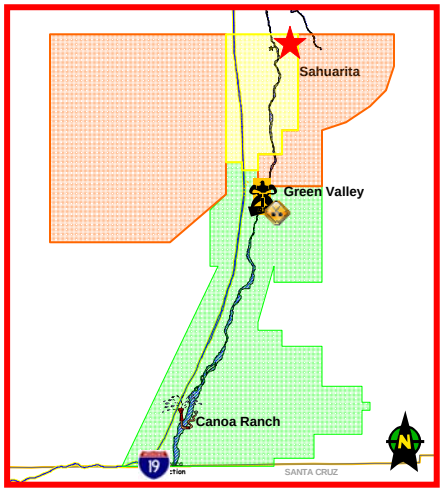
South Region



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GREELEY AND HANSEN

South Region – Green Valley

- Phased out Arivaca Junction
- Expanded Green Valley to match growth
- Water reclamation facility at Canoa Ranch?

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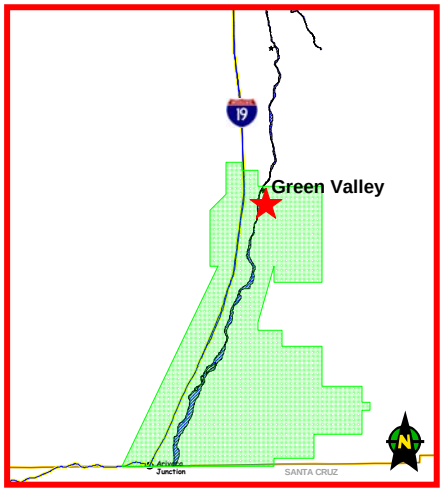
GREELEY AND HANSEN

Green Valley Service Area



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GREELEY AND HANSEN

South Region – Sahuarita

- Sahuarita continues as Designated Management Agency
- Absorbs Joint Planning Area?

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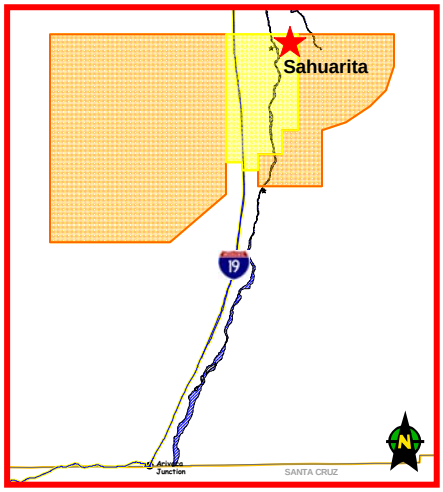
GREELEY AND HANSEN

Sahuarita Service Area



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GREELEY AND HANSEN

Southeast Region

- Phased out Fairgrounds and sent flow to SE Interceptor
- Expanded Corona de Tucson to match growth
- Constructed Southlands facility

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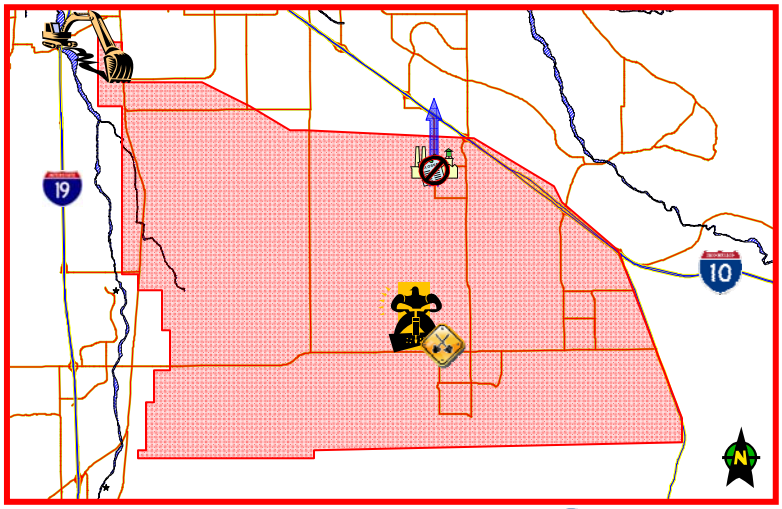
GREELEY AND HANSEN

Southeast Region



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GREELEY AND HANSEN

Current Wastewater Treatment

- Lagoons
- Package Plants [Extended Air]
- Oxidation Ditches

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GREELEY AND HANSEN

Planning Activities

- Avra Valley [BNROD]
- Corona de Tucson [CLR]
- Marana [Biolac]

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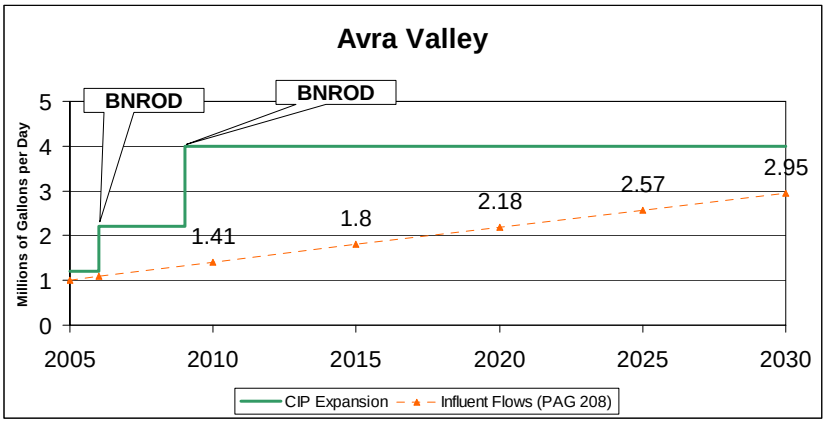
Avra Valley – Flow/Capacity



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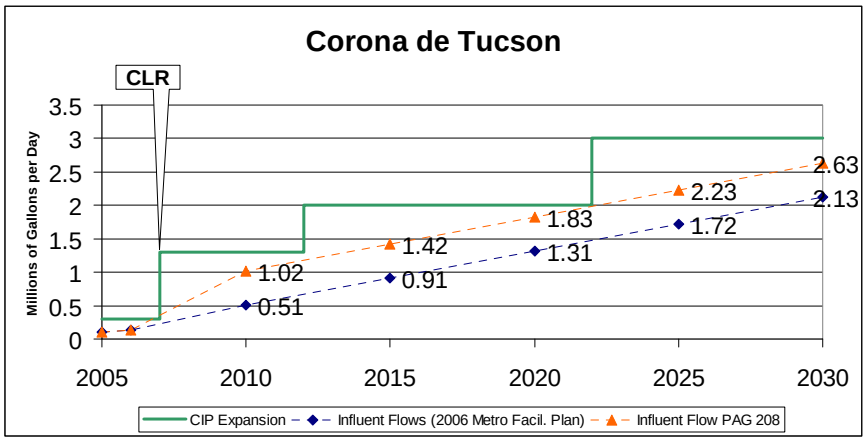
Corona de Tucson – Flow/Capacity



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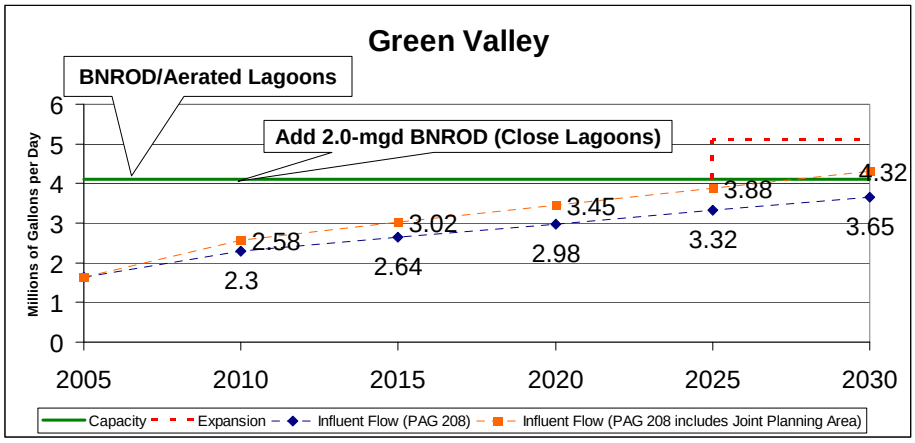
Green Valley - Flow/Capacity



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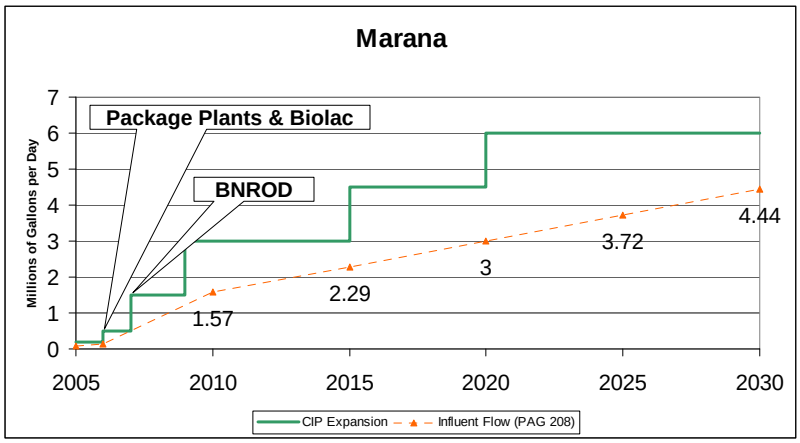
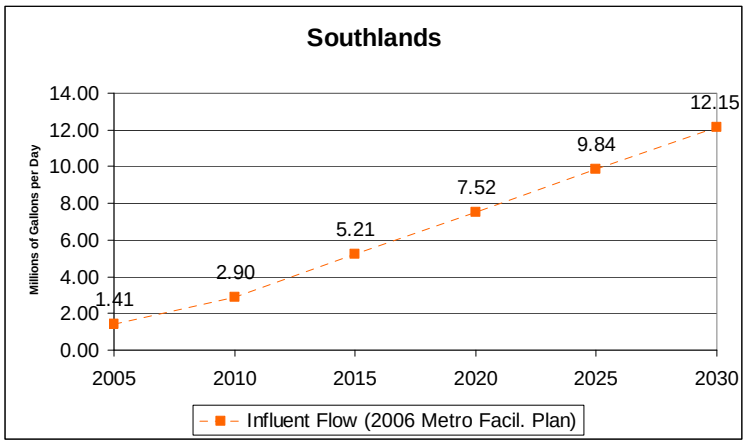
Marana – Flow/Capacity



Southlands – Flow/Capacity



Future Regulations (AZPDES)

- Total Nitrogen < 6 mg/L
- Total Phosphorus < 1 mg/L
- Pathogens
  - Non-detect 4 of 7 daily samples
  - Single sample maximum
    - Fecal coli – Not greater than 23cfu/100ml
    - E. coli – Not greater than 15cfu/100ml

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GREELEY AND HANSEN

Alternatives Evaluated

- Current
  - BNROD
- Alternatives
  - 5-Stage Bardenpho
  - MBBR
  - SBR

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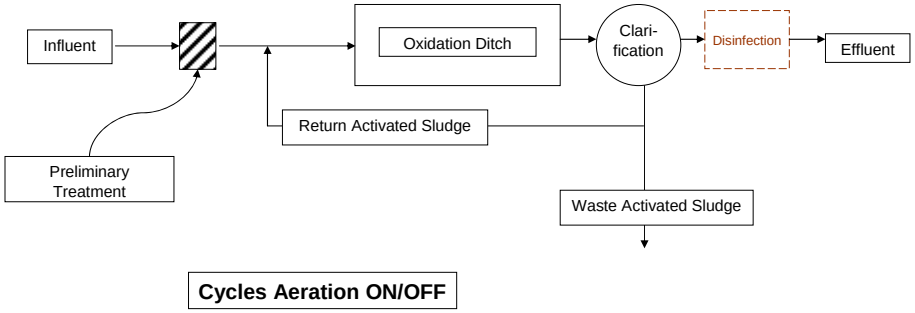
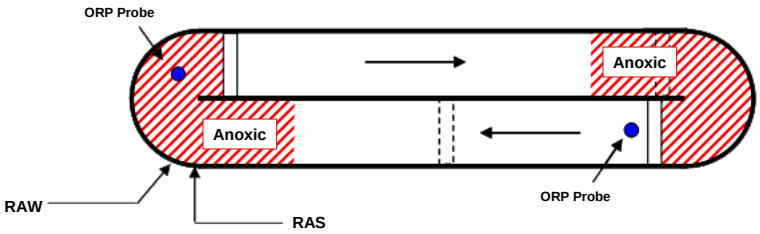
GREELEY AND HANSEN

Oxidation Ditch Process

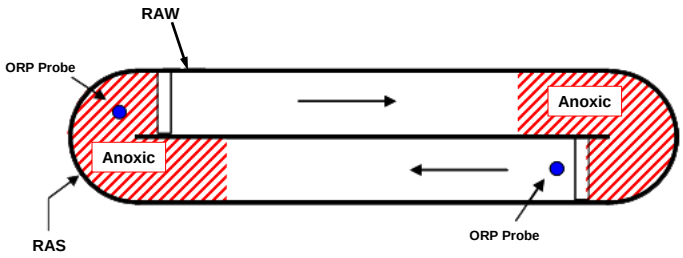


Cycles Aeration ON/OFF

Enhanced N_2 Removal



High Strength/Low Flow



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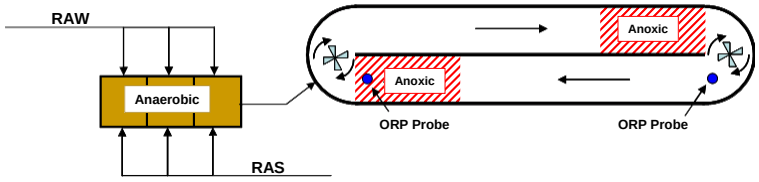
Phosphorus Removal



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Effluent Utilization

- Current Uses
- Reclaimed Water
  - Turf irrigation
- Water Reuse
  - Riparian Restoration
  - Reforestation
- Groundwater Recharge

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Biosolids Production

Facility	2006 Production (tpd)(1)	2030 Production (tpd)(1)
Arivaca Junction	0.08	*
Avra Valley	1.51	5.3
Corona de Tucson	0.189	3.8
Green Valley	2.45	8.5
Marana	0.21	6.2
Mt. Lemmon	0.003	0.003
Fairgrounds	Minimal	*
Rillito Vista	0.02	*
Southlands	*	19.2

(1) tpd=tons per day. Calculated using 2,800 dry pounds per day raw biosolids produced per mgd flow treated

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Biosolids Handling/Treatment

Facility	2030 Handling/Treatment
Arivaca Junction	*
Avra Valley	Thicken/Haul
Corona de Tucson	Thicken/Haul
Green Valley	Digestion
Marana	Digestion
Mt. Lemmon	Haul
Fairgrounds	*
Rillito Vista	*
Southlands	Digestion

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Biosolids Disposal

- Agriculture
- Mine Reclamation
- Landfill
- Dedicated Disposal Site

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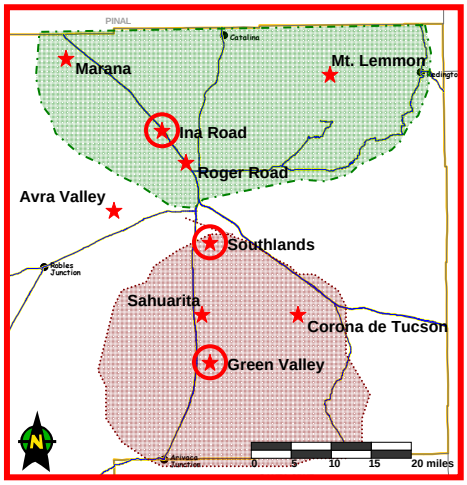
Regional Solids Processing



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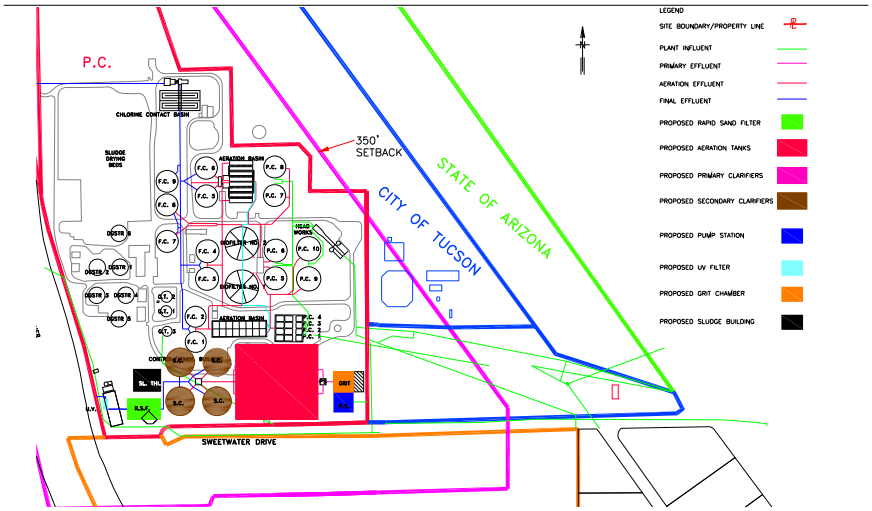
CIP Program

Jerry Bish / Harold Smith

Roger Road – 32-mgd "Greenfield"



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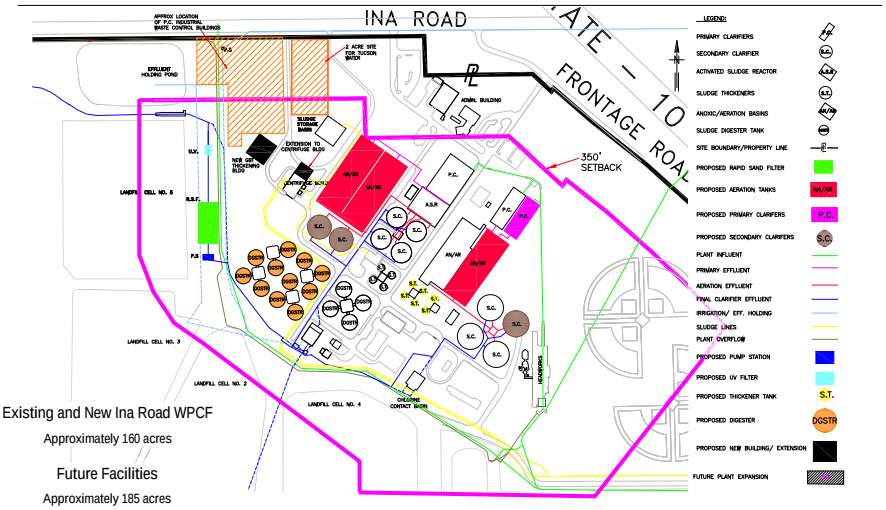
50-mgd Ina Road WPCF



Existing and New Ina Road WPCF

Approximately 160 acres

Future Facilities

Approximately 185 acres

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Project (2006) Costs

Description	Total Cost (2006) (x $1,000,000)
Roger Road	$234.8
Ina Road	$243.9
Plant Interconnect	$22.3
Total	$501.0
Misc. Electrical Service	$35.0

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Roger Road "Greenfield" 32-mgd – Project (2006)Construction Costs

Item	Description	Construction Cost (July 2006)
1	Demolition and Removal	$17,300,000
2	Influent Screenings	$3,000,000
3	Influent Grit	$2,000,000
4	Odor Control	$11,600,000
5	Primary Clarifiers	$15,400,000
6	Aeration Tanks	$57,400,000
7	Final Clarifiers	$20,200,000
8	PS to Filters/UV Disinfection	$1,800,000
9	Filters	$9,600,000
10	UV Disinfection	$11,700,000
11	Sludge Thickening & Dewatering Facilities	$2,200,000
12	Sludge Transfer Pump Station	$2,100,000
13	Sitework	$600,000
14	Paving	$700,000
15	Architectural	$13,900,000
16	Fence	$200,000
17	Irrigation / Landscaping	$500,000
	Subtotal	$170,200,000
	General Conditions, Overhead and Profit (18%)	$30,600,000
	Total	$200,800,000
	Contingency	$8,500,000
	Roger Road WWTP Construction Cost (July 2006)	$209,300,000

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Ina Road 50-mgd WPCF – Project (2006) Construction Costs

Item	Description	Construction Cost (July 2006)
1	New Influent Screenings Facility	$900,000
2	Odor Control	$13,300,000
3	Primary Clarifiers	$10,500,000
4	Aeration Tanks	$54,800,000
5	Final Clarifiers	$9,200,000
6	Pump Station to UV Disinfection	$3,000,000
7	Filters	$16,000,000
8	UV Disinfection	$23,900,000
9	Sludge Thickening & Dewatering Facilities	$10,200,000
10	Sludge Digestion Facilities	$21,900,000
11	Sitework	$400,000
12	Paving	$500,000
13	Architectural	$12,000,000
14	Irrigation / Landscaping	$200,000
	Subtotal	$176,800,000
	General Conditions, Overhead and Profit (18%)	$31,800,000
	Total	$208,600,000
	Contingency	$8,800,000
	Ina Road WPCF Construction Cost (July 2006)	$217,400,000

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Plant Interconnect – Project (2006) Construction Costs

Item	Description	Construction Cost (July 2006)
1	Interconnect Pipe	$17,400,000*
	General conditions, overhead and profit (18%)	$1,500,000*
	Total	$18,900,000*

*Does not include sludge pipe realignment nor property acquisition

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Miscellaneous Electrical Service Costs (2006)

Item	Cost
Roger Road	
Standby Power (4 megawatts)	
Construction	$6,000,000
Engineering	$1,000,000
Total	$7,000,000
Ina Road	
Power Generation Expansion/Upgrade (8 megawatts)	
Construction	$16,000,000
Engineering	$2,400,000
Total	$18,400,000
Miscellaneous Power	
Unify Power/Secondary Utility Feed Source – Ina Road	$9,600,000
Total	$35,000,000

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Engineering / Administrative Services

Engineering Services	Cost
Design	
Roger Road	$13,600,000
Ina Road	$14,200,000
Plant Interconnect	$1,800,000
Total	$29,600,000
Services During Construction (includes Resident Inspection)	
Roger Road	$11.900,000
Ina Road	$12,300,000
Plant Interconnect	$1,600,000
Total	$25,800,000

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Other Engineering / Administrative Services

- PCWMD administration
- Program management
- Construction management
- Real property
- Cultural resource
- Permits (under design/PCWMD admin)

Project Schedule and Costs

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Interconnect	**$22,300,000**															
Design		$1,338,000														
Construct				$20,962,000												
Ina Rd	**$243,900,000**															
Design 50 mgd		$14,634,000														
Construct 50 mgd						$212,193,000										
Construct Thermophilic Digestion														$17,073,000		
Roger Rd	**$234,800,000**															
Design 32 mgd			$12,660,000													
Construct 24 mgd							$148,755,000									
Demo Existing Plant									$23,800,000							
Construct 8 mgd											$49,585,000					

Total ROMP Projects Cost $501,000,000

Facilities After 2015

- 8 mgd at Roger Road WWTP
- Demolition/existing Roger Road Facility
- 2 GBT at Roger Road WTTP
- Mesophilic digester at Ina Road WPCF
- Centrifuge dewatering at Ina Road
- Thermophilic digesters at Ina Road

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Plant Interconnect Possible Construction Packages

- Plant interconnect (1 or 2 projects)

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Roger Road WWTP Possible Construction Packages

- Site preparation (temporary administration building)
- Headworks
- Bardenpho treatment (including clarifiers, solids thickening/pumping)
- Pump station/filtration
- UV disinfection

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Roger Road WWTP Possible Construction Packages *(continued)*

- Administration/control building
- Standby power generation
- Future 8-mgd Bardenpho system (including clarifier)
- Future gravity belt thickeners
- Existing Roger Road Facility demolition

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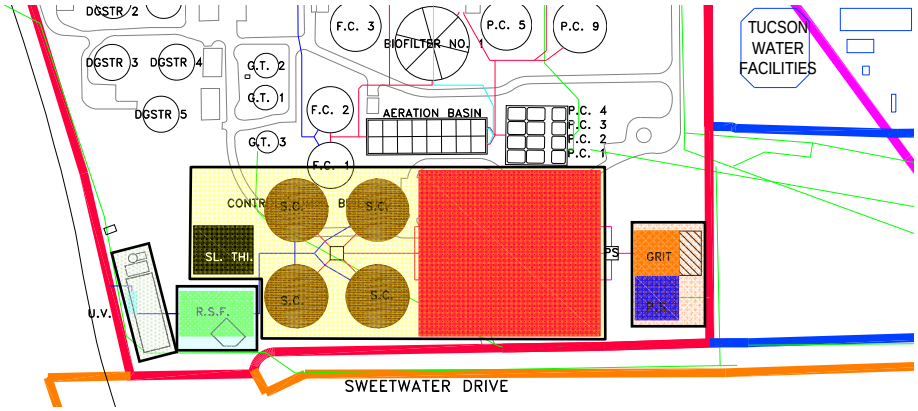
Roger Road – Construction Packages



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Ina Road WPCF Possible Construction Packages

- Site preparation
- Primary clarifier
- Bardenpho treatment (including clarifiers)
- Demolish HPO and oxygen system
- Mesophilic digestion (4 new, 4 existing)
- Gravity thickening (primary sludge)
- Gravity belt thickening (WAS sludge)
- Centrifuge dewatering
- Sludge storage

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Ina Road WPCF Possible Construction Packages *(continued)*

- Pump station/filtration
- UV disinfection
- Centralized laboratory
- Power unification/biogas power generation
- Future mesophilic digester
- Future centrifuge thickener
- Future thermophilic digesters

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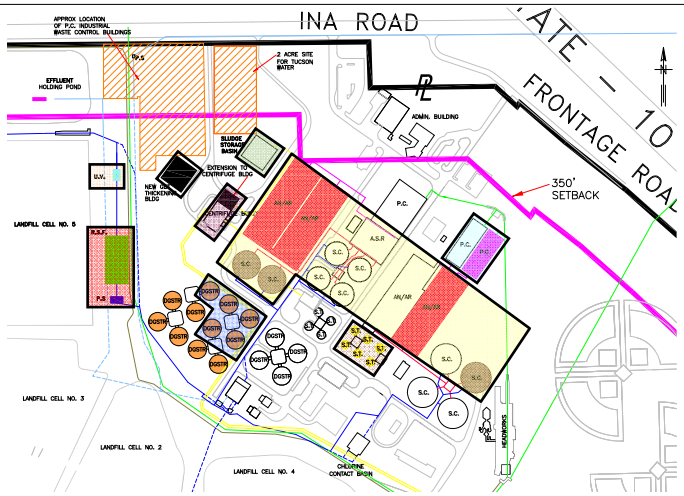
Ina Road Construction Packages



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CIP

Ed Curley

Non-Metro Facilities CIP – Next Five Years

Facility	FY	Activity
Avra Valley	2008/09	4.0 MGD Expansion
Corona de Tucson	2011/12	1.0 MGD Expansion
Green Valley	2009/10	2.0 MGD Expansion
Marana	2009/10	1.5 MGD Expansion
Mt. Lemmon	2009/10	Treatment/Conveyance Enhancements
Fairgrounds		Connection to SE Interceptor

CIP Number			Budget FY 06-07 Total	Projected FY 06-07 Total	FY 07-08 Total	FY 08-09 Total	FY 09-10 Total	FY 10-11 Total	FY 11-12 Total	Includes Total SDF
	1997 Bonds									
WL-91-001	Ina Rd WPCF Proc Chg & Exp to 37.5 mgd		$1,012,603	$612,603	$400,000					
WL-97-4L3	Tanque Verde Int., Craycroft-Tucson Country Club		$187,762	$187,762	$250,000	$3,219,487				
WL-87-427	Arivaca Junction WWTF Sewer Extension			$0	$471,000	$2,071,000				
	2004 Bonds									
WL-04-603	Santa Cruz Interceptor, Prince-Franklin (Phase II & III)		$2,537,713	$4,572,745	$22,469,787	$12,113,935				$14,477,863
WL-04-610	New Marana WWTF Expansion BNROD		$4,250,000	$7,303,860	$10,300,000	$9,752,859				$18,332,105
WL-04-611	Avra Valley BNROD Expansion to 4 MGD		$3,174,042	$4,974,664	$30,324,000	$9,711,000				$20,089,813
WL-04-605	Tanque Verde Int., Craycroft-Tucson Country Club					$2,682,762	$2,905,738			
WL-04-606	Marana Regional Airport Sewer Connection		$290,000	$280,000	$2,520,000					
WL-04-612	Mt. Lemmon Sewer System		$250,000	$250,000	$250,000	$500,000	$3,000,000	$3,192,082		
	Conveyance Rehabilitation		$4,538,275	$4,679,031	$3,000,000	$2,000,000	$2,048,394			
	Roger Road Rehabilitation - Includes JOC		$7,751,027	$10,163,791	$5,419,364	$3,947,699				
	2004 Bonds ROMP									
WL-05-0L4	SCR Basin Ina/Roger Rd N4N Imp Study/ROMP (Not in $501 M)		$1,399,996	$1,349,996	$400,000					
WL-04-607	Ina Road N4N - Design Plants				$9,427,417	$1,290,822				
WL-04-607	Roger Road N4N - Design Plants				$3,434,355	$645,411				
WL-04-604	Plant Interconnect - Roger Rd. WWTF to Ina Rd WPCF		$345,000	$362,250	$1,102,500	$9,729,838	$11,179,011			
	2008 Bonds									
	Park & 19th	($35 Million)					$5,000,000	$15,000,000	$15,000,000	
	Conveyance	($25 Million)				$4,000,000	$4,000,000	$4,000,000	$4,000,000	
	Treatment Capacity Includes: Green Valley/Marana	($50 Million)				$2,000,000	$15,500,000	$15,500,000	$17,000,000	
	Ina Electrical	($35 Million)					$5,000,000	$15,000,000	$15,000,000	
	Ina/Roger NDN	($110 Million)				-	-	-	-	
	Biosolids Improvement	($40 Million)				-	-	-	-	
	Ina Lab	($20 Million)				-	-	-	-	
	Odor Control	($40 Million)				-	-	-	-	
	ROMP Subtotal					$34,851,042	$51,026,625	$84,908,129	$128,777,467	
	ROMP Total with 2004 Bonds (Inflated $501) Through FY11/12			$362,250	$13,964,272	$46,517,113	$62,205,636	$84,908,129	$128,777,467	
	System Development Fund									
	Treatment		$7,915,473	$10,190,055	$3,202,279	$665,000				
	Conveyance		$409,034	$270,155	$1,793,526	$564,113	$2,330,300			
	Stream Crossings - Flood Protection		$1,305,982	$982,034	$1,756,744	$4,409,193				
	Pump Stations		$270,856	$295,856	$1,594,000	$1,100,000	$1,100,000	$1,100,000	$1,100,000	
	ADOT, PCDOT, COT DOT			$165,000	$4,591,356	$250,000	$250,000	$3,250,000	$5,250,000	
WL-00-3L1	Marana Colonia Project Sewer/Rodeo, Hunen Hgts. (Reimbursable)		$881,592	$881,592						
WL-03-4L1	New Federal Prison Sewer System (Reimbursable)		$5,387,122	$5,387,122	$2,000,000					
	Total Projects in CIP		**$41,906,477**	**$52,888,516**	**$104,706,328**	**$105,504,161**	**$103,340,068**	**$141,950,211**	**$186,127,467**	

								Total
1997 & 2004 BONDS	$33,936,337	$66,482,202	$20,321,333	$16,021,050	$1,908,560	$0	$0	$138,669,482
2008 BONDS	$0	$0	$6,000,000	$80,526,625	$134,408,129	$179,777,467	$0	$400,712,221
Reimbursable	$6,268,714	$2,000,000	$0	$0	$0	$0	$0	$8,268,714
SDF	$12,683,465	$36,224,126	$79,182,828	$6,792,393	$5,833,522	$6,350,000	$0	$146,866,334
TOTAL	**$52,888,516**	**$104,706,328**	**$105,504,161**	**$103,340,068**	**$141,950,211**	**$186,127,467**	**$0**	**$694,516,751**

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Project Delivery Alternatives and Selection Criteria

Eric Petersen

Overview

- 3 major projects: Roger Road, Ina Road, plant interconnect
- Other CIP projects
- Review of alternative project delivery method options
- Criteria for delivery method selection

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Alternative Project Delivery Methods

- Primary
  - Design-Build
  - Design-Build-Operate
  - Construction-Manager-at-Risk
- Others
  - Design-Bid-Build
  - Job-Order-Contracting

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Design-Build (1): Description

- Single entry contracts for both design and construction
- Fixed design-build price
- Competitive proposal process
- Multiple evaluation factors
- Design requirements
- Performance standards
- Acceptance test
- Proven in Arizona and nationally

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Design-Build (2): Advantages

- One point of responsibility
- Substantial risk transfer
- Prequalification of contractor
- Willingness of proposers to invest
- Competition on factors other than price
- Collaboration on design and construction
- Early stage, lower cost price certainty
- Schedule compression
- Minimization of change orders

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Design-Build (3): Disadvantages

- Less control over design details
- Less familiarity
- Lack of long-term vested interest by DB contractor
- Possibility of smaller number of competitors
- More complex selection
- More involved negotiations

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Design-Build-Operate (1): Description

- Single entity contracts for design, construction and operation
- Design requirements and acceptance test
- Long term operation and maintenance
- Long term repair and replacement
- Fixed operation and maintenance fee
- Performance guarantees
- Law compliance
- Workforce protection practices

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Design-Build-Operate (2): Advantages

- Design-build advantages apply
- Operator-driven design
- Long term performance risk transfer
- Long term operating cost risk transfer
- Strong companies
- Control by contract

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Design-Build-Operate (3): Disadvantages

- Design-build disadvantages apply
- Workforce not under direct county management
- Limited market
- Clear definition of service and workscope required

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Risk Transfer (1): Any Method

- Risks retained under any delivery method
  - Changes in law
  - Force majeure
  - Unusual influent parameters
  - Pre-existing site and environmental conditions
  - Buried infrastructure conditions
  - General price inflation

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Risk Transfer (2): DB/DBO

- Permitting risks
  - Terms and conditions
  - Delays
  - Non-issuance
  - Permitting cost overruns
  - Limitations

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Risk Transfer (3): DB/DBO

- Design risks
- Design liability
- Design cost overruns
- Technological obsolescence
- Securing patents and licenses

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Risk Transfer (4): DB/DBO

- Construction risks
- Completion risk (delay and efficacy)
- Construction cost overruns
- Disputes between designer and builder
- Labor relations

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Risk Transfer (5): DBO Only

- Operation and maintenance risks
- O&M cost overruns
- Regulatory compliance
- Capital maintenance
- Excess electricity consumption
- Market conditions affecting sludge disposal
- Labor relations

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Construction Manager At Risk (1): Description

- Separate Contracts for design and construction
- Select both on qualifications basis
- Specialized CM firms or general contractors
- Price not involved unless GMP offered later
- CM prepares bid packages and supervises construction performance
- Contractors contract with County when CM is agent

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Construction Manager At Risk (2): Advantages

- Professional selection of construction interface
- Guaranteed maximum price possible
- Design phase assistance
- Delivery schedule
- Complete control of design

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Construction Manager At Risk (3): Disadvantages

- Multiple Points of Responsibility
- Retention of Design Liability
- No Design Competition
- No Constructability Competition
- Limited Life Cycle Cost Considerations
- Degree of Design Conservatism

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Process in Arizona – RFQ

- Selection committee
- Request for qualifications (RFQ)
- Create short-list based on criteria published in RFQ
- Short-list may contain only 3 firms
- Negotiate with the most qualified firm on the RFQ short-list

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Process in Arizona – RFQ

- RFP is distributed to every firm on the RFQ short-list
- RFP contains scoring method
- Submittals contain separate technical and price proposals (option of preliminary and final)
- Award based on highest score
- Honorarium

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Criteria for Selection of Project Delivery Method

- Considerations
  - Procurement process
  - Design and construction
  - Operation and maintenance

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Procurement Process Considerations

- County familiarity and experience with the project delivery method
- Transactional and engineering costs for conducting the procurement process
- Stage at which actual project costs are known
- Schedule: Time to commencement of construction
- Depth and quality of contractor market
- Selection process complexity
- Likelihood of re-design and re-bid

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Design and Construction Considerations (1)

- Possibility of selections based on performance and qualifications
- Risk of disputes between owner-governmental agency, designer and builder
- Schedule: Time to completion of construction
- Degree of Owner-governmental agency design control
- Degree of design and construction competition and innovation

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Design and Construction Considerations (2)

- Transfer of design, construction and acceptance liability
- Degree of design conservatism
- Suitability for "Greenfield" projects
- Suitability for modifying and expanding existing treatment facilities
- Suitability for pipeline and transmission facilities
- Guaranteed permit compliance

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Design and Construction Considerations (3)

- Total contract price for design and construction
- Construction monitoring costs
- Likelihood of bid/proposal protests
- Likelihood of change orders

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Operation and Maintenance Considerations

- Direct versus contract control over project operations
- Guaranteed operational performance
- Guaranteed regulatory compliance
- Overall 20-year life cycle costs of the project
- Guaranteed operating and maintenance costs
- Operational integration with entire wastewater system

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Alternative Project Delivery in Practice

- Industry trends
- Contractor market
- Representative projects

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Alternative Project Delivery Industry Trendlines

- Extensive use in private sector
- Cooperation among participants permissible and desirable
- Life-cycle cost perspective
- Design build industry growth
- Long term contracts
- Substantial risk transfer
- Company consolidation
- Full labor protection

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Contractor Market

- Deep and international
- Investment grade credit companies
- Intense competition benefits municipalities
- Single, strong guarantor guarantees entire contract
- Surety role
- Worldwide research and development
- Operate dozens of plants
- Active commitment to market
- Excellent performance record

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Representative Projects

- Phoenix (AZ)
- Lawrence (MA)
- Fulton County (GA)
- Cranston (RI)
- Seattle (WA)
- Lynn (MA)
- Washington Borough (NJ)
- Springfield (MA)
- MWRA (MA)
- Naugatuck (CT)

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Phoenix (AZ)

- Lake Pleasant Water Treatment Plant – "Greenfield"
- 80 mgd, expandable to 320 mgd
- DBO chosen after alternative delivery methods study
- Sixth plant; current system remains publicly managed
- 15-year contract with renewal options
- RFQ (3 firms only), RFP process under new law
- Construction permit risk shifted to company

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Lawrence (MA)

- New, replacement 15-mgd Water Treatment Plant
- Mandated by consent decree
- RFEI, RFP process under special legislation
- Pilot testing after contract execution
- Fiscal constraints mandate no rate rise
- Highly automated plant reduces O&M costs
- Meter replacement program increases revenues

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Fulton County (GA)

- 23-mgd Camp Creek Wastewater Treatment Plant
- Expansion and treatment upgrade
- Renewal permit driven
- Vendor option to build new plant or make old plant improvement
- Modest labor protection
- Sludge included - landfill/land application
- First project under new omnibus
- DBO law

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Cranston (RI)

- 25-year 23-mgd wastewater operations
- Maintenance, repair, replacement
- Ten capital improvements DBO
- Tertiary treatment DBO – consent decree
- Industrial pretreatment program
- Collection system responsibility
- $48 million concession fee
- Private financing of improvements

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Seattle (WA)

- New 120-mgd Tolt River Water Plant
- Design-build-operate
- Maintain-repair-replace
- Cascade mountain reservoir source
- 88 water quality parameters guaranteed
- Current law plus enhanced standards
- Letter of credit secured company credit decline
- Success inspired Cedar River
- DBO project

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Lynn (MA)

- CSO judicial consent decree from 1990
- "Storage, pump-back" mandated
- DEP, EPA active assistance
- First in nation "DBO" for a "CSO"
- All technical approaches allowed
- Vendors proposed total sewer separation
- New sewers, not new storm drains
- Subsurface risk constrained
- Spread out construction avoided
- "Rate spike"

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Washington Borough (NJ)

- Small size (1 mgd)
- Greenfield wastewater project
- Traditional DBB bids vs. new DBO proposals
- DBO proposal won
- Major companies participated

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Springfield (MA)

- Large (64 mgd) existing wastewater plant
- Newly formed W&S commission
- Company took as-is risk, capital risk
- Company performs existing sludge compost contract
- Company takes sludge product marketing risk
- Odor event fines and termination
- Vigorous management plan response
- To competition

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MWRA (MA)

- Norembega covered water storage tank
- Design-build with 5 year warranty
- Municipal financing, operation, maintenance, repair
- Strict, detailed design requirements
- Construction contractor – driven proposal, guaranty
- 70% price, 30% technical selection
- Extended warranty

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Naugatuck (CT)

- 10-mgd existing regional wastewater plant
- Uniroyal Corp. – current operator, 50% influent
- Sludge is incinerated; excess capacity
- "Zero" user fee rate, historically
- Mandatory improvements - tertiary treatment, incinerator upgrades
- 20 year O/M/R/R contract
- "Merchant plant" allows
- Continuation of no/low rates

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Cost Savings (DBO vs. DBB "Baseline")

City	Type	Savings
Fulton County, GA	WW	$30M
Lynn, MA	WW	$150M
Cranston, RI	WW	$50M
Seattle, WA	W	$75M
Phoenix, AZ	W	$25M

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Next Steps

- Confirm of selection criteria
- Apply criteria to projects
- Determine delivery method for each project
- Relate to sequencing and financing
- Reflect analysis and determination in final report

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Summary

Andy Richardson

Workshop #14 Meeting Notes
First Draft of Report Study Workshop

1. The First Draft of Report Study Workshop for Pima County Regional Optimization Master Plan was held on February 21, 2007. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
Jeff Nichols
PCWMD Staff
Dave Bartos
Ed Curley
Laura Fairbanks (afternoon)
Frank Gall
Dave Garret
Mary Hamilton
Michael Kostrzewski
Mike Lueken
Byron McMillan
John Munden
Ron Riska, Project Manager
John Sherlock
Jack Van Riper
John Warner
Ken Weber
Legal
Chuck Wesselhoff

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Tim Thomure

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Gordon Culp
Joe Popeck
Andy Richardson
Vic Smith

2. Major topics of the workshop were:

- Workshop #14: First Draft of Report Study
  - Review of Chapters – 1 through 13
  - Green Power
  - Outlying Area wastewater treatment process
  - Biosolids handling/disposal
  - Enhanced chlorination

A set of handouts were provided to each attendee at the workshop. Throughout the workshop a set of notes were recorded on "flip-charts." Those notes summarize questions, comments and notes to be utilized by the project team while conducting the study. The flip chart notes are included at the end of the meeting notes.

3. Mike Gritzuk welcomed the attendees to the workshop and invited the workshop to begin.

4. Andy Richardson quickly outlined the meeting topics and objectives. He further elaborated on his role as facilitator and encouraged all to participate. The workshop objectives were to preview the rough draft of the report, identify unsettled issues and get to closure where possible. Yet to come are the financing plan, delivery method and implementation plan. Attendees were reminded to send their comments to Ron Riska who will compile them and forward them to Greeley and Hansen. For unsettled issues the plan is to have several small group meetings in the next few weeks on topics, such as, outlying facilities wastewater treatment processes, biosolids handling/disposal, disinfection and delivery methods. It will be decided later who will be involved in each of these meetings and when they will be held.

   Overview, agenda, meeting objectives, and ground rules were covered on pages 1 through 4 of the handout.

5. Jerry Bish reviewed the purpose and summarized the content of Chapter 1. It was noted that information relating to the outlying facilities, conveyance system evaluation and CIP development were incomplete. Paul Bennett indicated that the financial study needed to be referenced in Chapter 1. Further the financial plan needs to be added to Chapter 12 and that chapter title re-titled to reference the financial plan. Melodee Loyer stated that there is a reference in Chapter 1 that the water reuse facilities at Roger Road will be decommissioned. That needs to be changed to only the filters will be decommissioned. Mike Gritzuk stated that the use of "Greenfield" is a confusing term. The term to use in the report for the new Roger Road plant will be the "Water Reclamation Facility." Jackson Jenkins suggested that a list of acronyms and definitions would be very useful to the reader. Further, it was agreed to use "outlying", not "non-metro" facilities for the satellite plants. Ed Curley stated that a better description of why the County was doing this evaluation (e.g., to meet nutrient removal goals) is needed. The strategic goals, such as, meeting ammonia toxicity requirements, odor/noise control, aesthetics and good neighbor should be listed in the chapter.

   Review of Chapter 1 was covered on pages 5 and 6 of the handout.

6. Chapter 2 on regulatory requirements was summarized by Jerry Bish. Byron McMillan wanted to make sure the plants meet the 350-foot setback requirements. This is especially important at Ina Road WPCF for odor and noise considerations. Further state in the report that the new parts of Ina Road WPCF will have odor and noise control. The response is that the Ina Road WPCF will be described with odor and noise control features and will be shown with a 350-foot setback. Melodee Loyer asked why the use of CAP water by Tucson Water affects County treatment permits at Roger Road as stated on page 2.8 of the report. Ron Riska offered that the plant effluent may be considered as an augmentation to CAP water at some distance future. Would it not also affect Ina Road WPCF effluent? Report calls it a key issue but is it? The question is how much detail should be presented on this topic is an issue, and will be reviewed after the workshop. Mary Hamilton asked if the strategies to be developed will be identified in this chapter. Ed Curley indicated that the strategies to be developed should be listed in one place and not scattered in different places. Melodee Loyer pointed out that section 2.9 calls for 11 mgd for reuse (in 2006); the text needs to clarify the timing.

   Review of Chapter 2 was covered on pages 6 and 7 of the handout

7. Chapter 3 was summarized by Joe Popeck. Jackson Jenkins stated that permanent electrical upgrades for Roger Road were estimated to be at more than $10 million. With the decision to build a new Roger Road plant, interim electrical improvements will be implemented which will cost $4 million. The report should say that $6 million has been saved. Byron McMillan asked what will be the new power supply at the Roger Road Water Reclamation Facility. The response was that two new utility feeds will be provided, one for redundancy. Jack Van Riper asked what if power from both feeds is lost. For this on-site generators are provided as backup to critical process elements. Mike Gritzuk indicated that several issues related to digester gas need to be addressed. This will be discussed later under the topic of green power.

   Ron Riska was apprehensive about the information in the report on the condition of the existing Roger Road plant. John Sherlock offered that the condition has to be mentioned, because it is part of the rationale for justifying a new Water Reclamation Facility at Roger Road. Jack Van Riper stated that the general condition of Roger Road WWTP is good but it is not compatible with upgrading to the technology needed to meet new treatment standards. Mike Gritzuk indicated that it needs to be clear why we are going to a new Water Reclamation Facility, which relates to risks and compliance. It is important to note that Pima County is not cutting back on maintenance at Roger Road WWTP pending the new plant. PCWMD is doing whatever is necessary to keep the Roger Road WWTP in compliance. Jackson Jenkins expressed a concern about the condition of the electrical equipment at Ina Road WPCF. Further, along with the electrical equipment condition issue there needs to be a decision on the use of biogas and future use of existing generation facilities.

   The Chapter 3 review was covered on pages 7 through 10 of the handout

8. Joe Popeck covered the salient features of the overall treatment strategy as written in Chapter 4. Melodee Loyer observed that under Transfer Some description the text implies that all the water needed at Roger Road for reuse will be generated at the Roger Road facility. This is not the case and will need clarification. Further, the 30 mgd/20 mgd split of effluent for reuse at Roger Road and Ina Road, respectively, occurs in year 2030. Jackson Jenkins noted that 3 mgd of the reuse water comes from Randolph Park WRF. Further, Jackson Jenkins noted that facilities do not exist to transfer reclaimed water from Ina Road to Roger Road. Melodee Loyer reminded the group that 10 mgd can be transferred through an existing Tucson Water reuse pipeline when the facilities are available at Ina Road

   Mike Gritzuk observed that for risk related costs to rehabilitate the existing Roger Road the County has been using numbers lower than the $50 to $80 million shown. These values need to be checked. Dave Garrett asked if the 8-inch sludge line from Roger Road to Ina Road will be kept. The response was yes it is part of the sludge handling strategy between plants. John Munden asked what peak flow is the Roger Road Water Reclamation Facility sized for? The answer is 64 mgd, or 2 times average flow. John Munden confirmed that the plant interconnect would be a gravity line and asked how will the solids keep from settling at low flow? This will be discussed later under the chapter on conveyance. John Munden asked how the headworks at Roger Road were sized. The plan is to provide headworks at Roger Road to treat the flows to the Water Reclamation Facility at Roger Road.

Melodee noted that the area shown at Ina Road for Tucson Water facilities was inadequate. Tucson Water is looking for 10 acres. Mike Gritzuk indicated that 10 acres was for reuse water treatment facilities, but since Ina Road will produce Class A+ water that that much land should not be needed. Melodee Loyer indicated they need room for a reservoir and pumping station. The final acreage for Tucson Water will need to be resolved outside the workshop. Tucson Water will need to prepare some layouts of their facilities. Melodee Loyer indicated that Tucson Water will be getting A+ water before they can show a layout.

Paul Bennett noted that a needed warehouse at Ina Road WPCF was not shown. The warehouse will be added to an enhanced site plan layout for the site along with the additional overflow basin. Dave Garrett also indicated a need for the odor control and solids removal at the overflow basins.

Frank Gall asked if the headworks at Ina Road were sized for a peaking factor of 2. The response was yes, but Dave Garret indicated that the current screenings compactors were not sized to deal with the peak flow, but should be.

Frank Gall asked how were the side streams handled at Ina Road WWTP? The response was that the side streams were being returned ahead of primary settling. Mass balances were used in sizing the process units to account for side streams. It was suggested to change “most reliable” to “most viable” when describing Bardenpho. It was stated that the existing 12.5 mgd BNRAS plant will be modified to the Bardenpho process.

Frank Gall asked how were the turbidity units of less than 2 NTUs going to be accomplished. Response was by using rapid sand filters. The exact type of filters is not established, it may be deep bed, could be continuous backwash. A related issue is whether the non-detect fecal coliform standards can be met without filtration. Byron McMillan suggested removing the turbidity goal of 2 NTUs from effluent standard until the disinfection process is resolved.

When flow is at 80% of capacity, ADEQ requires the County to have a plan to expand the plant. The County will need to monitor flows relative to 80% of capacity so an appropriate plan can be developed and submitted to ADEQ. This needs to be stated in Chapter 2. The report shows how the plants can be expanded beyond the total of 82 mgd. It was further noted that under the first phase with Roger Road at 24 mgd and Ina Road at 50 mgd that the County will already be beyond the 80% of capacity.

Ron Riska stated that the general basis of design for the Roger Road Water Reclamation Facility, the 50 mgd Ina Road WPCF and the plant interconnect line be included in an Appendix to the master plan report.

Review of Chapter 4 – Overall Treatment Strategy was covered on pages 10 through 20 of the handout

9. Biosolids handling and treatment are covered in Chapter 5 and was summarized by Jerry Bish. David Bartos noted that at Ina Road that waste activated sludge goes to dissolved air flotation units and the figure showing this needs to be corrected. Currently, there is a problem with detention time in the digesters at Roger Road when one of the four digesters is out of service. It was suggested that a fifth digester be provided as backup. Also, there is a need to consider a

backup at Ina Road when a digester is out of service. John Sherlock cautioned that the need for another digester at Ina Road needs to be considered soon. The master plan is a plan for the future and it would be wise to get ahead of the biosolids system needs. For digestion the plant permit has both volatile solids destruction and detention time requirements.

Frank Gall asked at what outlying facilities plant size does hauling of sludge stop and processing onsite begin? This topic will be discussed later in the workshop. Paul Bennett wants a recommendation to stop hauling biosolids based on economics.

Ed Curley suggested that Section 5.8.2 in the report lacks an understanding of the national scene. For example, California is abandoning land application. A need is to look at farm land being used, the existing contract and other farm land available in the future. If all of these aspects are covered, more critical to address Class A than document leads you to believe. Jackson Jenkins offered that Class A processes will make more gas and green credits, which may drive the County to Class A sooner. John Sherlock added that backup plans are needed in case 503 regulations (EPA biosolids requirements) change suddenly or farm sites become unavailable. Need footprint and plan that will accommodate a backup. John Sherlock wants a clear relationship between power production and sludge processing. It was offered that a discussion on struvite control will be added to the report.

Review of Chapter 5 was covered on pages 20 through 25 of the handout

10. Chapter 6 on conveyance was summarized by Jerry Bish. Mike Bunch stated that the County got a CMOM permit for the collection system in November. This will be included in Chapter 2 and referenced in Chapter 6. Mike Bunch also offered that based on a recent meeting on the N. Rillito Interceptor (NRI) reviewing capacity during wet weather, the plant interconnect line needs to be constructed as soon as possible. Conveyance is looking at operating modifications to maximize flow through the NRI along with some capital project fixes to improve capacity. Because of the NRI situation Mike Gritzuk asked if the County is in violation of CMOM. Mike Bunch stated no, because CMOM allows 10 years to fix known problem areas. Ron Riska volunteered that conveyance was also developing a best management practices for the NRI.

Ron Riska indicated that a recent hydrology based conveyance system modeling study needs to mentioned in Chapter 6. Ed Curley indicated that in section 6.5.3.1 that the interstate I-10 and 18th Street area should mention since the bond and remediation plan is in place. There is a $35 million bond issue for remediation. Byron McMillan suggested adding odor control to the CMOM issues. In the slide for standardized rule the year was shown as 2008. John Warner indicated that the rule became law on Nov 14, 2005.

In response to an earlier question on scour velocity at flows of 4 to 5 mgd, plant interconnect flow velocities will be greater than 2.5 feet per second, which should be enough to prevent solids from settling out. Depending on the final design configuration there may be an issue with solids deposition in the siphon at low flows that may require operator attention Mike Gritzuk asked how the existing sludge line in the interconnect right-of-way was going to be addressed? The response was that the sludge line will be relocated in places where it crosses the plant interconnect line. This will be a design detail.

Mike Bunch asked how much will the augmentation projects affect the CIP budget? Ed Curley indicated that it will add about $25 million. The budget has $3 million per year. Some place holder projects may be replaced by these augmentation projects. Mike Bunch indicated that $180 million is identified in a rehabilitation program Mike Bunch also indicated that there is a need to break out projects addressing regulatory requirements, rehabilitation and capacity into separate categories. If not enough dollars are available, the County will first do regulatory projects, then rehabilitation, and then capacity projects in that priority. Ron Riska indicated that some costs on the CIP schedule looked a bit squirrelly. The table needs to be checked. John Warner stated that the hydraulic evaluation in the report does not indicate much surcharging. But when he looks in manholes at times of high flow, he can't see the pipe. He expected to see more red flags. The reaches where these visual observations of surcharge occur need to be identified for the report.

Review of Chapter 6 was covered on pages 25 through 29 of the handout.

11. The recommended treatment plant plan is developed in Chapter 7 and was summarized by Joe Popeck. Mike Gritzuk asked if Ina Road could be expanded beyond 50 mgd? The response is yes, but the space will occupy the current Sports Park. Mike Gritzuk asked why there are primary settling tanks (primaries) at Ina Road WPCF, but not at the Roger Road Water Reclamation Facility. The answer was that the influent characteristics are different at Ina Road which is affected by sludge recycle. There is no sludge processing is at Roger Road. The primaries are needed to avoid separate side-stream treatment. Jim Doyle concurred with the process arrangement at Roger Road and Ina Road. It was further offered that the primaries could in the future be replaced with fine screens and then converted to some other use, such as, anoxic basins. Leaving the primaries in place for now provides for conservative space planning.

It was noted that not all of the support facilities are shown on the layouts. A small group meeting will be required to define support facilities. All of the facilities need to be shown on the layouts including the lab, personnel facilities and covered parking.

Mike Gritzuk asked if regulations require standby power. The answer is a yes and two (2) independent power feeds can meet this requirement, but many utilities are looking at standby generation as more reliable. Byron McMillan stated that under the Ina Road WPCF air quality permits, if a new generator is added, the old generators will fall under new source requirements and will probably have to be replaced. The cost to replace all of the engine generator sets is $10 million. It was suggested that it may be possible to separately permit the new generators.

The plan shows TPAD for Class A sludge, largest footprint of Class A options and is a place holder. Heat drying might be selected instead or some other method depending on markets for biosolids at the time the final decision is made. John Sherlock indicated that Cambi process is pre-digestion and would save on digester volume needed.

Mike Gritzuk asked if the architectural and landscaping themes will be the same for Ina Road and the Roger Road Water Reclamation Facility. The response is not necessarily. At Ina Road the existing facility needs to be considered. At The Roger Road Water Reclamation Facility the need is to consider uses at adjacent park. Mike Gritzuk asked where does architectural concept development stand? Ron Riska indicated there was a proposal from Greeley and Hansen to develop the architectural themes.

Mike Gritzuk indicated that there has been some public criticism that the County was just moving the odor problem from Roger Road to Ina Road by moving all sludge processing to Ina Road. This needs to be addressed in the report.

Review of Chapter 7 was covered on pages 29 through 37 of the handout.

12. The next chapter covered in the workshop was Chapter 10. Jerry Bish addressed its purpose and summarized the content. Mike Gritzuk noted that UV was included as a CIP element. This needs to be addressed consistently throughout the report once the disinfection issue is resolved. Ed Curley further indicated that other CIP elements beyond those listed such as conveyance augmentation and rehabilitation need to be added. Ron Riska indicated that follow-up meetings will need to be scheduled to address enhanced chlorination/de-chlorination, biogas power, biosolids, collection system rehabilitation/augmentation, project delivery method, and Ina Road and Roger Road site plans.

    It was asked if the nomenclature for grouping of outlying facilities as south region, southeast region, southwest region was okay. No comments were made, but will need to be decided at some point. Mike Bunch asked about the future of the Fairgrounds WWTP. The Fairground WWTP is slated to be decommissioned in the future.

    Jim Doyle asked if the plan is to thicken waste activated sludge (WAS) at the Roger Road Water Reclamation Facility. The response is yes, WAS will be thicken to 3% solids. This is required because of capacity of 8-inch sludge line. Jim Doyle offered why not put all the WAS into the interconnect line without thickening. Nitrate in sludge may help odor control in plant interconnect line. This is an option, but in any case, the plant interconnect line is the backup plan for the sludge line. On the site plan space will be reserved for WAS thickening, but note an option to use the plant interconnect line.

    Mike Gritzuk thought that the existing sludge line will go away. Paul Bennett indicated that this is a timing issue. Plant interconnect line will be constructed in 2009-2010 which will require that sludge line remain in service. John Sherlock suggested that the 8-inch line could be used for moving reclaimed water. Melodee Loyer stated that the 8-inch line will move only a small amount of water compared to existing 24-inch reclaimed water line. Maybe could use 8-inch line to pull fiber optic lines.

    Mike Bunch asked if the HAMP is mentioned? The response is yes under the conveyance section of the report. Ed Curley noted that a developer financed Swan Southland plant in the SE region may turn out to be the Southland plant.

    Review of Chapter 10 was covered on pages 48 through 50 of the handout

13. Chapter 11, alternative project delivery systems, was outlined by Jerry Bish. Melodee Loyer indicated that Tucson Water desires to be involved in alternative delivery discussions because there will be interconnections between their system and the wastewater system. Need to include interconnections in scope for designers and contractors. Mike Bunch asked if recommendations were going to be made on which delivery methods to use? The answer is yes, for each project.

The project size will be tailored to the construction market. The recommendations will include a recommendation for each project and discussion of what other project delivery methods could work.

Mike Gritzuk emphasized that a detailed implementation plan is wanted showing all contracts with delivery method for each with schedule for each for procurement, design, construction, startup over the next 15 years. John Warner asked if project size will limit competition? Under current construction contracting conditions, bonding problems will occur for contractors when project sizes exceed $350 million. To get competition, may need to keep project packages about $100 million. In today's construction climate the County may need to market projects to contractors to get effective competition.

Review of Chapter 11 was covered on pages 50 through 52 of the handout.

14. Chapter 12 review was covered by Jerry Bish Melodee Loyer opined that the facilities for Tucson Water at Ina Road will be under construction at the same time as the wastewater facilities. The plan should be clear that there will be simultaneous construction and contractors will be crawling all over each other.

Paul Bennett stated that there is a need to express what rates are needed to fund bonds. Board of Supervisors need to know that approving a $100 million project implicitly means approving rates to support $100 million in bonds. Jeff Nichols indicated that the County contract language says that as of July 1 each year, if funds are not approved, contract stops. Financial plan must identify financial needs, when bond issues are needed and what are the rate impacts. Need to see $501 million program as unified program so that it is not piecemealed. Nothing can go away in the $501 million package – can not do like in the past where wastewater department has asked for a 10% rate increase and given 6% and thus have to eliminate low priority projects. All the pieces are needed to make this work.

Review of Chapter 12 was covered on pages 53 of the handout.

15. Vic Smith presented information on green power and the engine generators at Ina Road. John Munden asked if Pima County can we use all the heat produced from the engines in this climate? The answer is yes for heating the digesters and for plant cooling. Paul Bennett asked if parts are available for the existing Ina Road generators. The answer is yes that Waukesha still make parts for these units. Mike Kostrzewski asked if you run out of biogas, do not buy natural gas and don't run an extra engine just for the heat? The answer is yes that is the most economical approach.

Jackson Jenkins stated that a clean up of the digester gas is needed at Ina Road and there is no machining tolerance left in the existing units because of all the re-machining that has been done. Furthermore, premature failure of the new replacement engine occurred at 7,000 hours vs. 40,000 hours expected has left Pima County with no confidence in the existing system operations. Vic Smith stated that the engines need to run at 80% of capacity, but are only running about 20%, this is hard on the engines and the existing gas conditioning dryer is inadequate. Mike Gritzuk asked if the plant needs to run on biogas and replace the generators? The response is yes, the plant would be better off replacing the generators. Mike Gritzuk followed up by asking why there is a

big difference between the capital cost of biogas and natural gas? In response the costs are based on 3 MW more power generation with natural gas to meet the entire plant needs, which would require new facilities, not just replacing generator and engine sets.

Jackson Jenkins stated that siloxane has been present for many years, but asked why the sudden increase in problems. Response is the changes in the base component of cosmetics. Manufacturers are using more siloxane with a marked increase in the last 5 to 6 years. Clean-up of the gas for hydrogen sulfide and siloxane will decrease maintenance requirements and would improve operation, but maintenance has been a problem. Replacement prototype from Waukesha is considered a failure. The plant can barely run 2 of 5 engines from the biogas.

Base case option -- refurbish Ina Road power plant, a major rehab. Next step up would be a "zero time" approach where the facility is replaced. Dave Garret asked if the savings shown are with digester gas only? The response is yes, but there would still be savings with a natural gas supplement, but less savings. Jackson Jenkins indicated that more information is needed to be convinced.

Mike Gritzuk inferred from the presentation that there does not appear to be an advantage to a third party approach. It was confirmed that this is correct for on-site generation, but the gas could be sent off site for green power credits. Further, Mike Gritzuk asked if green power credits would work equally for a private party and the County. The response is not exactly. Tucson Electric Power (TEP) will give County credit for only two-thirds of gas currently lost at Roger Road, which would be an incentive of $355,000 per year. Third party would get an $1.5 million incentive. Saving advantage is to use all biogas at Ina Road. There is less savings with the use of natural gas compared to commercial power rate. If a third party comes onto the County site (avoids transmission costs) and generates green power, the company and County would get credits.

An approach is to ask the market for expression of interest in third party arrangement to produce power from biogas. It may make sense for a private-public partnership. The numbers in the presentation provide a basis to evaluate third party proposals.

Review of "Green Power" was covered on the slides on pages 54 through 63 of the handout.

16. The outlying treatment processes were presented by Gordon Culp. The process matrix comparing technologies was developed with group input. Matrix values prepared by the project team were modified based on the discussion of the various wastewater processes. A copy of the modified matrix and the weighted matrix are attached at the end of these meeting notes. After reviewing the weighted matrix results, the BNROD process was top rated with Bardenpho a close second. It was stated that sequencing batch reactor (SBR) would be more economical than an oxidation ditch. At Swan Southland, a SBR system was designed and built at $6.50 per gallon of capacity. Because of the current plant situation, Ed Curley suggested that there is a need to look at best solution for each site rather than standardize the process at all sites. A question was asked of how many other cities have gone to standardized approach for satellite plants. Some have gone to standardized approach to talk to developers on what to build that may be turned over to the public agency later. It may be desirable to have the Bardenpho treatment process at each plant? Frank Gall indicated that too much has been invested at Avra Valley in oxidation ditches to change.

Mike Gritzuk suggested that there is a need to look at how to make oxidation ditch plants aesthetically more pleasing. But for newer facilities, the County needs to look at options.

The outlying wastewater treatment processes were covered on pages 63 through 66 of the handout.

17. Biosolids handling and disposal were presented by Jerry Bish. Current sludge contractor reportedly needs 2000 acres for land application. Gordon Culp asked why not rely on a private party? Metro Denver applies 86% of its digested sludge to private farms rather than use its own operation. They have a waiting list of farmers wanting the sludge. John Warner indicated that there is a need to look at markets for biosolids such as use as fuel in power plants. Jackson Jenkins indicated that the public parks would be market for dried product. Joe Popeck offered that Chicago has private company taking one-third of sludge from Stickney plant as dry solids. Ron Riska suggested that air quality permits for sludge incinerators are nearly impossible to obtain.

    Biosolids handling and disposal were covered on pages 66 through 70 of the handout.

18. The value of a request for expression of interest process by the County was discussed. Besides the alternative project delivery approaches, private sector funding, green power (biogas utilization) and disposal of biosolids are candidates for testing the marketplace for ideas and direction to be taken by the County. The expression of interest will need to be formulated and completed within the next 60 to 90 days.

19. Additional meetings are required to obtain closure on: biosolids handling and disposal, enhanced chlorination, green power, alternative project delivery and plant layouts.

20. Mike Gritzuk closed the meeting by thanking all for their active participation and to Tucson Water for providing lunch.

Agenda
Workshop #14 – First Draft of Report Study
February 21, 2006

Time	Topic	Presenter
7:45 am	*Public Works Building at 201 N. Stone Ave. – Conference Room C (Basement)*	
8:00 am	Opening Session • Welcoming Remarks • Review Agenda • Workshop Goals	 Mike Gritzuk Andy Richardson
8:15 am	Chapters 1- 4 Review (Strategic Development) 1. Introduction 2. Regulatory and Customer Requirements 3. Treatment Plant Evaluation 4. Overall Treatment Strategy	Joe Popeck/Jerry Bish
10:00 am	Break	
10:15 am	Chapters 5 -9 Review (Strategic Development) 5. Biosolids/Biogas 6. Conveyance 7. Recommended Treatment Plant Plan 8. Non-Metro Area Evaluation 9. Non-metro Overall Treatment Strategy	Jerry Bish/Joe Popeck
11:45 am	Chapters 10-13 Review (CIP Development) 10. CIP Elements 11. Alternative Project Delivery Methods 12. CIP Phasing and Costs Schedules 13. Implementation Plan	Jerry Bish
12:30 pm	Lunch	
1:00 pm	Green Power Discussion	Vic Smith
2:00 pm	Non-Metro Wastewater Process Discussion	Gordon Culp
3:00 pm	Break	
3:15 pm	Biosolids Handling/Disposal Discussion	Jerry Bish
4:15 pm	UV vs. Enhanced Chlorination Discussion	Jerry Bish
4:45 pm	Summary Wrap-Up • Comments by Group • Closing Remarks	Andy Richardson Mike Gritzuk
5:00 pm	Adjourn	

Flip Chart Notes – February 21, 2007

ADDITIONAL MEETING SUMMARY

- Biosolids
- Enhanced Chlorination
- Alternative Delivery Consideration/Expression of Interest
- Green Power
- Roger Road and Ina Road. site plans

ROMP REPORT

- Chapter 1 – Need to address odor (good neighbor issue)
  - Page 1.4 – decommission filters only at water reuse facility
  - Need to mention reuse water treatment facility
  - Water Reclamation Facility for "New" instead of "Greenfield" for Roger Road
  - Add list of common terms up front
  - For Non-Metro use "Outlying Facilities"
  - Add discussion on odor
- Use of pump stations belong in Chapter 1 – "Guiding Principles"
- Chapter 3 – Address electrical decision at Roger Road with savings of $6 million
- Show 3 to legal for review
- Reclaimed water program
  - Add 3 mgd at Randolph Park and address effluent shares available
  - Confirm risk cost range of $50 to $80 million
- Ina Road site needs to have space for:
  - Tucson water 2 acres vs. 10 acres
  - Warehouse space
  - Emergency overflow basin # 4
  - Laboratory location?
- Headworks sized for a peaking factor of 2
- Where does side stream flows go? Plant processes sized for them.
- Change <u>reliable</u> to <u>viable</u> on summary
- Do we still want a 2 NTU effluent quality? Base on "Re-look" at CL_2 disinfection
- Add 80% discussion and charts in s 2 & 4 per ADEQ Requirements
- Provide basis of design for each major element as a separate deliverable:
  - Plant Interconnect
  - Ina Road
  - "New" water reclamation facility
- Biosolids – need to address what is being done now with regards to biosolids and what new facilities are required – need to forecast when a new digester is needed
- Need to consider asbestos removal costs at Roger Road since old plant includes some. Cost in estimates
- Need to add economic analysis on when Biosolids should no longer be hauled – want recommendation in Chapter 5
- "Include in 5 a discussion on biosolids as it relates to the "reality" in Pima County and CA that there could be a greater driver for class "A"
- Consider separate treatment process for struvite control

- Get CMOM permit information and place in Chapter 2.
- In Chapter 6 make reference to comprehensive hydraulic study and include scope and completion date.
- Indicate in report where existing programs are in place to take care of identified problems need "Cross – Reference Effort"
- Identify odor control effort
- Break conveyance program into:
  - Regulations
  - Rehabilitation
  - Capacity

  } For CIP Representation
- Review conveyance cost table"
- ID areas where field observations do not match model results
- Air Quality Permit Implications of adding a new generator – all would have to be looked at as new
- With new digesters – what is the new estimated gas production?
- Need to address comments on transferring smell from Roger Road to Ina Road
- CIP Elements Add
  - Conveyance and other ones related to the program
  - Fairgrounds WWTP listed in Southeast
- What is the plan for sludge from Roger Rd.?
  - Place in plant interconnect. No.
  - Need to decide impacts of 8" sludge link and plant interconnect design
- Southland WWTF (Developer Financed)
- Recommendation first on alternative delivery followed by what other methods will work
- Show conveyance CIP in areas: Regulations, Rehabilitation and Growth
- Add Tucson water facilities to Ina Road. expansion program
- Need to show how funding fits into future rate increases
- Melodee Loyer was acknowledged for submitting consolidated report comments from Tucson Water. Those comments will be considered in the next report draft

GREEN POWER

- Vic Smith to talk w/ Jackson Jenkins about engine generator issues
- Zero time option
- Alternatives: natural gas and all commercial power
- Expression of interest meetings next step

OUTLYING FACLITIES PROCESS

- Site specific process selection at each facility of the outlying areas

ENHANCED CHLORINATION

- Is BADCT timing negotiable – when does it kick-in?

EXPRESSION OF INTEREST

- Areas of interest:
  - "Green" power biogas
  - Funding
  - Biosolids disposal regional and outlying
  - Project delivery

- Tasks
  1. Develop EOI letter
  2. Meeting w/respondents
  3. Report on findings
  4. Meet w/Pima County on steps forward

Modified System Evaluation Matrix

Criteria	Rank				
	Bardenpho	BNROD	MBBR	SBR	MBR
Cost	4	4	3	5	2
Environmental Impact	4	4	3	3	3
Feasibility	3	5	4	3	3
Operational Capability	4	4	3	2	4
Land Required	4	3	4	4	5
Maintenance	5	5	3	3	2
Public Acceptability	3	3	3	5	5
Reliability	3	4	3	3	2
Sludge Production	3	5	3	3	3
Water Reuse Potential	4	4	4	4	4
Odor Control	4	3	4	3	4
Total	41	44	37	38	37

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Modified Weighted System Evaluation Matrix

Criteria	WF	Rank					Weighted Rank				
		Bardenpho	BNROD	MBBR	SBR	MBR	Bardenpho	BNROD	MBBR	SBR	MBR
Cost	5	4	4	3	5	2	20	20	15	25	10
Environmental Impact	4	4	4	3	3	3	16	16	12	12	12
Feasibility	3	3	5	4	3	3	9	15	12	9	9
Operational Capability	4	4	4	3	2	4	16	16	12	8	16
Land Required	2	4	3	4	4	5	8	6	8	8	10
Maintenance	4	5	5	3	3	2	20	20	12	12	8
Public Acceptability	5	3	3	3	5	5	15	15	15	25	25
Reliability	4	3	4	3	3	2	12	16	12	12	8
Sludge Production	1	3	5	3	3	3	3	5	3	3	3
Water Reuse Potential	4	4	4	4	4	4	16	16	16	16	16
Odor Control	5	4	3	4	3	4	20	15	20	15	20
Sum of Weighted Ranks							155	160	137	145	137

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Pima County Regional Optimization Master Plan

Workshop #14
First Draft of Report Study

February 21, 2007

Workshop Presenters

Mike Gritzuk	Welcome/Closing
Andy Richardson	Facilitator
Jerry Bish	Chapters 1, 2, 5, 6, 8-13
Joe Popeck	Chapters 3, 4, 7
Vic Smith	Green Power
Gordon Culp	Non-Metro Wastewater Processes
Andy Richardson	Wrap-Up

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Welcoming Remarks

Mike Gritzuk

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Overview

Andy Richardson

Agenda

- Review Draft ROMP Report chapters
- Discussion topics
  - Green power
  - Non-metro WW treatment process
  - Biosolids handling/disposal
  - UV vs. enhanced chlorination

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Objective

- Receive critical comments on Draft Report
- Identify open/unsettled issues
- Advance open/unsettled ROMP issues to closure
- Identify who, what and when necessary for issue closure

6

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

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Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

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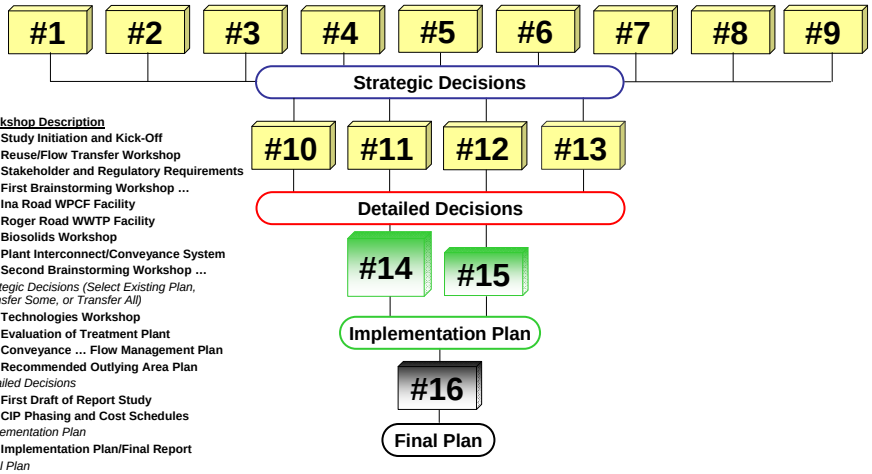
Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

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First Draft Regional Optimization Master Plan

Jerry Bish/Joe Popeck

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Chapter 1 – Introduction

Jerry Bish

Chapter 1 – Introduction

- Sets forth purpose of master plan and establishes basis for report
- Identifies strategic issues / sets strategic direction
- Integrates Capital Improvement Plan

Purpose

- Identify optimal strategy for wastewater treatment
- Identify optimal biosolids treatment / disposal
- Provides 25-year road map
- Develop key decisions through consensus process

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Needed Additions

- Add non-metro facilities
- Add conveyance evaluation
- Add CIP development

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Chapter 2 – Regulatory and Customer Requirements

Jerry Bish

Regulatory and Customer Requirements

- Governing agencies
  - US EPA
  - ADEQ
  - Pima County Department of Environmental Quality
- Permits (metro/non-metro facilities)
  - AZPDES
  - APP (new for Marana)
  - Air quality
  - Reclaimed water

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Regulatory and Customer Requirements *(continued)*

- Water reuse
  - Intergovernmental agreements
  - Underground storage recharge / recovery
- Cultural / historic preservation
- Regulatory closure requirements at Roger Road

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Chapter 3 – Treatment Plant Evaluation

Joe Popeck

Existing Treatment Capacity

- Roger Road WWTP
  - Permitted capacity = 41mgd
    - Preliminary and primary treatment
    - Biotowers with Activated sludge, final clarifiers
    - Chlorine disinfection
    - Anaerobic digestion

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Condition Assessment – RR WWTP

- Summary of condition assessment
  - Most major structures appear in generally good condition
    - However, clarifiers and aeration tanks are not functionally optimal for conversion to BNR process
    - Flow distribution is marginal and cannot be readily improved
  - Most major equipment appear in generally good condition
    - However, major equipment may not be of required capacity for BNR process

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Condition Assessment – RR WWTP

- Summary of condition assessment
  - Most major electrical components appear in generally good condition
    - However, system is ungrounded Delta – not optimal for equipment such as VFD's
  - Significant lack of I&C
    - Fiber optic system installed
    - PLC's and other SCADA devices to permit remote monitoring/operation not fully utilized

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Condition Assessment – RR WWTP

- Summary of condition assessment
  - Roger Road facilities, due to condition and functional risk are deemed marginal for conversion to BNR
  - Planned improvements for several areas of the plant are necessary to maintain treatment effectiveness regardless of the final decision on the long-term continued use of Roger Road WWTP

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Existing Treatment Capacity

- Ina Road WPCF
  - Permitted capacity = 37.5 mgd
    - Preliminary and primary treatment
    - 25-mgd HPO activated sludge, final clarifiers
    - 12.5-mgd BNRAS, final clarifiers
    - Chlorine disinfection
    - Anaerobic digestion

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Background / Condition Assessments

- Summary of condition assessment
  - Most Major Structures appear in generally good condition
  - Most Major Equipment appear in generally good condition
  - Most Major Electrical Components appear in generally good condition
  - Significant lack of I & C

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Background / Condition Assessments

- Summary of condition assessment
  - Much of the Ina Road Facility that would be used either as a BNR process component or support process is viable.
    - However, HPO tanks are not functionally optimal for conversion to BNR process

Condition Assessment – IR WPCF

- Summary of condition assessment
  - Planned Improvements for several areas of the plant are necessary to maintain treatment effectiveness prior to modifications for plant-wide BNR.

Chapter 4 - Overall Treatment Strategy

Joe Popeck

Overall Treatment Strategy

- Future wastewater flows and characteristics
- Treatment strategy alternatives with three flow-split options
- Reclaimed water program
- Biological nutrient removal (BNR) treatment alternatives
- Alternative evaluation criteria
- Evaluation of alternatives
- Selection of recommended alternative
- Preliminary sizing facilities
- Summary

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Future Wastewater Flows

Wastewater Flow Split Options Used for Plant Evaluations

Flow Split Options *	Flow to Roger Road, mgd			Flow to Ina Road, mgd		
	Current	Future	Total	Current	Future	Total
Existing Plan	22.6	9.4	32.0	36.5	13.5	50.0
Transfer Some	14.1	5.9	20.0	45.0	17.0	62.0
Transfer All	0.0	0.0	0.0	59.1	22.9	82.0

* Randolph Park WRF capacity of 3.0 mgd is not included.

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Future Wastewater Flows and Characteristics

Selected Year 2030 Wastewater Characteristics

Based on Complete Mass Balance

Parameter	Units	RRWWTP		IRWPCF	
		Primary Influent	Primary Effluent	Primary Influent	Primary Effluent
Flow	mgd	33.2	32.6	52.6	51.4
COD	mg/L	659	443	689	456
BOD_5	mg/L	301	214	324	229
$sBOD_5$	mg/L	121	123	123	126
TSS	mg/L	310	126	358	146
VSS	mg/L	243	104	282	123
TKN	mg/L	47	46	63	61
TP	mg/L	10	10	15	14

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Treatment Strategy Alternatives with Three Flow-Split Options

- Existing Plan
  - At both Roger Road and Ina Road, continue to follow present long-range CIP project schedule to address capacity and regulatory needs of both RRWWTP and IRWPCF
- Transfer Some
  - Maintain a facility at the RRWWTP to continue to provide effluent to the adjacent Tucson Reclaimed Water Treatment Plant (TWTP), and direct remainder of influent flows to IRWPCF
- Transfer All
  - Transfer all wastewater flow from the RRWWTP service area to IRWPCF and decommission RRWWTP

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Reclaimed Water Program

- Reclaimed water program
  - Effluent water will be made available to Tucson Water for reclaimed water service at the future RRWWTP and IRWPCF. Plan allows for approximately 30 mgd at RRWWTP and approximately 20 mgd at IRWPCF based on allocated effluent water shares.
  - Up to 7 mgd would be made available for discharge into the Santa Cruz River at the RRWWTP site.
  - This may require that up to 5 mgd (existing plan) and as much as 37 mgd (transfer all plan) of the IRWPCF effluent be transferred to the RRWWTP site via a pumping station/force main system.

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Biological Nutrient Removal (BNR) Treatment Alternatives

- Treatment process alternatives were developed to meet the goal of future effluent limits for nutrients with the following criteria:
  - Ammonia nitrogen concentration of 2 mg/l or less
  - Total nitrogen concentration of 8 mg/l or less
  - Total phosphorus concentration of 1mg/l or less

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Biological Nutrient Removal (BNR) Treatment Alternatives

- Initial screening of BNR process alternatives
  - Modified Ludzack-Ettinger (MLE)
  - Bardenpho
  - Step-feed nitrification and denitrification (NDN)
  - Integrated fixed-film activated sludge (IFAS)
  - Membranes (MBR)
  - Biostyr and Biofor systems
  - Activated sludge/nitrifying trickling filter (AS/NTF)
  - Biotowers/nitrifying activated sludge (BT/NAS)
  - Moving bed bioreactor (MBBR)

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Biological Nutrient Removal (BNR) Treatment Alternatives

- BNR processes selected for detailed evaluation
  - Ability to achieve the effluent goal
  - Adaptability to remove emerging contaminants of concern
  - Is high dose of methanol required?
  - Can use existing Biotowers at RRWWTP?
  - Is it flexible for Bio-P removal?
  - Are capital costs in the range of Bardenpho? (Initial comparative cost analysis showed the lowest life cycle cost with Bardenpho)
  - Can use existing tankage?
  - Can achieve turbidity less than 2 NTU?
  - Can be applied with high purity oxygen (HPO)? (IRWPCF has a HPO system)
  - Are O&M costs in the range of Bardenpho? (Initial comparative cost analysis showed the lowest life cycle cost with Bardenpho)
  - Has the process been used in biological nitrogen removal in the plant size of larger than 20 mgd for more than three years?

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Biological Nutrient Removal (BNR) Treatment Alternatives

- Processes carried forward for detailed evaluation:
  - Bardenpho
  - MLE
  - IFAS
  - BT/NAS for RRWWTP and Bardenpho for IRWPCF

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Alternative Evaluation Criteria

- Technical criteria
  - Operability
  - Proven process
  - Life cycle cost
  - Site compatibility
  - Resource consumption
  - Ease of operation and maintenance during construction

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Alternative Evaluation Criteria

- Financial criteria
  - Capital costs
  - Operation and maintenance (O&M) costs
  - Present worth of capital and O&M costs

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Alternative Evaluation Criteria

- Non-economic factor criteria
  - Cost (exclusive of risk-related costs involved in the rehab RRWWTP option)
  - Schedule
  - Constructability
  - Flexibility
  - System Reliability
  - System Operability
  - Environmental Impacts
  - Water/Waster System Optimization
  - Public Acceptance
  - Potential for Cost Sharing
  - Effect on Financing

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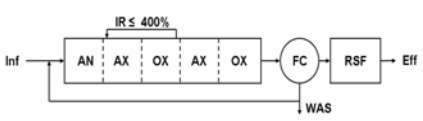
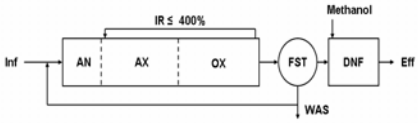
Evaluation of Alternatives

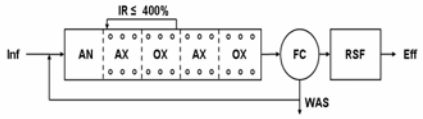
Typical 5-Stage Bardenpho Process Diagram



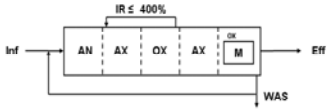
Typical MLE Process Diagram



Typical IFAS Process Diagram



Typical MBR Process Diagram



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Evaluation of Alternatives

Summary of Technical and Financial Evaluation of Alternatives for RRWWTP

Criteria	Bardenpho RR/IR	MLE RR/IR	IFAS RR/IR	BT/NAS RR/IR
Operability	0 / 0	0 / 0	0 / 0	0 / NA
Proven process	+ / +	+ / +	0 / 0	0 / NA
Life cycle costs	+ / +	- / -	- / -	- / NA
Site compatibility	+ / +	- / -	+ / +	+ / NA
Resource consumption	+ / +	- / -	- / -	- / NA
Ease of maintaining treatment capacity during construction	+ / +	+ / +	+ / +	+ / NA
Recommended process	Yes	No	No	No

Notes: 0 means neutral; + means positive; – means negative; NA means not applicable; RR means RRWWTP; and IR means IRWPCF.

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Evaluation of Alternatives

Capital and Present Worth (PW) Costs of Alternatives (1) (2)

Process	Flow Split RR/IR = 32/50		Flow Split RR/IR = 20/62	
	PW	Capital	PW	Capital
Bardenpho at RR&IR	$431	$287	$464	$319
IFAS at RR&IR	$439	$295	-	-
MLE at RR&IR	$446	$300	-	-
BT/NAS at RR and Bardenpho at IR	-	-	$479	$327

(1) Physical limitations of existing trickling filters at RRWWTP limit the BT/NAS process application to the 20/62 mgd flow split

(2) The costs are shown in million dollars

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Evaluation of Alternatives

Capital and Present Worth (PW) Costs for Bardenpho Process with Three Flow Split Options (1)

Flow Split	Capital Cost	PW Cost
RR=32 mgd IR=50 mgd	$287	$431
RR=20 mgd IR=62 mgd	$319	$464
RR=0 mgd IR=82 mgd	$375	$514
RRGF=32 mgd IR=50 mgd	$320	$457
RRGF=20 mgd IR=62 mgd	$340	$480

(1) The costs are shown in million dollars.

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Risk Related Costs, Roger Road Rehab

- Schedule – added inflation, increased risk of missing deadlines, risk of moratorium **(one year delay, inflation at 5% =$8.5M, added inspection and field overhead = $0.9M, steel and concrete price volatility = $6.9M, permit violations=$9.1M)**
- Constructability – increased risk of changed conditions claims **(10-30% = $17M-$51M)**
- Operability – patchwork of old and new **(10 added staff = $7.3M present worth)**

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Risk Related Costs, Roger Road Rehab

- Reliability – increased risk of failure of older plant components **($25,000 per day for permit violations)**
- Environmental impacts – increased chance of disrupting treatment during construction **($25,000 per day for permit violations)**
- Risk related costs estimated at **$50,000,000-$80,000,000** exclusive of moratorium effects

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Evaluation of Alternatives

- Non-economic factor criteria are included in the list shown below:
  1. Cost
     (exclusive of risk-related costs involved in the rehab RRWWTP option)
  2. Schedule
  3. Constructability
  4. Flexibility
  5. System Reliability
  6. System Operability
  7. Environmental Impacts
  8. Water/Waster System Optimization
  9. Public Acceptance
  10. Potential for Cost Sharing
  11. Effect on Financing

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Evaluation of Alternatives

Non-economic Factor Criteria Evaluation Matrix with Complete Scores (Rating scale of 1-5 with a rating of 5 being most favorable)

Crit-eria	Weig-hting	Un-weighted Score					Weighted Score				
		RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF =32 IR=50	RRGF =20 IR=62	RR=32 IR=50	RR=20 IR=62	RR=0 IR=82	RRGF=32 IR=50	RRGF=20 IR=62
1	5	5	4	2	4	3	50	40	20	40	30
2	5	3	3	5	5	5	15	15	25	25	25
3	3	2	2	4	5	4	6	6	12	15	12
4	4	3	3	5	5	5	12	12	20	20	20
5	4	4	4	5	5	5	16	16	20	20	20
6	4	3	3	4	4	4	12	12	16	16	16
7	4	3	3	4	4	4	12	12	16	16	16
8	5	5	4	3	5	4	25	20	15	25	20
9	5	1	2	2	3	2	5	10	10	15	10
10	3	5	4	3	5	4	15	12	9	15	12
11	3	5	4	2	4	3	15	12	6	12	9
Total		39	36	39	49	43	183	167	169	219	190

Selection of Recommended Alternative

- Recommendation
  - Use Bardenpho process at both plant locations
  - Use a flow split of 32 mgd for RRWWTP and 50 mgd for IRWPCF
  - Use Greenfield design for RRWWTP plant and rehabilitation for the IRWPCF facilities
  - Implement Greenfield design at RRWWTP without primary treatment

Preliminary Sizing Facilities

- Preliminary sizing of facilities
  - The facility for RRWWTP and IRWPCF was sized to adequately treat the future wastewater loads and to consistently meet the future effluent requirements meeting the treatment goals. The facilities were initially sized based on conventional design approach and confirmed by the GPS-X modeling.
  - Hydraulic capacity for the RRWWTP and IRWPCF is based on a peak hourly flow rate of 2.0 Average Daily Flow.

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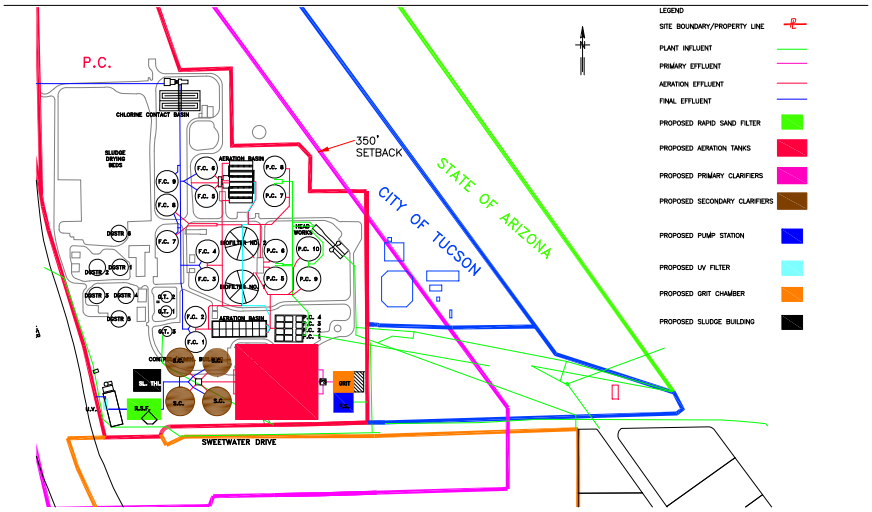
Roger Road – 32-mgd "Greenfield"



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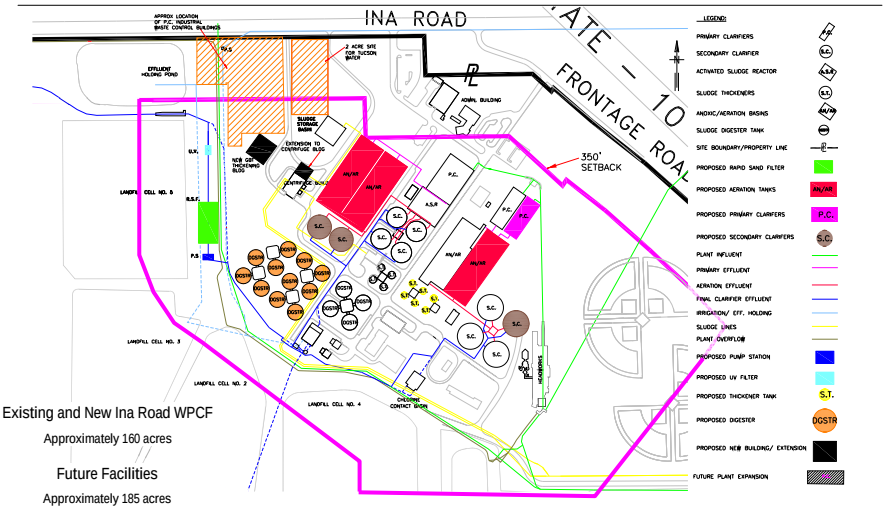
50-mgd Ina Road WPCF



Existing and New Ina Road WPCF

Approximately 160 acres

Future Facilities

Approximately 185 acres

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Summary

- 2030 wastewater flows in the Roger Road and Ina Road service areas were estimated based on population projections and flow estimates contained in PCWMD 2006 document. The year 2030 total flow within the two service areas is approximately 85 mgd.
- Wastewater characteristics were determined based on information contained in 2004-2005 GPS-X modeling, future loadings predicated on water conservation, and mass balance with recycle flows from expected future biosolids operation. Because of higher recycle contribution, the nutrient concentrations in the IRWPCF influent were substantially higher than the RRWWTP influent. Peaking factors were estimated based on operating data.
- Among a number of flow-split options reviewed, three flow-split options were selected for flow split between the treatment plants for further analysis and these include:
  - 32 mgd to RRWWTP and 50 mgd to IRWPCF
  - 20 mgd to RRWWTP and 62 mgd to IRWPCF
  - All 82 mgd to IRWPCF

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Summary

- Due to expected stringent effluent requirements and effluent reuse requirements, a high degree of treatment would be required and the effluent goals were set at:
  - Ammonia nitrogen concentration of 2 mg/l or lower
  - Total nitrogen concentration of 8 mg/l or lower
  - Total phosphorus concentration of 1 mg/l or lower
  - Turbidity of 2 NTU or lower
- To meet effluent goals, a combination of biological nitrogen removal processes and biological phosphorus (Bio-P) removal was found to be most cost effective.
- A review of biological nutrient removal (BNR) processes for nitrogen and phosphorus removal resulted in consideration of nine processes which were screened based on economic and non-economic criteria. As a result, four alternatives were selected for further evaluation:
  - Bardenpho
  - MLE
  - IFAS
  - BT/NAS (for treatment of 20 mgd at RRWWTP)

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Summary

- Four BNR alternatives were further evaluated based on technical and economic criteria. Bardenpho process was determined as most reliable and cost effective process for both treatment plants.
- Using the Bardenpho process, flow split options were analyzed based of technical and economic criteria. Flow-split option of 32 mgd to RRWWTP and 50 mgd to IRWPCF was determined as most reliable and cost effective option.
- Greenfield option of replacing the existing RRWWTP with a new treatment plant at the Roger Road location was evaluated. Considering cost uncertainties involved in rehabilitating and modifying the RRWWTP and considering non-economic factors, the Greenfield option was determined to be most favorable option for the Roger Road facility.

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Summary

- Preliminary sizing was made for both treatment plants based on conventional design approach and was confirmed with GPS-X modeling. No chemical use is required for the Greenfield RRWWTP, but some amount of alum (or ferric chloride) will be required at the IRWPCF when phosphorus removal becomes a requirement in the future. This is due to relatively high nutrient concentration in the IRWPCF influent and insufficient carbon source to support both denitrification and Bio-P. Chemical will remove additional amount of P, after Bio-P removal, to meet the effluent P requirement in the future.

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Project (2006) Costs

Description	*Total Cost (2006) (x $1,000,000)*
Roger Road	$234.8
Ina Road	$243.9
Plant Interconnect	$22.3
Total	$501.0
Misc. Electrical Service	$35.0

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Chapter 5 – Biosolids

Jerry Bish

Chapter 5 – Biosolids

- Existing Class B facilities
- Mesophilic digesters at Roger Road
  - Sludge transfer pipeline to Ina Road
- Mesophilic digesters at Ina Road
- Centralized sludge loading operation

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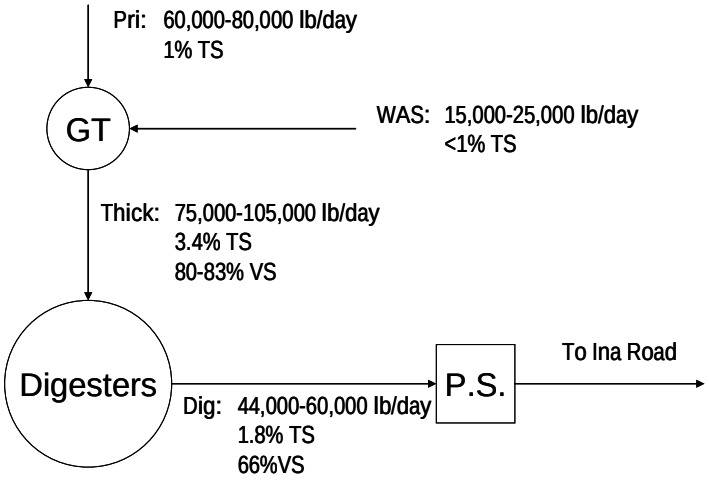
Existing Roger Road WWTP Biosolids Diagram (@38.3 mgd)



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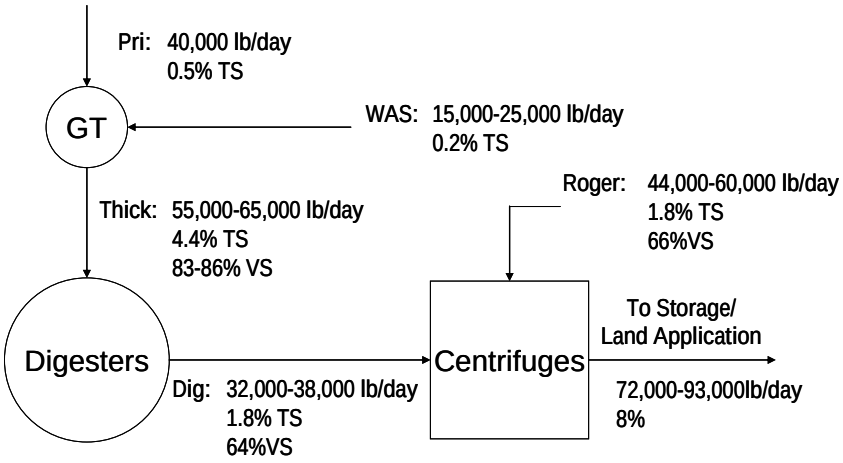
Existing Ina Road WWTP Biosolids Diagram (@23.4 mgd)



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Non-Metro Facilities

Location	Current, tpd(1)	Processing, Disposal
Marana	0.28	storage, hauled ⇒ Ina
Rillito Vista	0.014	---
Avra Valley	2.2	storage, hauled ⇒ Roger Road
Green Valley	5.7	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Arivaca Junction	0.09	---
Corona de Tucson	0.16	Evaporation, hauled to landfill when pond is cleaned
Pima Co. Fairgrounds	0.004	Evaporation, hauled to landfill when pond is cleaned
Mt. Lemmon	0.018	storage, hauled ⇒ Ina
Southlands	0.0	---
Total	8.47	

(1) Based on 2,800 dry lbs/day raw biosolids produced per mgd of flow treated.

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Future Solids Streams

- Roger Road WWTP

Solids Stream	Flow, mgd	% Solids	Solids Mass, lb/day	VSS Mass, lb/day
Waste Activated Sludge	1.72	0.7	100,600	76,400
Thickened WAS (to Ina Road Digestion)	0.36	3.0	90,500	68,800
Thickener Overflow	1.36	0.1	10,100	7,600

- Ina Road WPCF

Solids Stream	Flow, mgd	% Solids	Solids Mass, lb/day	VSS Mass, lb/day
Primary Sludge	1.15	1.0	95,300	72,400
Waste Activated Sludge	1.35	0.7	78,800	59,900
Thickened Sludge (WAS + Primary)	0.42	4.5	156,600	119,000
Thickener Overflow	2.07	0.1	17,400	13,200

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Non-Metro Biosolids

Location	Future, tpd(1)	Processing, Disposal
Marana	6.16	storage, hauled ⇒ regional facility
Rillito Vista	0.00	---
Avra Valley	5.26	storage, hauled ⇒ regional facility
Green Valley	6.79	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Arivaca Junction	0.00	---
Corona de Tucson	3.77	storage, hauled ⇒ regional facility
Pima Co. Fairgrounds	0.00	---
Mt. Lemmon	0.003	storage, hauled ⇒ regional facility
Southlands	14.7	separate processing and disposal
Total	36.68	

(1) Based on 2,800 dry lbs/day raw biosolids produced per mgd of flow treated

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Class B Processes

Process	Requirements
Aerobic Digestion	MCRT of 40 days @ 20°C or MCRT of 60 days @ 15°C
Air Drying	Dry on beds for 3 months, with 2 months ≥ 0°C
Anaerobic Digestion	MCRT of 15 days @ 35-55°C or MCRT of 60 days @ 20°C
Composting	5 days @ 40°C and 4 hours of the 5 days @ 55°C
Lime Stabilization	Lime addition to pH 12 and maintained for 2 hours

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Class A Processes

Process	Requirements
Thermophilic Aerobic Digestion 1	MCRT of 10 days @ 55-60°C
Heat Drying 1	Direct or Indirect Gas Drying to ≤ 10% moisture content and solids temperature of 80°C
Heat Treatment 1	MCRT of 30 minutes @ 180°C
Composting 1	3 days @ 55°C for in-vessel or static pile 15 days @ 55°C for windrow
Pasteurization 1	30 minutes @ 70°C
Alkaline Stabilization 2	pH 12 and maintained for 72 hours with biosolids ≥ 52°C for 12 hours, followed by air drying to 50% TS
Time/temperature 3	Process meets detention time at temperature requirements by solids concentrations given in 503 regulations or has been given equivalency by USEPA (TPAD and batch thermophilic digestion for example)

Available Markets

- Agricultural land application
- Landfilling
- Mine tailing reclamation
- Dedicated land disposal
- Alternative land application option (Class A) – landscaping products
- Feed as fertilizer (Class A with amendments)
- Waste-to-energy (screen process)

Class A Drivers

- Regulations (state/federal)
- National biosolids partnership – environmental management system participation
- Local community pressure

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Class A Facilities Arrangement

- Temperature phased anaerobic digestion
- Heat drying
- Cambi process

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Recommendations

- Centralize biosolids handling / treatment
- Continue with Class B / land apply
- Ready to adapt to changes in disposal market

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Biogas Use

- 500 million cubic feet per year
- Options
  - Continue biogas for power generation / engine-driven equipment
  - Sell biogas to third party for commercial use
  - Purchase power from local utility and use biogas for heating and cooling functions

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Struvite Control

- Control strategies that can be employed
  - Glass line piping downstream of digesters (minimize attachment)
  - Add ferric chloride, ferric sulfate or alum at digesters to form vivianite (minimize formation)
  - Research and pilot testing of magnesium hydroxide addition at anaerobic digester or to centrate to precipitate out struvite
    - If added at digester, struvite bound in sludge
    - If added to centrate, requires aeration and separation
  - Facilities often take multiple strategy approach

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Chapter 6 – Conveyance System Evaluation

Jerry Bish

Chapter 6 – Conveyance System Evaluation

- Comprehensive system review
- Hydraulic capacity analysis
  - Existing
  - Future
- Wet weather capacity impacts
- Plant interconnect pipeline
- CIP capacity projects

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Regulatory Standards – CMOM

- 2008 – Standardized Rule
- Convey peak dry and wet weather flows
- Convey 10-year-24-hour rain event
- Upgrade deficient system elements within 10 years
- Prevent SSOs
- Capital Improvement Plan

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Regulatory Standards – Other

- Max Dry Weather d/D = 0.75
- Appropriate peaking factor
- Wet weather allowance based on:
  - Percentage of peak dry weather flow
  - Gallons per acre
- Minimum depth of cover = 3 feet
- V_d = 2 – 10 feet/second

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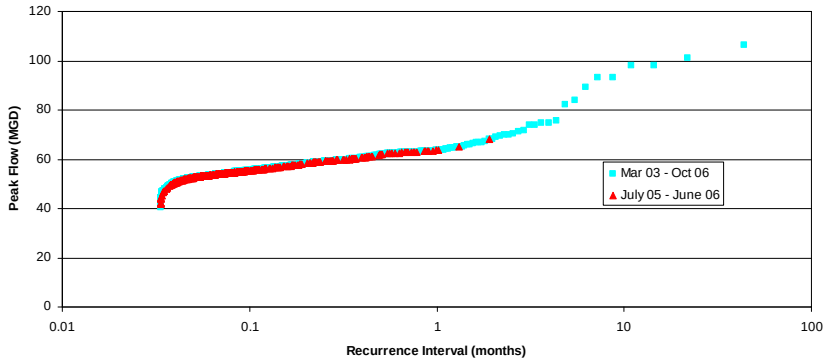
Roger Road Peak Flow Analysis

Results in 264 gpd/acre



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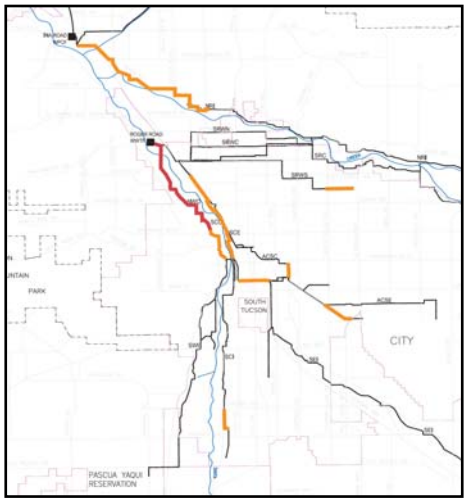
Existing Capacity Issues



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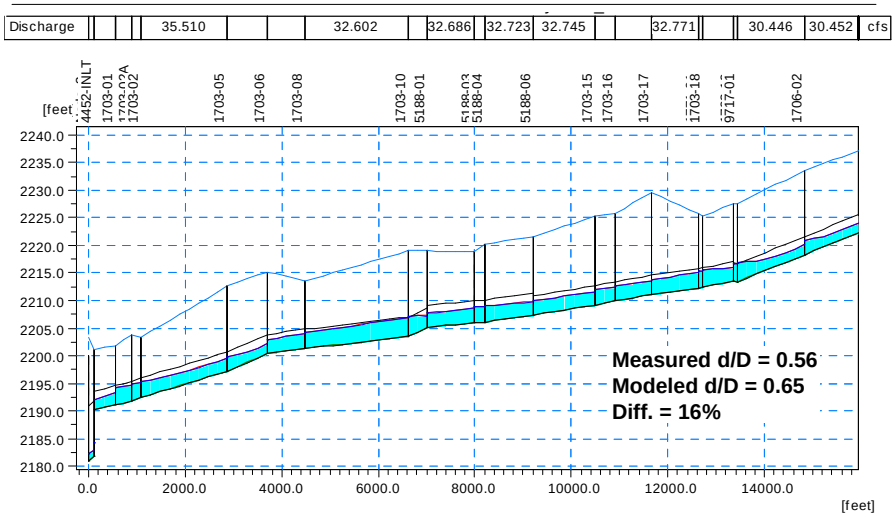
NRI Profile



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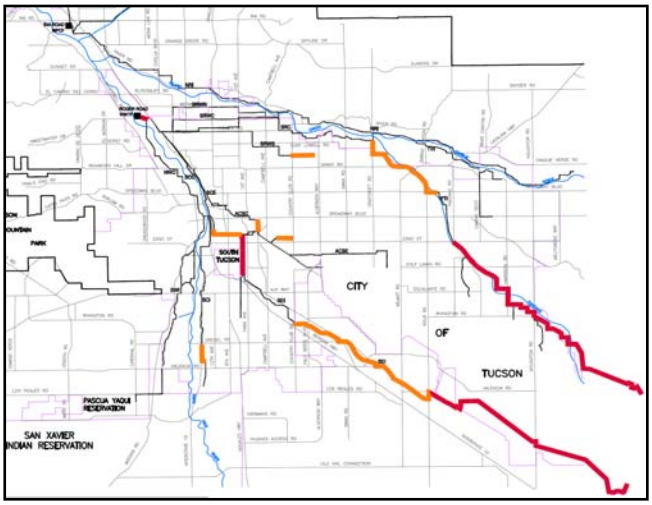
2030 Capacity Issues



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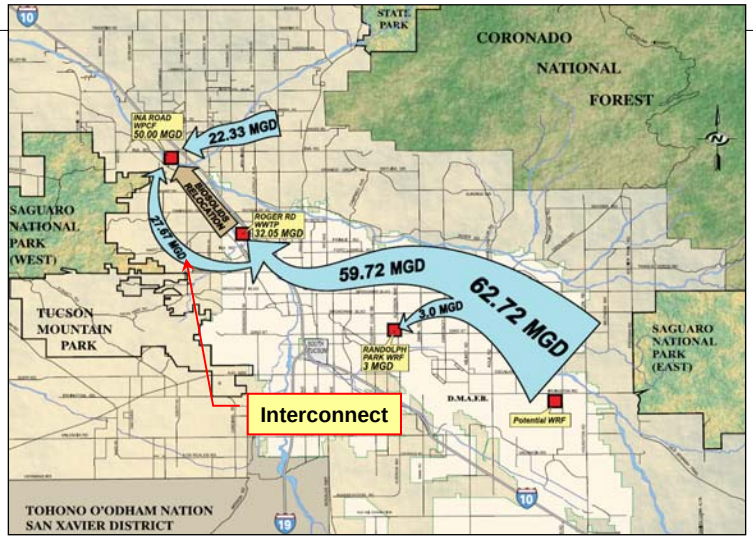
Plant Interconnect



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Interconnect Costs

	Route	Pipe Size	Cost (millions)	Not Included
Existing Plan	Route 1	54" - 66"	$18.90	R.O.W. acquisition
	Route 2	54" - 66"	$29.60	
	Route 4	54" - 72"	$28.00	
Transfer Some	Route 1	54" - 60"	$17.80	R.O.W. acquisition
	Route 2	54" - 66"	$28.90	
	Route 4	48" - 66"	$25.90	
Transfer All	Route 1	66" - 96"	$26.70	R.O.W. acquisition Return pumping of 37 MGD
	Route 4	72" - 84"	$37.10	Return pumping of 37 MGD

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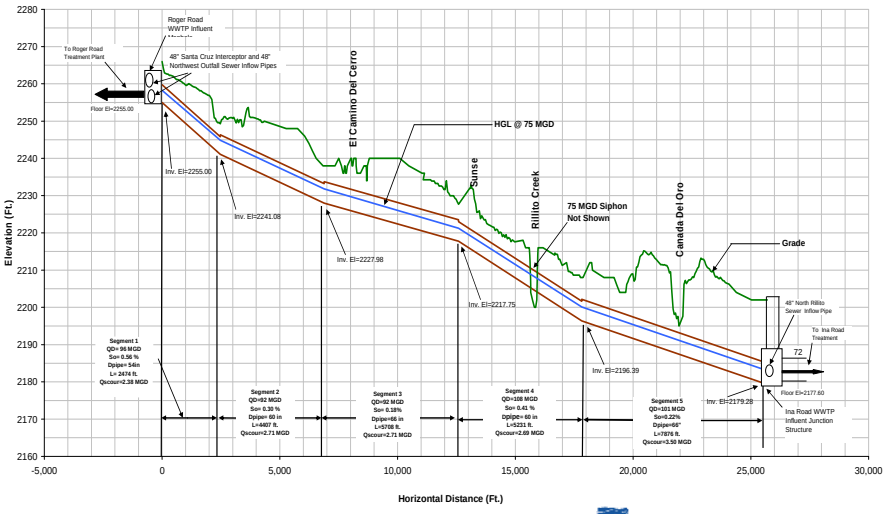
Plant Interconnect – Route 1



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CIP Projects

Project	MH Start	MH End	Year	Item	Qty	Units	Unit Cost	Cost	Type
1	4636-30A	4190-05A	2020	Replace 18" pipe with 21"	10,336	FT	$290.22	$3,000,000	Congested
				Project 1 Subtotal				*$3,000,000*	
2	6036-21	3979-101	2015	Replace 18" pipe with 24"	1,193	FT	$433.58	$513,000	Congested Road
	3919-101	6031-01		Replace 18" pipe with 24"	5,466	FT	$166.33	$913,000	Open Area
				Project 2 Subtotal	*6,669*			*$1,426,000*	
3	8635-11	8635-10	2020	Replace 18" pipe with 21"	620	FT	$350.02	$217,000	Semi-Congested Rd.
				Project 3 Subtotal				*$217,000*	
4	5627-08A	9907-49	2010	Replace 15" pipe with 24"	5,050	FT	$376.69	$1,902,000	Open Area
				Project 4 Subtotal	*5,050*			*$1,902,000*	
6	8130-01	1779-02	2016	Replace 30" pipe with 42"	1,163	FT	$271.29	$313,000	Open Area
	9917-20	9910-21		Replace 33" pipe with 36"	5,402	FT	$504.30	$2,724,000	Semi-Congested Road
	6887-01	6862-01		Replace 30" pipe with 42"	3,875	FT	$588.84	$2,281,000	Semi-Congested Road
	1779-02	6887-01		Replace 30" pipe with 42"	1,416	FT	$588.84	$833,000	Semi-Congested Road
	9910-21	9910-19		Replace 36" pipe with 42"	660	FT	$506.07	$278,000	Congested
				Project 6 Subtotal	*12,306*			*$6,429,000*	
8	8149-06	1726-29	2010	Replace 15" pipe with 21"	3,943	FT	$401.46	$1,583,000	Congested Road
	3983-06	8149-06		Replace 15" pipe with 24"	887	FT	$376.69	$334,000	Semi-Congested Road
	1726-29	1726-26		Replace 18" pipe with 24"	1,368	FT	$433.58	$802,000	Congested Road
	1726-26	1726-19		Replace 24" pipe with 30"	3,776	FT	$428.37	$1,618,000	Semi-Congested Road
				Project 8 Subtotal	*9,994*			*$4,137,000*	
7	4630-09	4630-02	2016	Replace 21" pipe with 24"	3,013	FT	$166.33	$501,000	Open Area
				Project 7 Subtotal	*3,013*			*$501,000*	
8	1761-09	1761-01	2010	Replace 18" pipe with 24"	4,712	FT	$376.69	$1,775,000	Semi-Congested Road
				Project 7 Subtotal	*4,712*			*$1,775,000*	
9	8628-01	8604-16A	2010	Replace 8" pipe with 15"	100	FT	$287.54	$29,000	Semi-Congested Road
				Project 7 Subtotal	*100*			*$29,000*	
10	9521-02	9549-05	2020	Replace 15" pipe with 18"	1,008	FT	$317.61	$319,000	Semi-Congested Road
				Project 7 Subtotal	*1,008*			*$319,000*	
Misc			2010	Fully Open Gate at Manhole 9910-21 Diversion	1	EA	$0.00	$0	
	1708-22	8604-16A		36" Reverse Sewer	2,160	FT	$504.00	$1,094,000	
				Grand Total				*$20,819,000*	

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Chapter 7 – Recommended Treatment Plant Plan

Joe Popeck

Recommended Treatment Plant Plan

- Transportation corridors and other area infrastructure
- Land use and area development
- Special projects
- Location of future treatment expansions
- Expansion of treatment infrastructure
- Expansion of treatment utilities and utility corridors
- Architecture and landscape
- Support facilities
- Year 2030 master plan layout for selected alternative
- Summary

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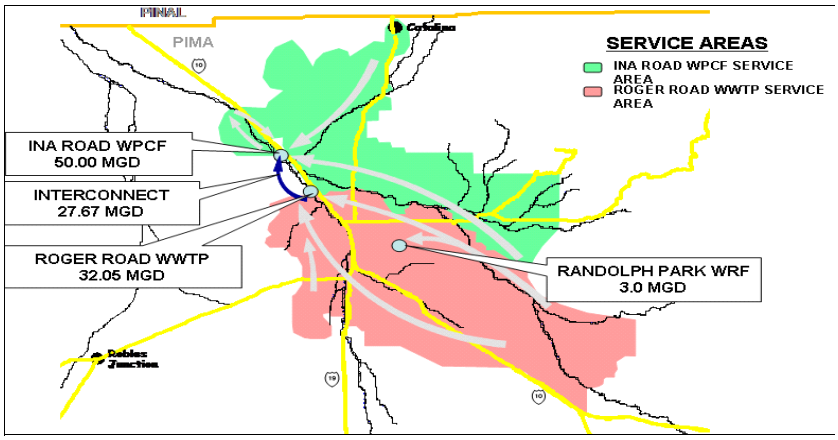
Recommended Treatment Plant Plan

Year 2030 Location of Major WWTPs Relative to the Metropolitan Tucson Service Area



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Transportation Corridors and Other Area Infrastructure

Major Transportation Corridors Near Treatment Plants

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Land Use and Area Development

- Current Land Use
  - Current land use is limited to existing treatment facilities at both treatment plant locations, except sports complex with baseball diamonds at the southeast side of Ina Road WPCF facilities

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Land Use and Area Development

Future Area Development Site Plan for RRWWTP

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Special Projects

- The Tres Rios Del Norte Project Ecosystem Restoration Feasibility study is being conducted by the Corps of Engineers with support by Pima County Regional Flood Control District (PCRFCD), City of Tucson and City of Marana. The study covers 18 miles of the Santa Cruz River from Prince Road to North Sanders Road and encompasses 19,800 acres. Objectives of the study are:
  - Ecosystem restoration
  - Flood damage control
  - Groundwater recharge
  - Recreation
  - Cultural resource preservation

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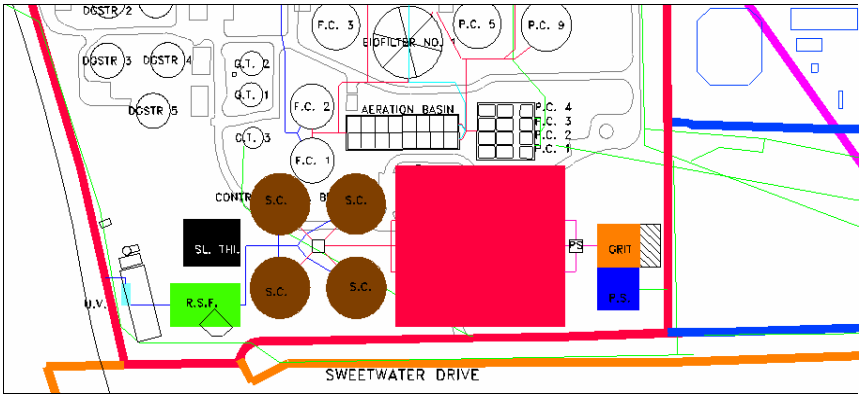
Location of Future Treatment RRWWTP

Roger Road – 32 MGD Facility



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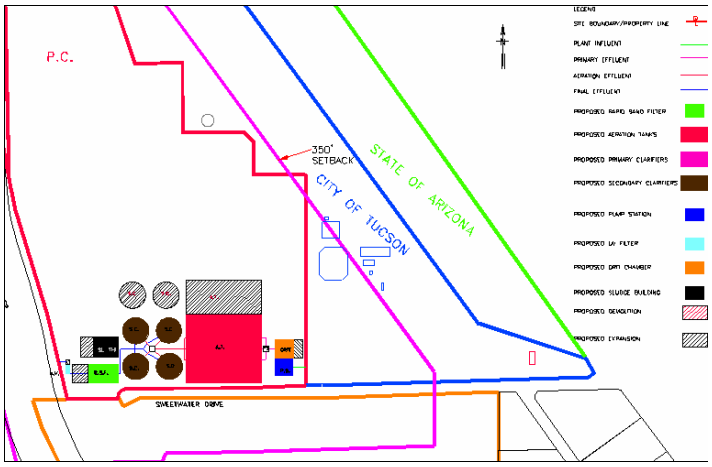
Location of Future Treatment Expansions

Roger Road WWTP Future Expansion Beyond Year 2030



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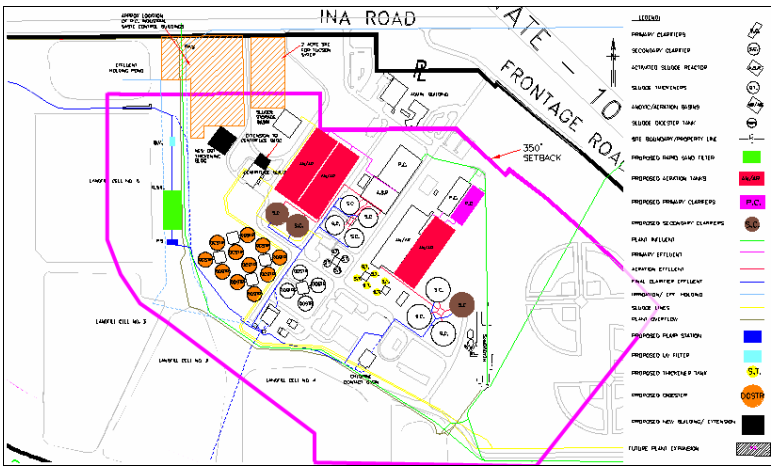
Location of Future Treatment IRWPCF

Ina Road WPCF 50 MGD Site Plan for Year 2030



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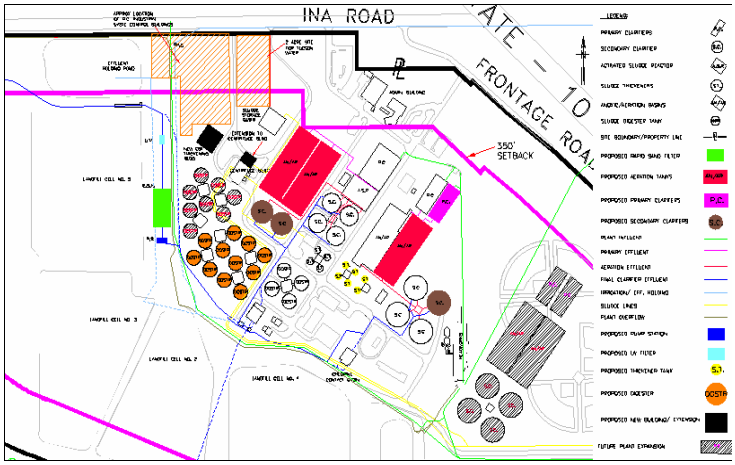
Location of Future Treatment Expansions

Ina Road WPCF Future Expansion Beyond Year 2030



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Expansion of Treatment Utilities and Utility Corridors

- Power Supply – Roger Road WWTP
  - Plant is presently served by a 2400 volt, 3-phase, 3-wire delta ungrounded electrical service from Tucson Electric Power Company
  - Utility service drop consists of 3-500kVA transformers feeding a Main Switchgear that is configured in a hot sequence arrangement with six fusible contactors
  - 2400 volt power is distributed to Power Centers and transformers throughout the site
  - Motor control centers are configured in a Main-Tie-Main circuit breaker arrangement with one main served from the utility source and the other from plant generators

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Expansion of Treatment Utilities and Utility Corridors

- Power Supply – Roger Road WWTP *(continued)*
  - Plant generators consist of 3-400kW, 480 volts, 3-phase, 3-wire delta ungrounded natural/methane duel fuel engine driven generators
  - Existing power distribution system will remain to serve the existing plant with minor alterations made to provide power to interim and temporary plant improvements
  - Plant to be served with a new power distribution system
  - System will have redundant power sources

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Expansion of Treatment Utilities and Utility Corridors

- Power Supply – Ina Road WPCF
  - Plant is served from two utility sources with multiple service drops and on site generators
  - Original treatment plant constructed during the 1970's and Centrifuge Building added in the 1980's is powered by generators at the plant power generation facility
  - Plant expansion is powered from three separate Tucson Electric Power (TEP) incoming utility electric services

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Expansion of Treatment Utilities and Utility Corridors

- Power Supply – Ina Road WPCF *(continued)*
  - Plant power generation system consists of seven 650kW, 4160 volts, 3-phase generators connected in parallel to 4.16kV Switchgear "A/B"
  - Three TEP incoming utility electric services are located at the Headworks, New RAS/WAS Pump Station and the Blower Building

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Expansion of Treatment Utilities and Utility Corridors

- Power Supply – Ina Road WPCF *(continued)*
  - A unified power distribution system will be implemented as plant is expanded
  - Unified system will feature redundant power sources. This will consist of dual utility sources, on site generators or combinations of both
  - Three existing utility services will ultimately be decommissioned and equipment combined into new distribution system

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Expansion of Treatment Utilities and Utility Corridors

- Potable Water Supply
  - Potable water is supplied to RR WWTP and IRWPCF by Tucson Water
  - A new potable water supply network will be provided for new Greenfield facility at Roger Road WWTP and the existing potable water system will be decommissioned upon startup of new facilities

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Expansion of Treatment Utilities and Utility Corridors

- Reuse Water Supply
  - At RR WWTP up to 30 mgd of plant effluent will be available to Tucson Water from new Greenfield Plant
  - At IR WPCF up to 20 mgd of plant effluent will be made available to Tucson Water
    - New supply, reservoir system, distribution disinfection system and distribution piping will be constructed by Tucson Water on a parcel of land at IRWPCF, provided by Pima County

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Expansion of Treatment Utilities and Utility Corridors

- Plant Air Supply
  - New plant air supply system will be provided for new Roger Road WWTP facilities
  - Existing plant air supply system at the Ina Road WPCF will be upgraded to facilitate needs for the expanded future facilities

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Architecture and Landscape

- Existing facilities consist of a wide variety of architectural styles and landscape types, reflecting independent decisions made at each plant expansion
- Through the year 2030 planning horizon, architectural and landscaping design will be guided by a single architectural and landscape theme to harmonize existing and new facilities consistent with new land use plan

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Support Facilities

- Odor Control
  - Year 2030 plan will provide a long-term solution for potential odors from both collection system and wastewater treatment plants. Odor control measures will include:
    - Minimize odor potential in collection system with pH adjustment, oxygen addition and chemical addition
    - Cover openings and channels
    - Collect and treat odorous air
    - Disperse treated air into atmosphere in a manner to minimize odor impact to surrounding communities

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Support Facilities

- Personnel Facilities (to be developed)
- Maintenance Facilities (to be developed)
- Laboratory Facilities (to be developed)
- Parking (to be developed)
- Support Facilities (to be developed)
- SCADA (to be developed)
- Chemical Handling (to be developed)
- Security (to be developed)
- Plant Stormwater Plan (to be developed)

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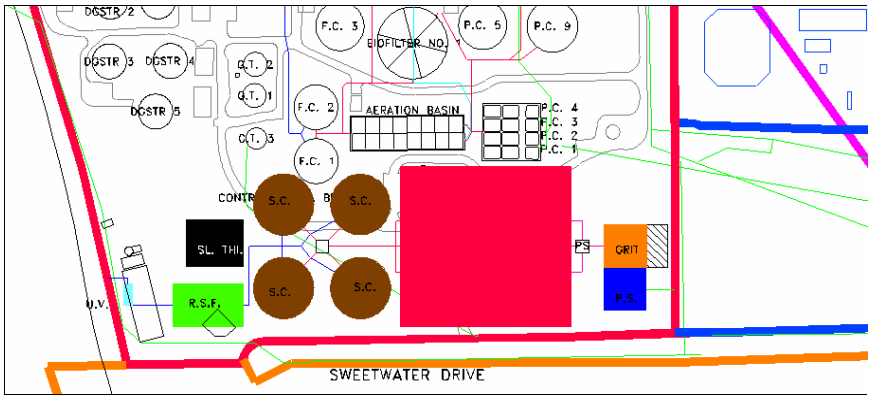
Year 2030 Master Plan Layout for Selected Alternative

Roger Road WWTP – Year 2030 Master Plan Layout



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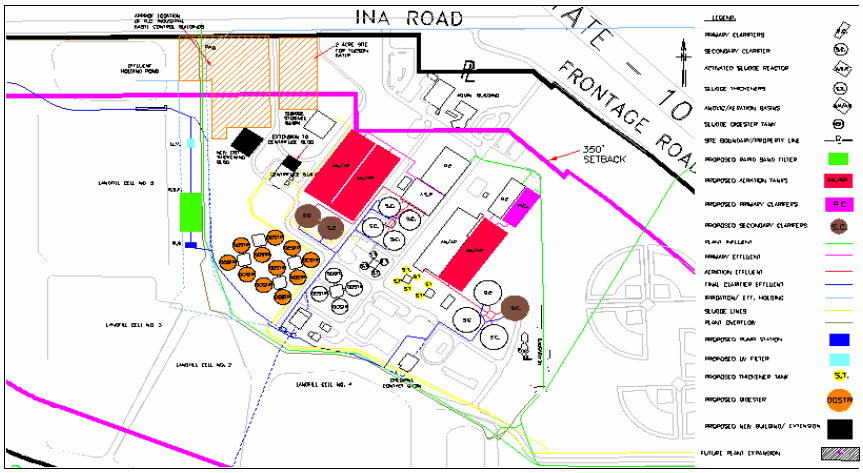
Year 2030 Master Plan Layout for Selected Alternative

Ina Road WPCF – Year 2030 Master Plan Layout



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Summary

- Recommended treatment plant plan for the year 2030 provides a new plant at Roger Road WWTP and an expansion of existing plant at Ina Road WPCF
  - Transport corridors and storm water and flood control measures
  - New multi-faceted recreational, commercial and ecological development adjacent to the RR WWTP
  - Ecosystem restoration and creation of riparian habitat in the Santa Cruz River
  - Provision for future expansion beyond the year 2030 at both treatment facilities
  - New infrastructure to be constructed
  - Existing infrastructure to be expanded, upgraded or demolished
  - Expansion of infrastructure to accommodate the increased flows to be handled at both plant locations
  - Provision for new and/or expansion of the utilities including power, potable water, reuse water and plant air supply.
  - Architecture and landscape amenable to provide public friendly image
  - Complete Plant-wide Odor Control at each facility and the Conveyance System

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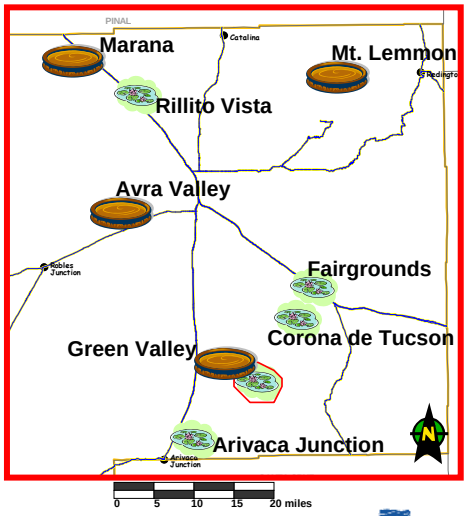
Chapter 8 – Non-Metropolitan Area Evaluation

Jerry Bish

Non-Metro Facilities



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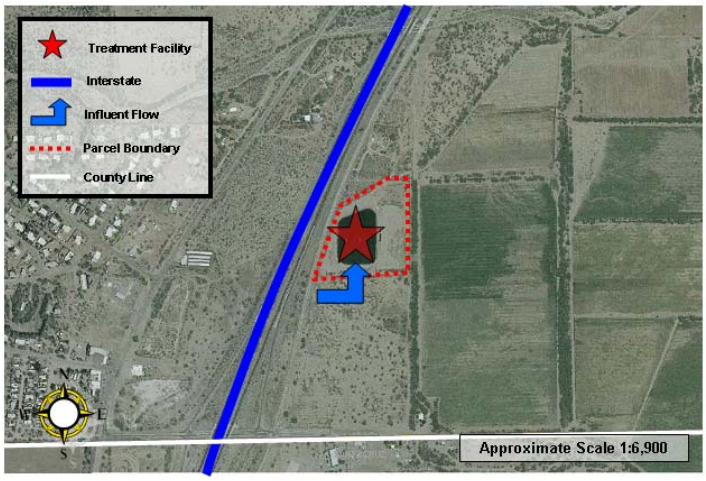
Arivaca Junction WWTF



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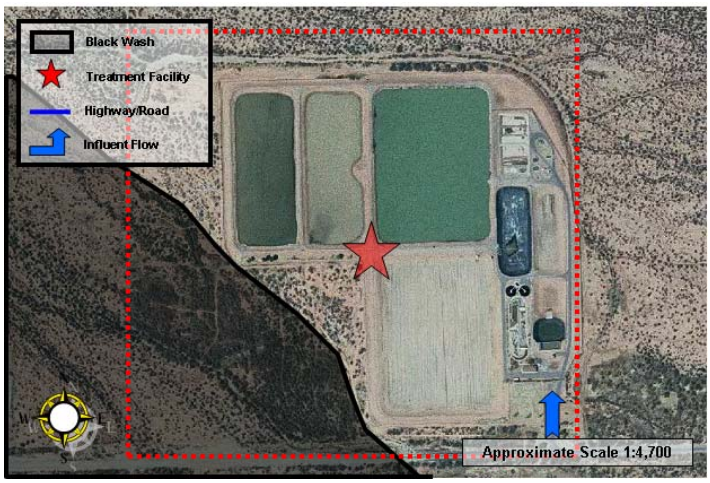
Avra Valley WWTF



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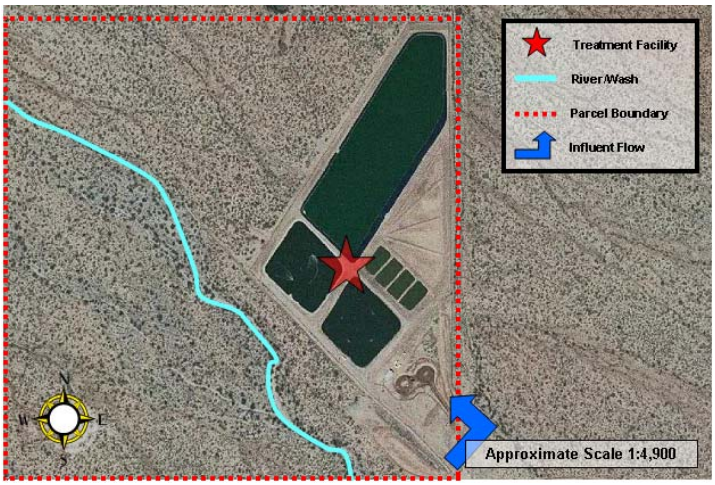
Corona de Tucson WWTF



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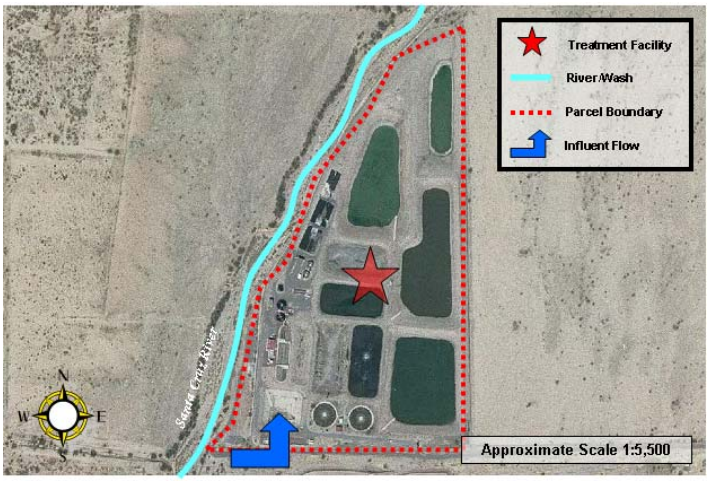
Green Valley WWTF



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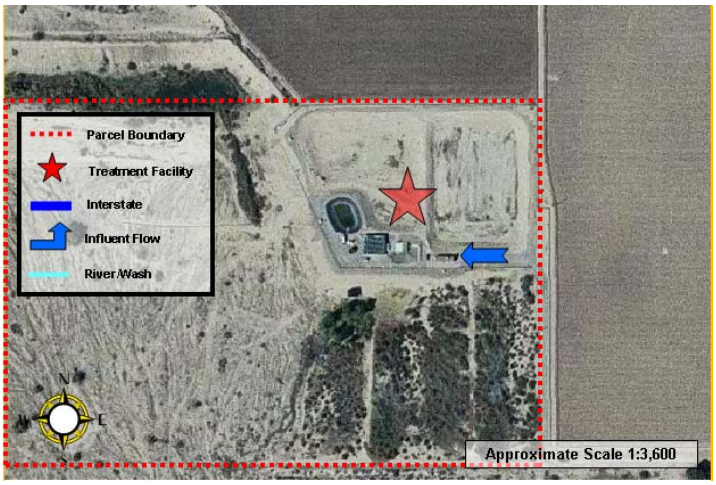
Marana WWTF



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Mt. Lemmon WWTF

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Pima County Fairgrounds WWTF

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Rillito Vista WWTF

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Reclaimed Water Permits

Facility	Permit	Produced (gpd)(1)	Percent of Total Treated
Arivaca Junction	Class C	40,000	68
Avra Valley	Class B+	320,000	30
Green Valley	Class A+ (BNROD) Class B (lagoon)	1,500,000	~~86~~ 100
Marana	Class B+	57,000	38
Mt. Lemmon	Permit (AZPDES)	2,000	100

(1) 2005 Effluent Generation/Utilization Report

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Summary of Non-Metro Facilities

Facility	Facility Parcel Area (acres)	Design Capacity (mgd)	Current Treatment Technology	Current Effluent Utilization
Arivaca Junction	10.5	0.1	Partially mixed, aerated lagoon	Percolation/evaporation. Class C delivered to Reventone Ranch.
Avra Valley	~~280~~ 139*	1.2	BNROD	Plant irrigation (Class B+). Percolation/evaporation.
Corona de Tucson	200	0.3	Partially mixed aerated lagoons	Evaporation, SAT.
Green Valley	68	2.0 BNROD 2.1 lagoon	Primarily BNROD. Excess inflow sent to aerated lagoons.	Delivered to Quail Creek for irrigation (Class A+). Plant irrigation (Class B). Percolation.
Marana	156	0.2	Smith & Loveless BNR package plants. Interim Parkson Biolac.	Plant irrigation (Class B+). Possible riparian restoration.
Mt. Lemmon	1.7	0.015	Enclosed extended air package plant.	Spray field irrigation.
PC Fairgrounds	8.8	0.035	Stabilization ponds.	Percolation/evaporation.
Rillito Vista	-	0.02	Stabilization ponds.	Percolation/evaporation.

*Additional 140-acres of land adjacent to facility parcel.

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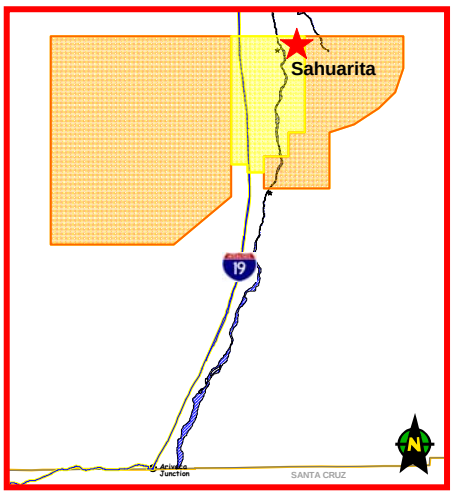
Sahuarita Designated Management Agency

- Negotiation to modify service-area



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Flow Projections

Facility	2010	2015	2020	2025	2030
Avra Valley	1.4	1.8	2.2	2.6	3.0
Corona de Tucson	0.5	0.9	1.3	1.7	2.1
Green Valley	2.7	3.1	3.6	4.0	4.4
Marana	1.6	2.3	3.0	3.7	4.4
Mt. Lemmon	0.002	0.002	0.002	0.002	0.002
Southlands (excludes Corona)	1.2	3.6	6.0	8.2	10.5

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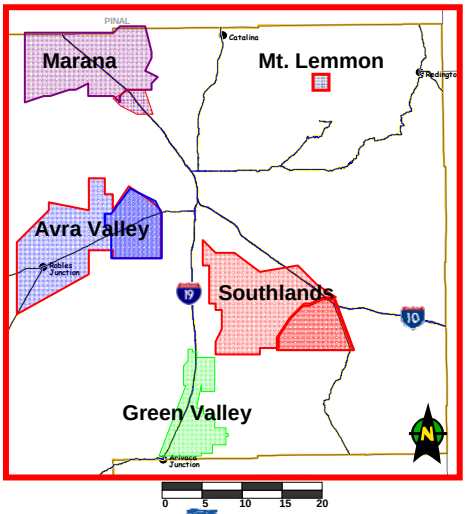
Service Areas (2030)

- Change Avra's service-area



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Current Water Reuse

Current Water Reuse		
Facility	**Permit**	**Use**
Arivaca Junction	Class C	Reventone Ranch (Agriculture)
Avra Valley	Class B+	Spray Field Disposal
Green Valley	Class A+	Robson/Quail Creek, Inc. (Turf Irrigation)
Marana	Class B+	~~Santa Cruz River Discharge and~~ Plant Turf Irrigation
Mt. Lemmon	~~USFS~~ AZPDES Permit	Spray Field Disposal

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Current Biosolids Production

Current Biosolids Production		
Location	**Produced (tpd)**	**Processing, Disposal**
Arivaca Junction	0.09	-
Avra Valley	2.2	Storage, transported to Roger Road
Corona de Tucson	0.16	Evaporation, hauled to landfill when pond is cleaned
Green Valley	5.7	GBTs, Aerobic Digesters, BFPs, Drying, Sent to Asarco Mines
Marana	0.28	Storage, transported to Ina Road
Mt. Lemmon	0.018	Storage, transported to Ina Road
PC Fairgrounds	0.004	Evaporation, hauled to landfill when pond is cleaned
Rillito Vista	0.014	-
Total	**8.47**	

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Future Biosolids Production

Future Biosolids Production						
Location	**Produced (tpd)**					**Processing, Disposal**
	2010	**2015**	**2020**	**2025**	**2030**	
Arivaca Junction	-	-	-	-	-	-
Avra Valley	3.12	3.67	4.20	4.73	5.26	storage, hauled ⇒ regional facility
Corona de Tucson	1.50	2.07	2.63	3.21	3.77	storage, hauled ⇒ regional facility
Green Valley	2.79	3.79	4.79	5.80	6.79	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Marana	3.79	4.40	5.00	5.60	6.20	storage, hauled ⇒ regional facility
Mt. Lemmon	4.22	4.22	4.22	4.22	4.22	storage, hauled ⇒ regional facility
PC Fairgrounds	-	-	-	-	-	-
Rillito Vista	-	-	-	-	-	-
Southlands	1.68	5.04	8.40	11.48	14.70	separate processing and disposal
Total	**17.10**	**23.19**	**29.24**	**35.04**	**40.94**	

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Chapter 9 – Recommended Non-Metropolitan Area Treatment and Expansion Plan

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Influent Wastewater Characteristics

Characteristic	Non-Metro Facility Influent Concentrations (mg/L)
BOD_5	300
$SBOD_5$	125
COD	590
TSS	270
VSS	220
TKN	57
TP	10

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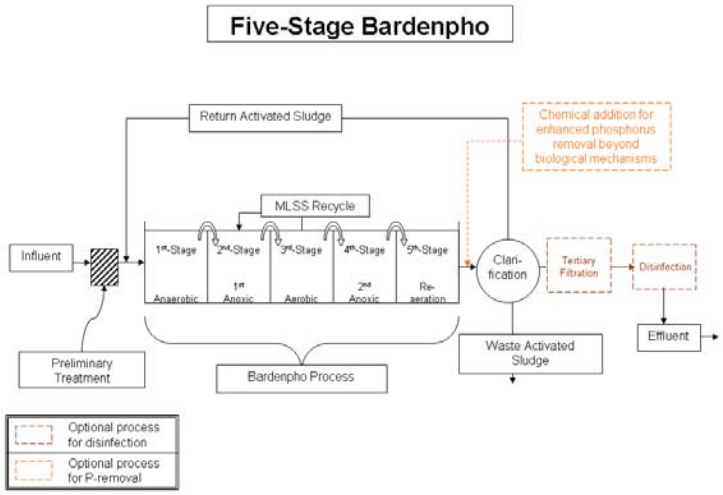
Probable Effluent Quality

Parameter	Effluent Quality
BODs	< 6 mg/L
TSS	< 10 mg/L
NH4-N	< 1 mg/L
TN	< 10 mg/L
TP	< 1 mg/L
Pathogen removal	No detect in 4 of 7 samples/week. None exceeding 23cfu/100ml
pH	6.8 – 7.2

131

Bardenpho Process



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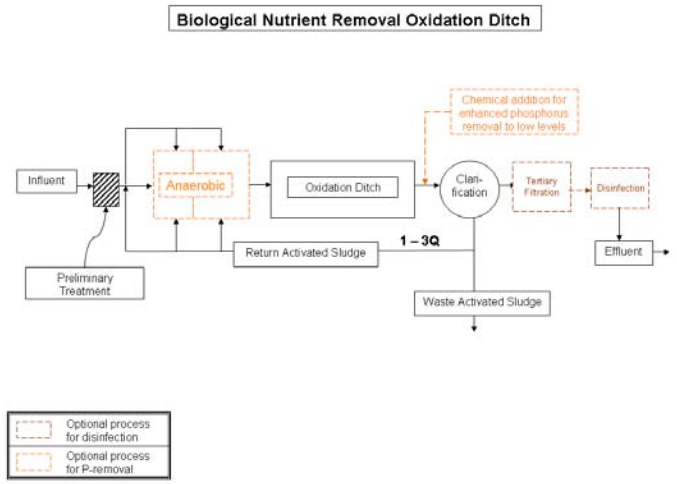
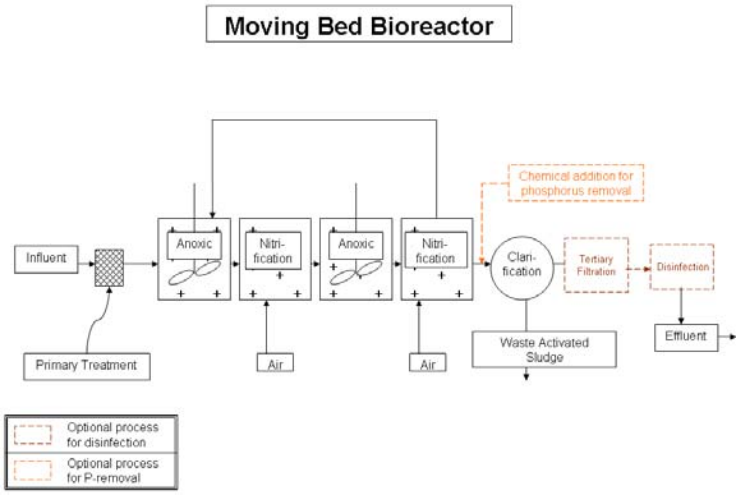
BNROD



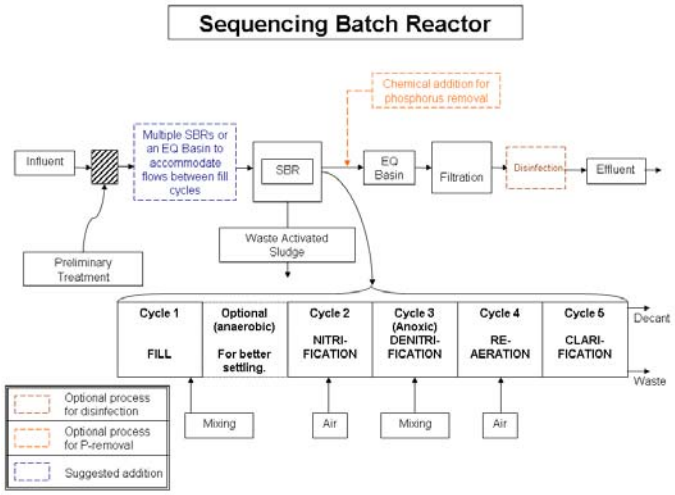
133

MBBR

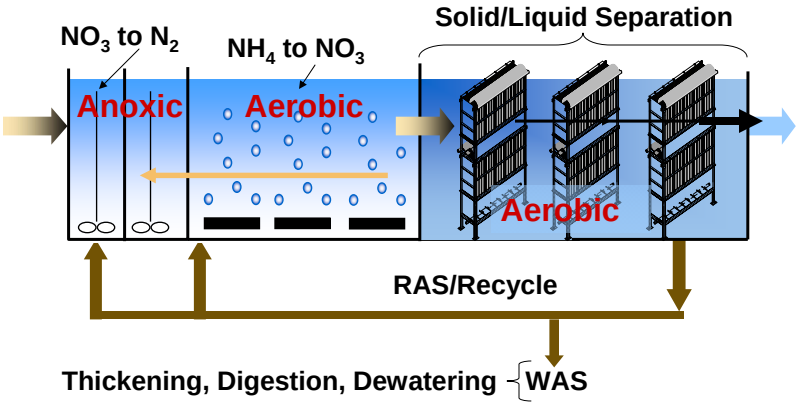


134

SBR



Membrane Bio-Reactor



Evaluation Matrix

Criteria	WF	[illegible]				Weighted Rank			
		Bardenph[illegible] o	[illegible]	[illegible]	[illegible]	[illegible]	BNRO D	MBBR	SBR
Cost	5	[illegible]	[illegible]	3	5	[illegible]	[illegible]	15	25
Environmental Impact	4	[illegible]	4	1	2	[illegible]	[illegible]	4	8
Feasibility	3	[illegible]	1	4	[illegible]	[illegible]	[illegible]	12	9
Operation Compatibility	4	[illegible]	3	4	[illegible]	8	[illegible]	16	4
Land Required	2	[illegible]	4	[illegible]	[illegible]	6	[illegible]	2	4
Maintenance	4	[illegible]	1	[illegible]	[illegible]	8	[illegible]	12	16
Public Acceptability	4	[illegible]	3	[illegible]	1	16	[illegible]	8	4
Reliability	4	[illegible]	[illegible]	[illegible]	3	8	[illegible]	16	12
Sludge Production	1	[illegible]	[illegible]	4	2	[illegible]	[illegible]	4	2
Water Reuse Potential	4	2	[illegible]	[illegible]	[illegible]	[illegible]	16	4	12
Sum of Weighted Rank[illegible]						[illegible]	**96**	**93**	**96**

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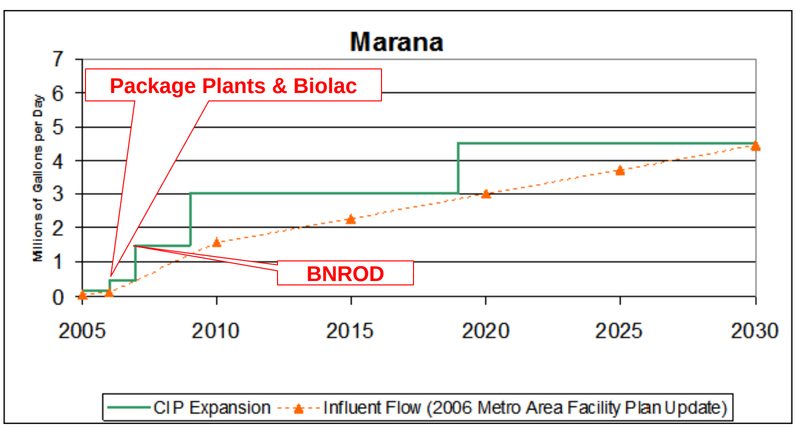
Marana – Flow/Capacity



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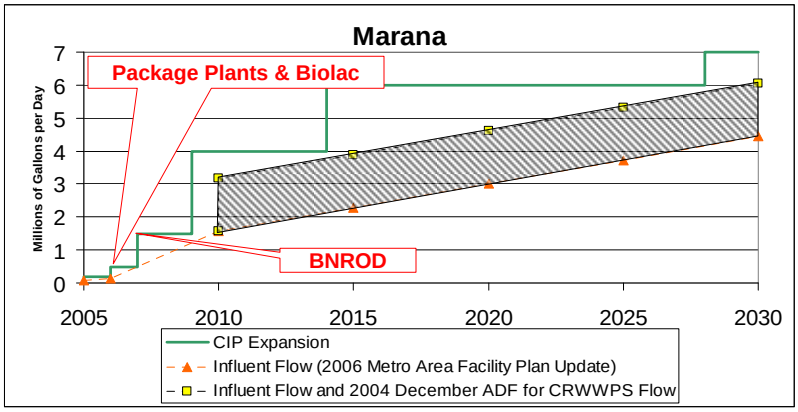
Marana – Flow/Capacity



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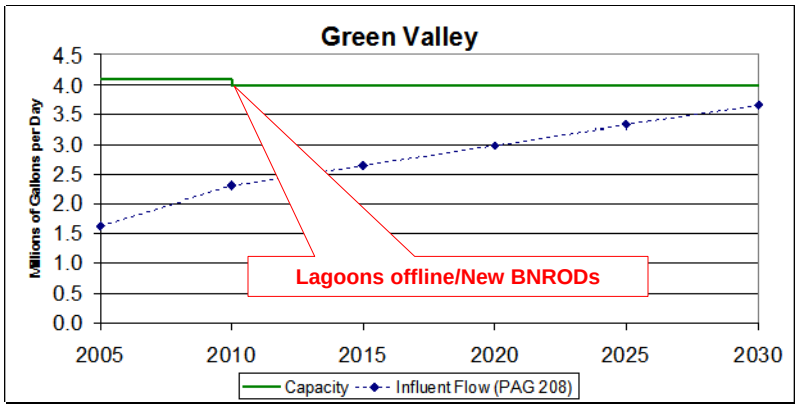
Green Valley – Flow/Capacity



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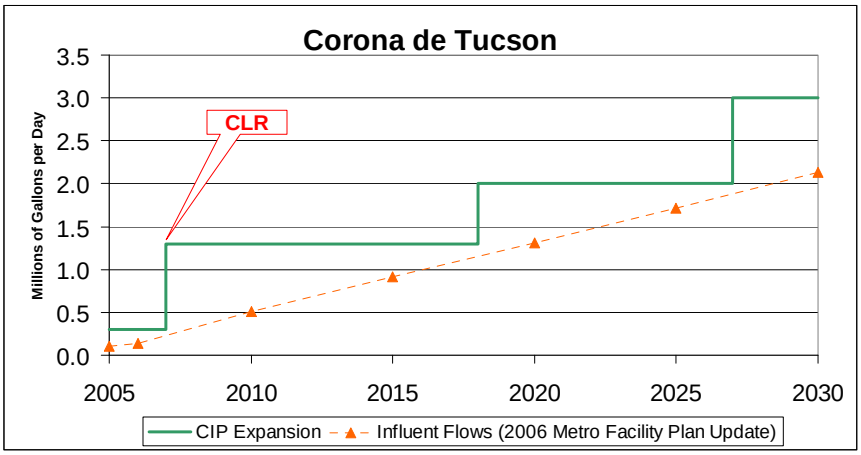
Corona de Tucson –Flow/Capacity



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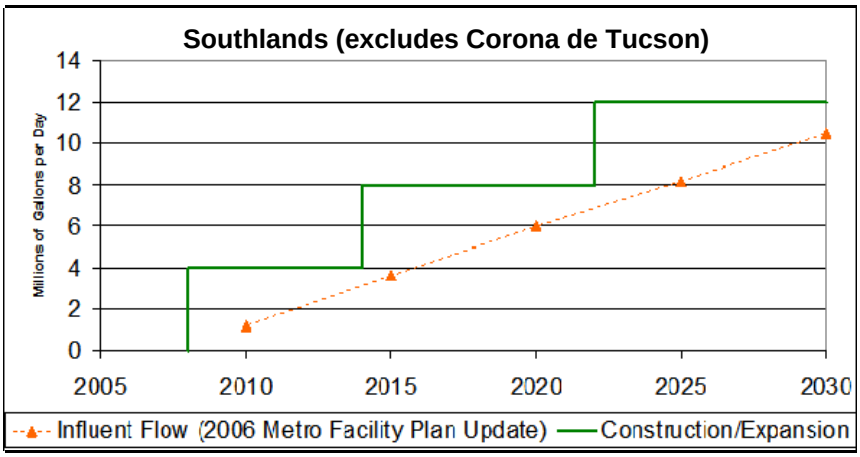
Southlands – Flow/Capacity



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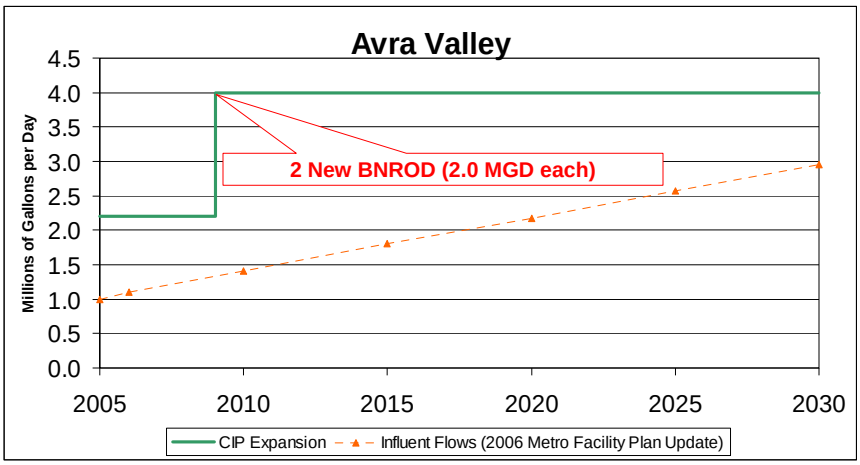
Avra Valley – Flow/Capacity



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Chapter 10 – CIP Elements

Jerry Bish

CIP Elements

- Plant interconnect
- Roger Road
- Ina Road
- Support Facilities
- Non-Metro Facilities Expansions

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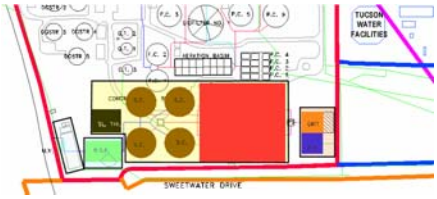
Roger Road WWTP

- Site preparation (temporary administration building)
- Headworks
- Bardenpho treatment (including clarifiers, solids thickening/pumping)
- Pump station/filtration
- UV disinfection
- Administration/control building
- Standby power generation
- Future 8-mgd Bardenpho system (including clarifier)
- Future gravity belt thickeners
- Existing Roger Road Facility demolition



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Ina Road WPCF

- Site preparation
- Primary clarifier
- Bardenpho treatment (including clarifiers)
- Demolish HPO and oxygen system
- Mesophilic digestion (4 new, 4 existing)
- Gravity thickening (primary sludge)
- Gravity belt thickening (WAS sludge)
- Centrifuge dewatering
- Sludge storage
- Pump station/filtration
- UV disinfection
- Centralized laboratory
- Power unification/biogas power generation
- Future mesophilic digester
- Future centrifuge thickener
- Future thermophilic digesters

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Non-Metro Facilities Expansion

- Southwest Region
  - Avra Valley WWTF
    - Expansion 1 (from 1.2 to 2.2 MGD)
    - Expansion 2 (Phase out existing BNROD and start up 2 new BNROD trains providing a total treatment capacity of 4.0 MGD)
    - Expansion 3 (rehabilitate old BNROD to add 1.6 MGD of treatment capacity)
- Southeast Region
  - Corona de Tucson WWTF
    - Expansion 1 (from 0.3 to 1.3 MGD)
    - Expansion 2 (from 1.3 to 2 MGD. This requires closing the lagoons and adding a new 1 MGD treatment facility.)
    - Expansion 3 (from 2 to 3 MGD)
  - Southland WWTF
    - Expansion 1

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Non-Metro Facilities Expansion

- South Region
  - Green Valley WWTF
    - Expansion 1 (from 4.1 MGD BNROD/Aerated Lagoon to 4.0 MGD BNROD)
    - Expansion 2 (from 4.0 MGD to 5 MGD)
    - Decommission Arivaca Junction WWTF
- Northwest Region
  - Marana WWTF
    - Expansion 1 (from 0.5 to 1.5 MGD)
    - Expansion 2 (from 1.5 to 3 MGD)
    - Expansion 3 (from 3 to 4.5 MGD)
    - Expansion 4 (from 4.5 to 6 MGD)
    - Decommission Rillito Vista WWTF
- Mt. Lemmon WWTF
  - No change unless changes in area restrictions

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Chapter 11 – CIP Delivery Method

Jerry Bish

Alternative Delivery Methods

- Design-Build
- Design-Build-Operate
- Construction-Manager-At-Risk
- Design-Bid-Build

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Procurement Method Selection Considerations

- Procurement process
- Design and construction
- Operation and maintenance

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Chapter 12 – CIP Phasing and Cost Schedules

Jerry Bish

Chapter 12 – CIP Phasing and Cost Schedules

- *Capital Projects*
  (Include final agreed upon ROMP projects and costs)
- *Other Capital Projects*
  (Include 15-year CIP information)
- *Total Capital Plan*
  (Include 15 year CIP information)
- Zero Coupon Bonds and Capital Appreciation Bonds
  (Insert current data on interest rates for zero coupons)
- State Revolving Funds
  (Provide current information regarding availability of WIFA funds)

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Chapter 12 – CIP Phasing and Cost Schedules

- *Baseline Financing Plan*
  (Evaluate options once costs finalized)
- Customer Impacts
  (CIP data required)
- *Applicability of International Finance to Pima County*
  (Requires further research)

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Chapter 12 – CIP Phasing and Cost Schedules

- *Private Financing Approaches in the United States*
  (Requires further research)
- Private Activity Bonds
  (Update to address pending legislation that may make PABs a more viable option)
- Tax-Exempt Corporation
  (Update after further discussions with the County)
- *Private Financing Case Studies in the United States*
  (Requires further research)

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Chapter 13 – Implementation Plan

Jerry Bish

Chapter 13 – Implementation Plan

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Interconnect	**$22,300,000**															
Design		**$1,338,000**														
Construct				**$20,962,000**												
Ina Rd	**$243,900,000**															
Design 50 mgd		**$14,634,000**														
Construct 50 mgd					**$212,193,000**											
Construct Thermophilic Digestion														**$17,073,000**		
Roger Rd	**$234,800,000**															
Design 32 mgd			**$12,660,000**													
Construct 24 mgd						**$148,755,000**										
Demo Existing Plant									**$23,800,000**							
Construct 8 mgd											**$49,585,000**					

Total ROMP Projects Cost $501,000,000

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Implementation Details

- List of CIP projects
  - Metro/Non-Metro Facilities
  - Conveyance
- Scheduled implementation
- Project delivery
- Funding source

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Other Topics

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Chapter 5.8 – Biogas Utilization

Vic Smith

2014 Biogas Production

(@ 550 BTU per cubic foot)

479 MCF per year

263 kMBTU per year

2,633 kTherms per year

30,070 kBTU per hour

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Raw Natural Gas Value

(@ $1.00 per therm)

$2,633,000 per year

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Some Other Assumptions and Clarifications

- Boiler efficiency 75%
- Electricity cost $0.09/kWH
- Over time, natural gas and electricity will escalate at approximately the same rate per energy value
- 1 kW = 3,414 BTU per hour
- M = 1,000,000
- k = 1,000
- BTUH = BTU per hour
- 1 Therm = 100,000 BTU

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Biogas Options

- On-site electricity and heat generation (combined heat and power, CHP 1 and 2)
- On-site heat and cooling generation only (heating and cooling use, HCU1)
- Third party use and agreements (TPU 1 and 2)

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Combined Heat and Power System Alternatives

- Turbines
- Microturbines
- Fuel cells
- Sterling (external combustion) engines
- IC (internal combustion) engine-generators*

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Primary CHP Selection Criteria

- Mechanical and electrical efficiencies
- Tolerance to biogas impurities
- Fit with and adaptability to existing power plant systems
- Proven technology
- Cost per kW
- Emissions

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IC (Internal Combustion) Engine Generators – Energy Balance by System and Percentage

System	% Energy in	Useful Energy
*Electricity	35%	35%
*Jacket Water	28%	28%
*Exhaust Recovered	13%	13%
Exhaust Lost	12%	
Lube Oil	5%	
Intercooler	3%	
Radiation	2%	
Generator	2%	
	100%	76%

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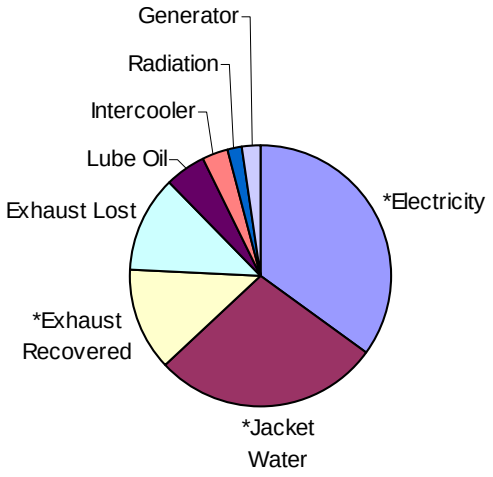
IC Engine Energy Balance – By System



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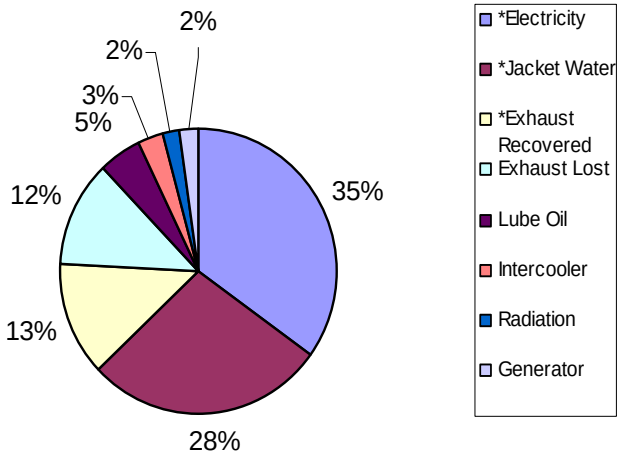
IC Engine Energy Balance – By Percentage



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Existing Power Plant IC Engine Capacities

Maximum Electric	4,550 kW
Maximum Thermal	22,400 kBTUH

Assuming One Standby and 80% of Max Output

Nominal Electric	3,120 kW
Nominal Thermal	12,400 kBTUH

Coincidental, but a surprisingly good match for projected biogas production.

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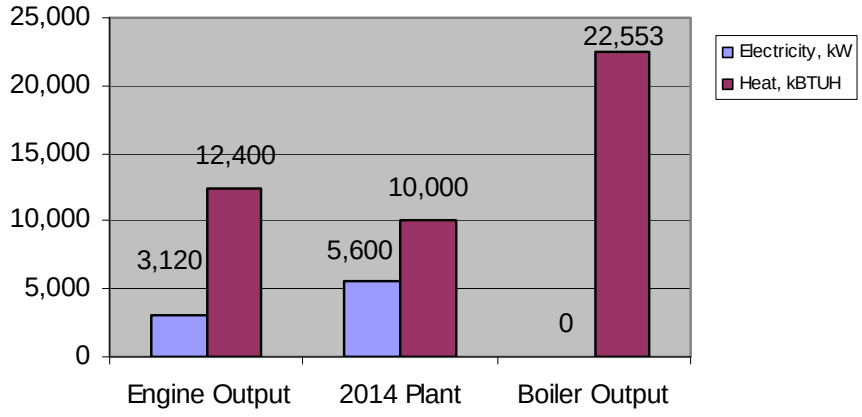
IC Generator and Boiler Outputs Compared to Projected Plant Demands



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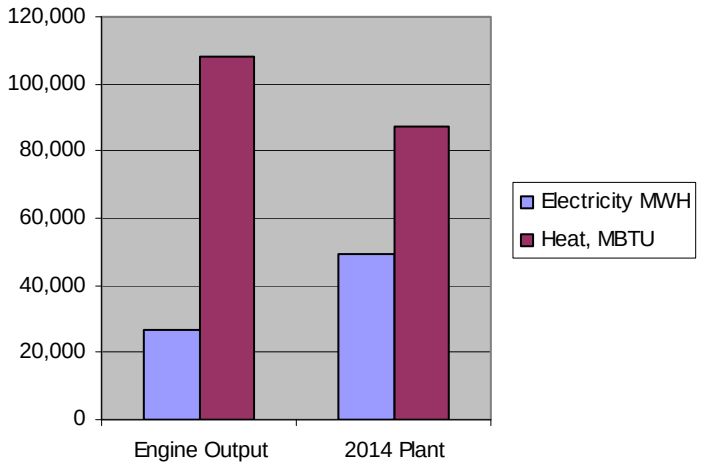
IC Engine Annual Energy Output Compared to Projected Plant Usages



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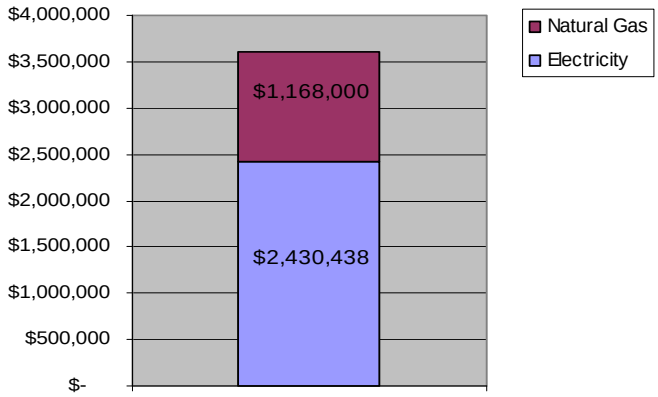
Annual IC Engine Savings



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Incremental Savings

As the size of the energy recovery facility increases:

Case 1:	**All biogas produced electricity and heat are consumed**
Case 2:	**All biogas produced electricity and part of the heat are consumed**
Case 3:	**NG is used to produce electricity up to the average demand**
Case 4:	**NG is used to produce electricity up to the peak demand**

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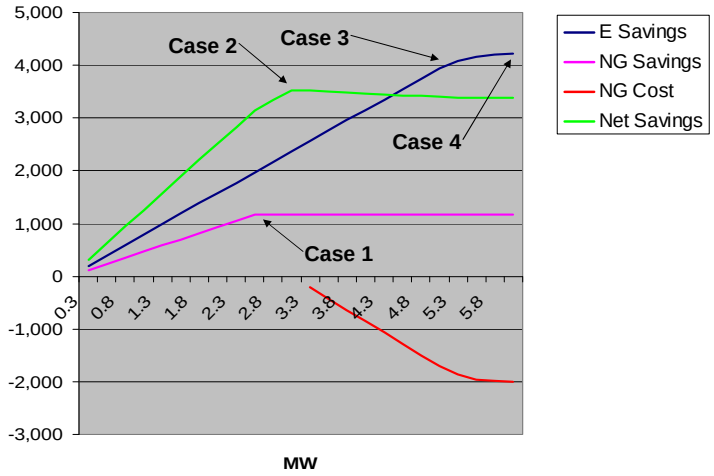
Incremental Savings ($ x 1,000)



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Savings by Case, $kWH

Case 1:	**All biogas produced electricity and heat are consumed**	**$0.13**
Case 2:	**All biogas produced electricity and part of the heat are consumed**	**$0.09**
Case 3:	**NG is used to produce electricity up to the average demand**	**($0.05)**
Case 4:	**NG is used to produce electricity up to the peak demand**	**($0.05)**

Cases 1 and 2 are representative of Option CHP1
Cases 3 and 4 are representative of Option CHP2

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Biogas Options and Alternatives

- Combined heat and power
  - CHP1: Biogas consumption only
  - CHP2: Biogas consumption and natural gas consumption to supply remaining electrical usage
- Heating and cooling use
  - HCU1: Biogas consumption for heating and cooling only
- Third party use and agreements
  - TPU1: Off-Site energy developer use
  - TPU2: On-Site energy developer (or operator) use

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CHP 1 and 2 Economics
($ x 1,000)

Option and Alternative	Capital Cost	Energy Savings	Operating Costs	Annual Savings
CHP1: BG only	5,500 to 12,000	3,595	1,475	2,125
CHP2: BG + Nat Gas	25,000 to 30,000	3,375	1,975	1,400

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CHP1 Cost Considerations

- Capital costs
  - Value of existing power plant
    - Central cooling
    - Cooling distribution
    - Central process and space heating
    - Heating distribution
    - Engine heat rejection systems
    - General infrastructure
  - Changes needed
    - New generators and synchronization
    - New electrical addition and remodeling
    - Gas conditioning
  - Closely matches projected 2014 biogas output

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CHP1 Cost Considerations
(continued)

- Operating costs
  - Gas conditioning
    - Hydrogen sulfide
    - Siloxanes
  - Consumables
  - Major overhauls (and other contract work)
  - Personnel

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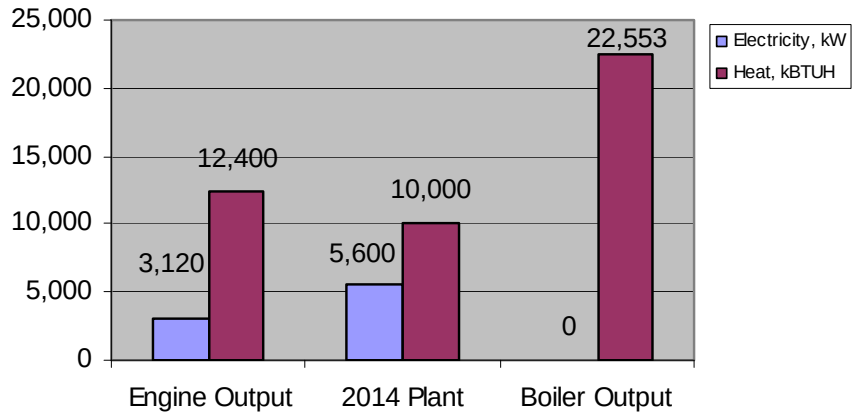
HCU1 Economics

Heating and cooling uses less than 45% of the biogas



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TPU1: Off-Site 3rd Party Use Economics

- The energy developer accrues capital and operating costs similar to those of PCWMD in option CHP1
- The energy developer faces additional capital and operating costs for gas transport
- At this point in time, there are no significant capital incentives, operating rebates or tax deductions for TPU1 (or TPU2)

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TPU2: On-Site 3rd Party Use Economics

- The energy developer does not have a significant labor advantage; other costs like consumables, overhauls, etc., are similar
- This alternative may be cumbersome from a labor relations perspective
- Proposed green and renewable initiatives are available to both PCWMD and the energy developer

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Green and Renewable Energy Incentives – REST

- Arizona Corporation Commission- Environmental Portfolio Standard (EPS): Rulemaking to encourage an increasing percentage of renewable generation- biogas is one of the renewable categories
- The program name is being changed to Renewable Energy Standard Tariff (REST) from EPS
- REST is currently out for review by manufacturers, interest groups, utilities and others
- Upon review completion and comments incorporation, the program still needs funding approval

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REST Incentives

- Proposed Incentives for biogas are:
  - $0.054 per kWH, electricity generation only, or
  - $0.031 per kWH-elec and $0.016 per kWH-thermal for CHP
- There is no 'Upfront Incentive'
- The incentives, as proposed, are transferable
- Baseline for incentive calculation is 1996 biogas consumption for electricity or CHP generation

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REST Example

- Assume the biogas flared at Roger Road could be burned in the engines at Ina Road
- Since the baseline year approximately 140MCF are flared annually
- If this gas were consumed at Ina, the annual energy savings are $845,600 assuming only half the thermal output is used, $.08/kWH and $.80/Therm
- The REST incentive, based upon its Uniform Credit Purchase Plan table, is $355,460

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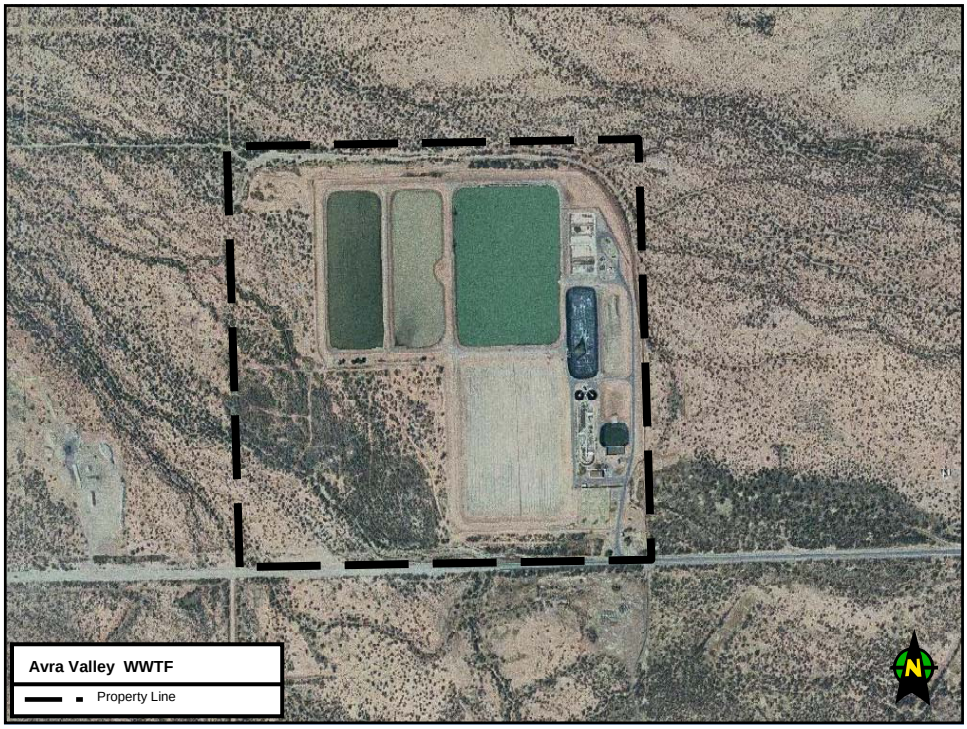
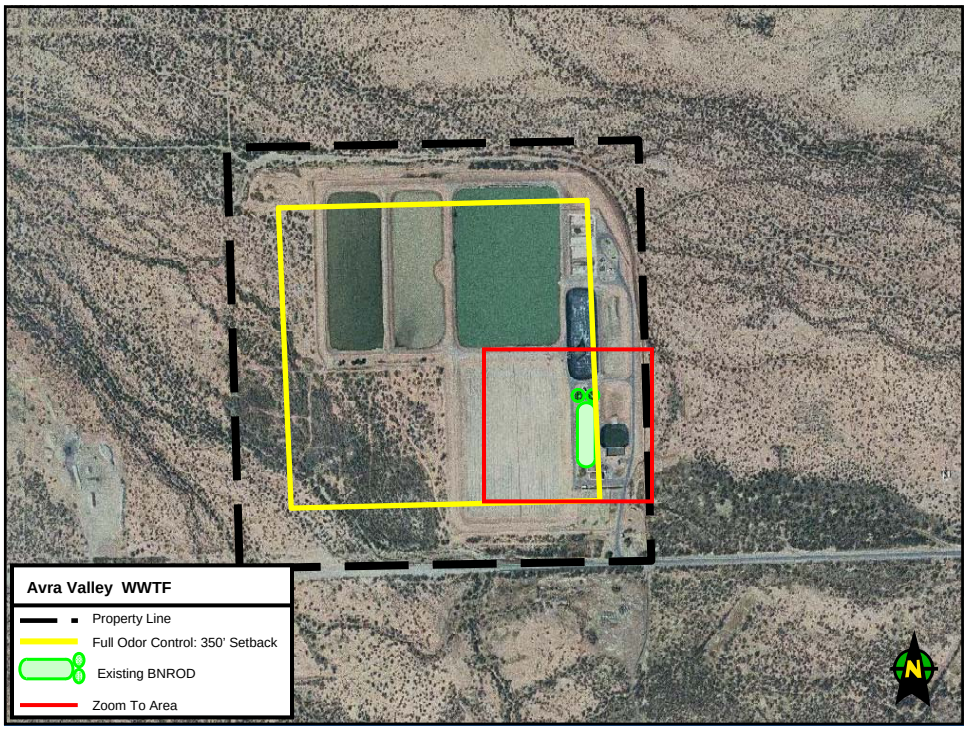
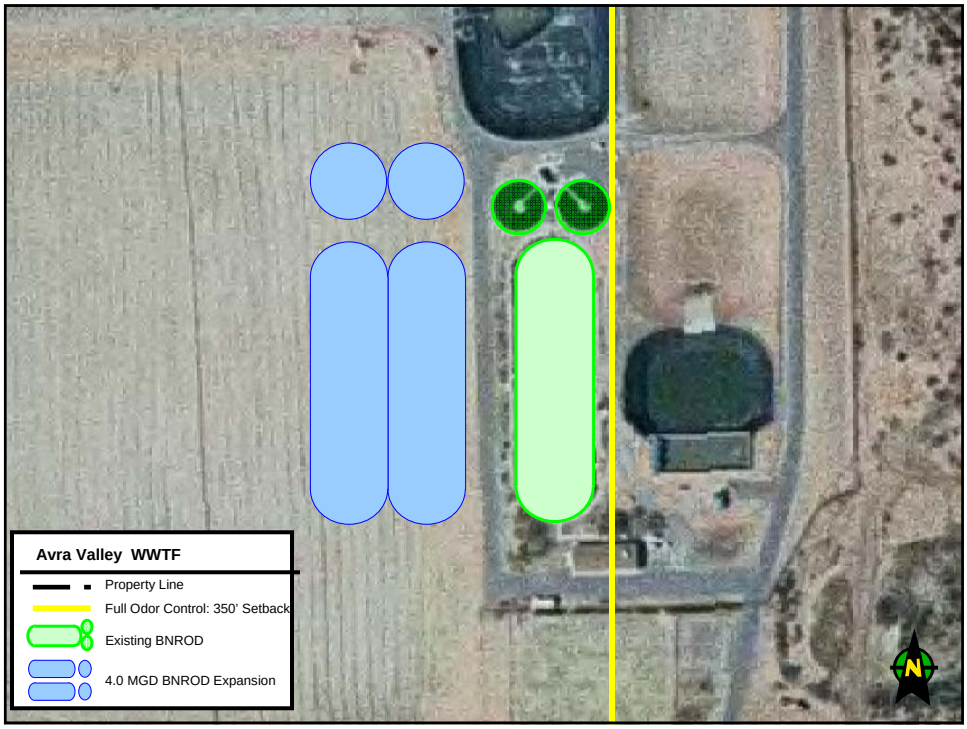
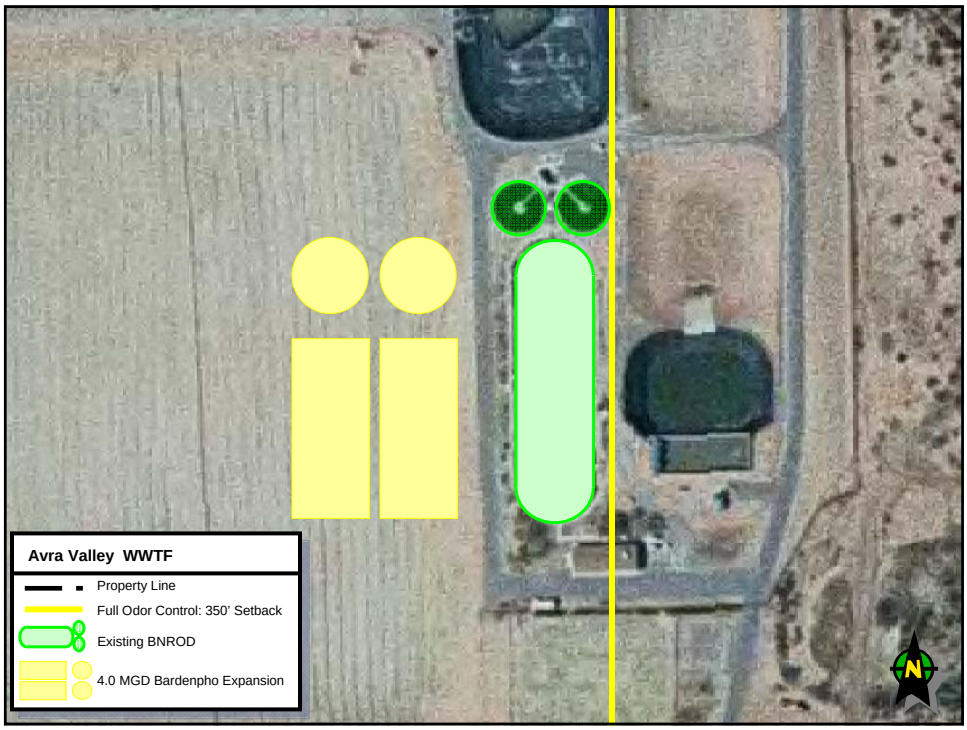
Non-Metro Treatment Facilities WW Process

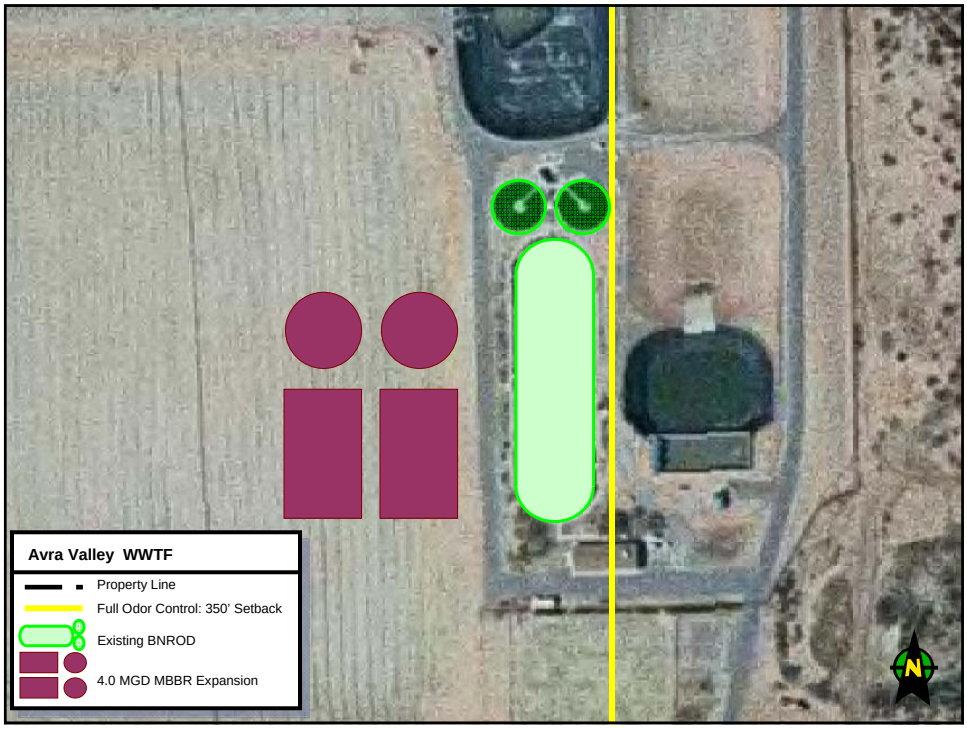
Gordon Culp

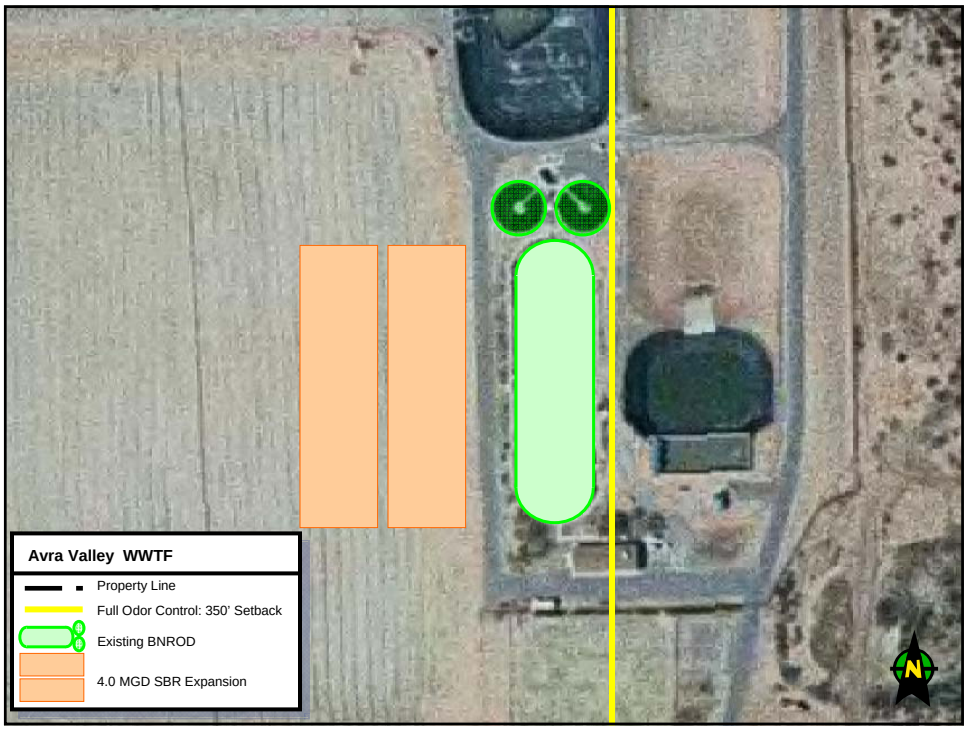

Avra Valley WWTF
Property Line
N

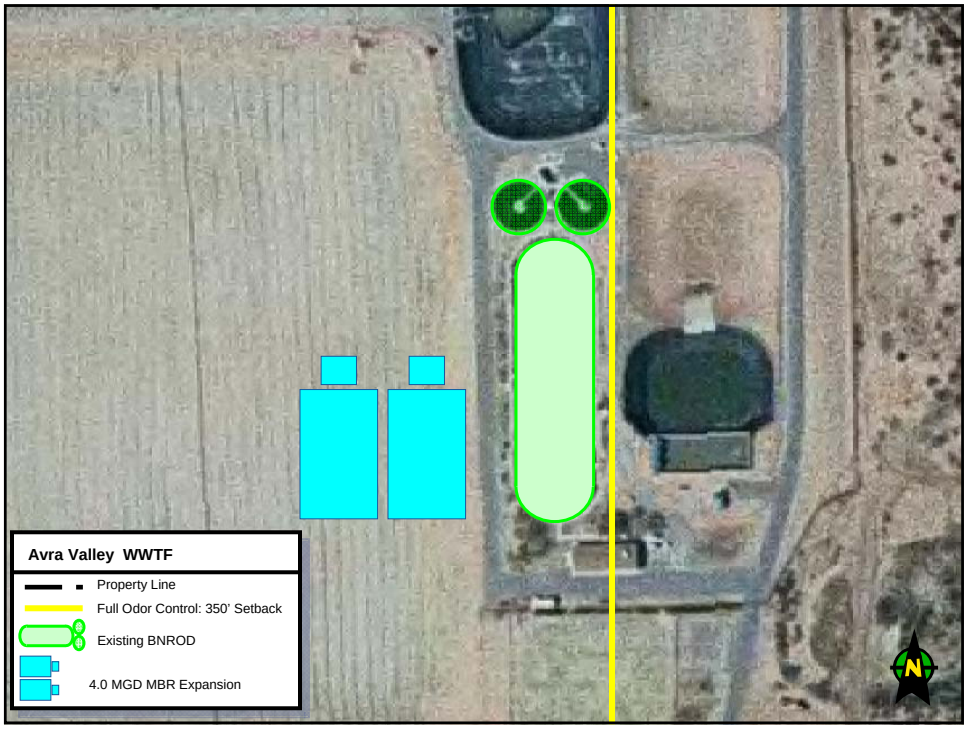

Avra Valley WWTF
Property Line
Full Odor Control: 350' Setback
Existing BNROD
Zoom To Area
N


Avra Valley WWTF
Property Line
Full Odor Control: 350' Setback
Existing BNROD
4.0 MGD BNROD Expansion
N


Avra Valley WWTF
Property Line
Full Odor Control: 350' Setback
Existing BNROD
4.0 MGD Bardenpho Expansion
N


Avra Valley WWTF
Property Line
Full Odor Control: 350' Setback
Existing BNROD
4.0 MGD MBBR Expansion
N


Avra Valley WWTF
Property Line
Full Odor Control: 350' Setback
Existing BNROD
4.0 MGD SBR Expansion
N



System Evaluation Matrix

Criteria	Rank				
	Bardenpho	BNROD	MBBR	SBR	MBR
Cost	4	4	3	5	1
Environmental Impact	3	4	3	3	3
Feasibility	3	5	4	3	4
Operational Capability	4	4	3	2	4
Land Required	4	3	4	4	5
Maintenance	3	5	3	3	2
Public Acceptability	3	3	3	3	4
Reliability	3	4	3	3	2
Sludge Production	3	5	3	3	3
Water Reuse Potential	4	4	4	4	5

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Weighting Factors

Criteria	Weighting Factor
Cost	5
Environmental Impact	4
Feasibility	3
Operational Capability	4
Land Required	2
Maintenance	4
Public Acceptability	4
Reliability	4
Sludge Production	1
Water Reuse Potential	4

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Weighted System Evaluation Matrix

Criteria	WF	Rank					Weighted Rank				
		Bardenpho	BNROD	MBBR	SBR	MBR	Bardenpho	BNROD	MBBR	SBR	MBR
Cost	5	4	4	3	5	1	20	20	15	25	5
Environmental Impact	4	3	4	3	3	3	12	16	12	12	12
Feasibility	3	3	5	4	3	4	9	15	12	9	12
Operational Capability	4	4	4	3	2	4	16	16	12	8	16
Land Required	2	4	3	4	4	5	8	6	8	8	10
Maintenance	4	3	5	3	3	2	12	20	12	12	8
Public Acceptability	4	3	3	3	3	4	12	12	12	12	16
Reliability	4	3	4	3	3	2	12	16	12	12	8
Sludge Production	1	3	5	3	3	3	3	5	3	3	3
Water Reuse Potential	4	4	4	4	4	5	16	16	16	16	20
Sum of Weighted Ranks							120	142	114	117	110

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Covered Oxidation Ditch

- Cambridge, MN 1.84 mgd (ADWF)

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Biosolids

Jerry Bish

Major Issues/Concerns

- What are others in Southwest doing?
- Concerns about issues arising in California about land application
- Currently single land applicator controls majority of land around Pima County
- Can not produce Class A biosolids now if Class B became unacceptable to public

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Other AZ Utilities:

- Land application in AZ:
  - Approx. 65,000 tpy land applied in AZ from AZ
  - Approx. 35,000 tpy land applied in AZ from CA
- Phoenix Regional
  - 91st Street – landfill
  - 23rd Avenue – land application
- City of Tolleson (Peoria and Sun City) – land application
- Other major utilities that landfill biosolids:
  - Chandler
  - Flagstaff
  - Mesa
  - Avondale/Glendale
  - Lake Havasu City

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Other Southwest Utilities Are:

- CA – Considerable land application
  - City of LA has land application and composting
  - LA County SD contracting for commercial biosolids to E-fuel to start in 2008
  - LA County currently landfilling and land application, much of it in NV and AZ
- NV – Las Vegas valley utilities landfill unstabilized solids

203

California LA Example

- City of Los Angeles land applies Class A/EQ biosolids on own 4,688 acre farm in Kern County
- In 2003 Kern County required that land applied biosolids be Class A/EQ in unincorporated areas
- Kern County voted in a land application ban on all biosolids in unincorporated areas in June 2006 to start Jan. 2007 (85% voted yes)
- LA and partners suing in Federal Court to continue land application
  - Class A/EQ product did not safeguard land application

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California LA Example *(continued)*

- Review of news information indicates:
  - Ban supporters talk about LA dumping on them – urban vs. rural or powerful vs. marginalized issue
  - Kern County allows Class B solids from Kern County to be applied to land in incorporated areas
  - Emotional issue – not related to facts and inconsistently applied

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Land Application

- Current contractor does not foresee interest in Class A biosolids in area
  - Hauling of liquid is well contained so no mess or odors in populated areas
  - Current liquid (up to 10%) directly incorporated = low odors at sites
  - Hauling/incorporating cake = more odors
  - Class A more odorous in contractor's opinion

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Single Land Contractor Locally

- Current land application cost relatively low
- Other contractors have bid in the past
- Synagro and Solid Solutions are contractors working in the Phoenix area
- <u>County should have a backup plan</u>
  - Recommend ability to make cake that could be landfilled as backup
  - Explore future dedicated land application
  - Could install one thermophilic digester to see if product is more marketable and gain experience in operation

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Class A vs. Class B

- Opposition to land application does not appear limited to Class B
  - Converting to Class A may not help with this market
- Type of Class A process to use depends on available markets
  - Liquid (TPAD) best option if land applying
  - Drier product desired for mine reclamation, bagging/landscaping or energy generation

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Class A vs. Class B

- Class A processing is more expensive in capital cost and operation cost
- Stable market for Class A unknown at this time
- Do not want to invest significant $ before knowing viable market – market analysis
  - Arrange site to have space for a future Class A process
  - Could be a fit for future DBO project

209

Composting at Los Reales

- Los Reales landfill currently performing pilot testing on composting operation
- Looking for good/consistent nitrogen source (trying manure)
- Could it be a fit for Pima County biosolids, maybe an outlying plant?
- Los Reales Concerns: don't want odors or metals from the biosolids
- Worth exploration by Pima County to further diversity future biosolids program

210

Dedication Land Application

- Requires significant land
  - Approx. 1,400 acres for main plants solids
  - Approx. 1,900 acres for all plants solids
- Line application site
- Must contain surface runoff
- Must monitor groundwater
- No agronomic limit to application rate
- Provides County with control over own destiny

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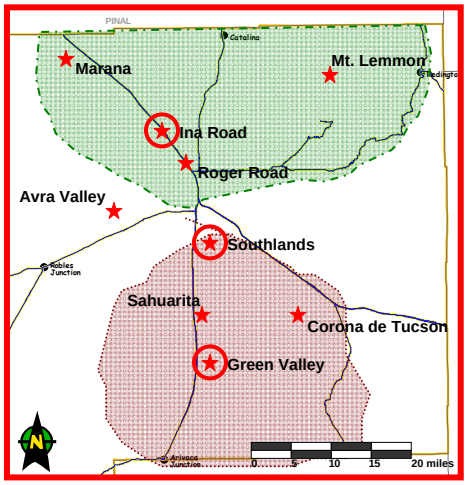
Regional Solids Processing



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UV vs. Enhanced Chlorination

Jerry Bish

UV Disinfection vs. Enhanced Chlorination – Systems

- UV Requirements
  - Lift pump station
  - Filtration
  - High Intensity UV
- Enhanced Chlorination
  - Contact Tank (longer retention)
  - Higher sodium hypochlorite dosages
  - Higher sodium bisulfite dosages

214

UV Disinfection vs. Enhanced Chlorination – Cost Impacts

- UV Costs $91.0 million
  - Construction/Contingency/ Engineering
- Enhanced Chlorination $17.6 million
  - Construction/Contingency/ Engineering

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Enhanced Chlorination Study/Investigation

- Identify/list critical success factors
- Research
  - Literature review
  - Conduct a facility survey
  - BADCT standards evaluation
  - On-site investigations/performance
- Chlorine-based Disinfection Alternative Evaluation
- Alternative Chlorine-Based Disinfection Evaluations

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Enhanced Chlorination Study/Investigation *(continued)*

- Develop a Regulatory Strategy
- Conduct a Cost/Affordability Analysis
- Facilitate Three (3) Workshops
- Facilitate One (1) Meeting with State Regulatory Authority

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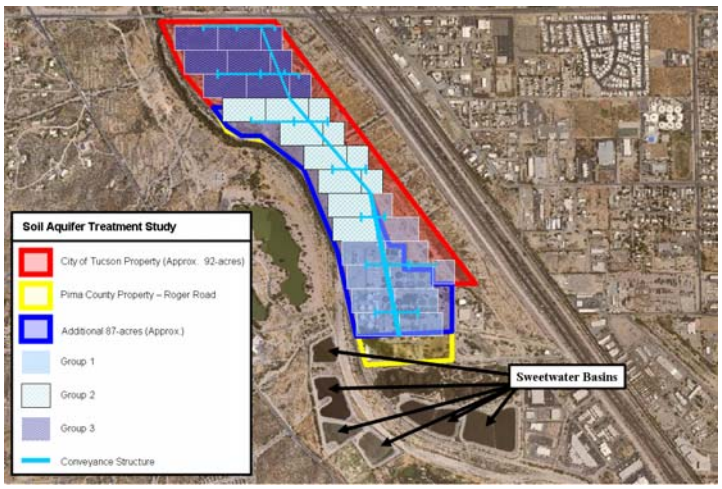
Soil Aquifer Treatment



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SAT Features

- Percolation Rate = 0.064 ft/day
- Available Area = 179 acres + Sweetwater
- Required land = available + 49 acres

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SAT – Issues of Concern

- Setback issues
- Floodplain issues
- Vector control issues
- Infiltration tests
- Appropriate wetting and drying cycles based on infiltration tests
- Hydrogeologic study on surrounding property and landfill areas
- Environmental disruptions
- Environmental permits
- Additional property procurement
- Cultural resource assessment/impacts
- Costs expensive as compared to other available technologies
- Costs for facilities proportionally similar at the Ina Road WPCF
- Loss of economic potential to use land for other purposes

220

Roger Road – SAT Costs

Item	Total Cost ($mil)
Land Acquisition	-------
Soil Excavation (6.3 Million CY @$ 5/CY)	$ 32
Hauling and Grading ($40/CY)	$300
Pipes and Valves (Lump Sum)	$ 5
Engineering and Permits (15%)	$ 58
Contingency (30%)	$118
Total	$513

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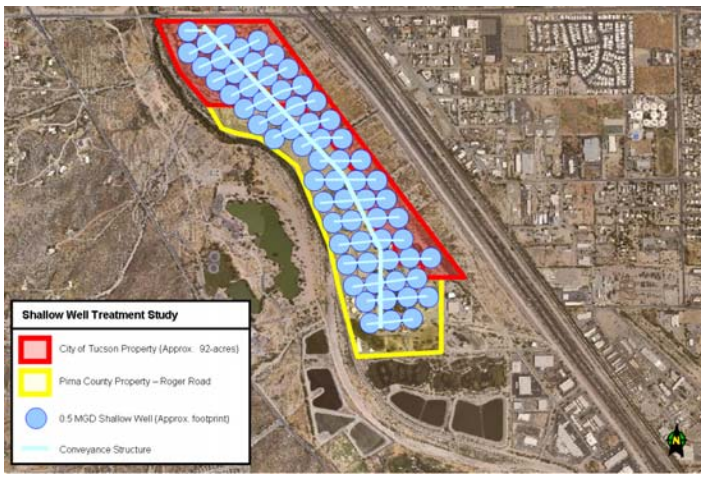
Shallow Wells



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Shallow Well Features

- Assume infiltration rate similar to SAT percolation rate
- Available Area = 179 acres + Sweetwater
- Required land = available + 49 acres

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Shallow Well – Issues of Concern

- Setback issues
- Floodplain issues
- Infiltration tests
- Biofouling/plugging issues
- Hydrogeologic study on surrounding property and landfill areas
- Environmental permits
- Additional property procurement
- Cultural resource assessment/impacts
- May be legal prohibitions/challenges
- Demonstration required
- Costs for facilities proportionally similar at the Ina Road WPCF

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Roger Road – Shallow Well Costs

Item	Total Cost ($mil)
Land Acquisition	------
Filtration ?	------
Shallow Wells ($ 100k/well)	$ 7
Pumping Station	$ 5
Pipes and Valves (Lump Sum)	$ 8
Engineering and Permits (15%)	$ 8
Contingency (30%)	$ 9
Total	$ 37

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Summary

Andy Richardson

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Workshop #15 Meeting Notes
Miscellaneous ROMP Issues Workshop

1. The Miscellaneous ROMP Issues Workshop for Pima County Regional Optimization Master Plan was held on March 21, 2007. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
PCWMD Staff
Dave Bartos
Gary Blomstrom
Ed Curley
Frank Gall
Dave Garrett
Mary Hamilton
Houssam Eljerdi
Marty Jones
Michael Kostrzewski
Mike Lueken
Byron McMillan
Jeff Prevatt
Helen Rhudy
Ron Riska, Project Manager
John Sherlock
Jack Van Riper
John Warner
Eric Wieduwilt
Legal
Harlan Agnew
Barbra McMurray
Chuck Wesselhoff

TUCSON WATER
Tucson Water Staff
Melodee Loyer
Dennis Rule
Wally Wilson

GREELEY AND HANSEN PROJECT TEAM
Tim Bennett
Jerry Bish
Gordon Culp
Andy Richardson

2. Major topics of the workshop were:
   - Workshop #15: Miscellaneous ROMP Issues
     - Updates
       - Biogas Utilization
       - Enhanced Chlorination
       - Request for Expression of Interest

- Biosolids Handling at Outlying Facilities
- Wastewater Treatment Process at Outlying Facilities
- County-Wide Biosolids Disposal
- Preliminary Architectural Development for Roger Road WRF/Ina Road WPCF

A set of handouts were provided to each attendee at the workshop. Throughout the workshop a set of notes were recorded on "flip-charts." Those notes summarize questions, comments and notes to be utilized by the project team while conducting the study. The flip chart notes are included at the end of the meeting notes.

3. Mike Gritzuk welcomed the attendees to the workshop and invited the workshop to begin.

4. Andy Richardson quickly outlined the meeting topics and objectives. He further elaborated on his role as facilitator and encouraged full participation by all. The primary workshop objective was to review miscellaneous open issues pertaining to the regional optimization master plan (ROMP) for wastewater facilities in Pima County. The goal is to provide closure on all issues where possible. Items to come include the financing plan, delivery method and implementation plan. Attendees were reminded to send their comments on the draft ROMP document as soon as possible to Ron Riska who will compile them and forward them to Greeley and Hansen. For unsettled issues the plan is to have several small group meetings in the next few weeks on topics, such as, outlying facilities wastewater treatment processes, biosolids handling/disposal, disinfection and delivery methods. It will be decided later who will be involved in each of these meetings and when they will be held.

   Overview, agenda, meeting objectives, and ground rules were covered on pages 1 through 4 of the handout.

5. Regarding updates Mike Gritzuk asked for an update on the upcoming meeting with ADEQ on BADCT requirements associated with the treatment plant upgrades. Issues to be considered in an agenda for the meeting are: the scientific bases for 4 non-detects of fecal or E. coli out of 7 grab samples, requirements for site specific standards, and enhanced chlorination approaches. Ron Riska opined that Pima County is not the first to deal with this situation. Other agencies in Arizona, such as Phoenix, are in the same predicament and are going through similar issues. California has similar strict requirements and what has been their experience. Other agencies in Arizona need to be contacted to learn what discussion they have had with ADEQ. Mike Gritzuk indicated that in talks last week with Phoenix that all the samples from their SAT are non-detect.

   The team to address the ADEQ BADCT requirements was identified as: Jeff Prevatt, Byron McMillan, Chuck Wesselhoff, Harlan Agnew, Ron Riska, and Jackson Jenkins.

   Mike Gritzuk stated that support by ADEQ on the disinfection approach was important. ADEQ was informed on January 26th that Pima County would be looking to save $76 million through enhanced chlorination/de-chlorination disinfection. Harlan Agnew indicated that a legal challenge to the disinfection standard is an approach, but a variance would take less time. Byron McMillan offered that a variance may need to be offered statewide, thereby ADEQ may be reluctant to issue a variance.

Also, to change BADCT requirements would take a long time under the rule making process in Arizona, and that ADEQ will not listen without supportive scientific information to make any change.

Jackson Jenkins wants the benchmarking within the enhanced chlorination investigation and study to find who is meeting BADCT standards and what technology they use. Jeff Prevatt indicated that Arizona, California and Florida have tough disinfection standards.

6. Jerry Bish reviewed the biogas issues. The biogas is a significant resource that is being underutilized. There are options for the future use of biogas, but improved gas conditioning could realize short term benefits. Plant operations are on the right track at looking for gas conditioning now – poor quality of gas limits use. Currently there is a band-aid approach to stop a hemorrhage in lost of energy production.

   One possible option in the future would be to have a third party take the biogas and operate a combined heat and power facility for Pima County. This would take Pima County out of the power business. The request for expression of interest (RFEI) will provide insight into that possibility. Regardless of the outcome of the RFEI, Pima County should proceed with improved gas cleaning.

   Byron McMillan provided a caution that adding more generators at Ina Road WPCF could trigger replacement of all generators. Chuck Wesselhoff offered that if additional generators are placed into a different building it may not trigger replacement of the generators. Jerry Bish indicated that the costs for electrical improvements at Ina Road WPCF included the change-out of all generators, and included a new permit process.

   The biogas issues were covered on pages 5 and 6 of the handout.

7. The next update was on the enhanced chlorination/de-chlorination investigation and study. Jerry Bish reviewed the purpose and goals of the investigation and study along with a schedule of activities. Mike Bunch asked that dates be placed on the schedule. It was indicated that Dr Larry Leong was looking at other plants for compliance with strict disinfection requirements. Harlan Agnew stated that actual performance data needs to be evaluated, not just permit requirements. Data suggests that methods of measurement are all over the place. Region 9 puts data on their site. Byron McMillan indicated that the rules need to be looked at as well.

   The enhanced chlorination/de-chlorination issues were covered on pages 6 and 7 of the handout.

8. The request for expression of interest (RFEI) purpose and status were presented by Jerry Bish. The RFEI document was in rough draft form and consists of 6 sections. The introduction section provides statements of general purpose and background, while subsequent sections become more detailed and specific with information, process and procedures. Mike Gritzuk asked that since there were no cost implications in the document, just information gathering, whether it needed to go through procurement. Ron Riska offered that procurement does not have a procedure for this type of document, although that they want to review the document and comment, but would not issue it. Therefore, the County Administrator or Mike Gritzuk will be signing the letter. A principal purpose of the letter is to create excitement about opportunities in Pima County within the marketplace at large. This should result in creative and cost effective methods and approaches to delivering the projects needed by the County over the next 25 years.

Ron Riska suggested that contractors are uneasy about performing large projects for Pima County and insert added contingences in their bids because they will be held to task. Therefore, jobs this large may be performed by unknown contractors (unfamiliar with Pima County procedures and processes). Recently, projects are receiving 2 to 3 bids when 5 or 6 are expected. This may be indicative of Pima County's relationship with contractors. Mike Bunch also indicated that many Pima County jobs end up in litigation. One task of a program manager will be to keep all parties within bounds of reasonableness.

Mary Hamilton asked if the projects will be broken down into small jobs. This is an issue to be sorted out through the RFEI activity. Mike Gritzuk observed that design-bid-build was not listed as a delivery method in the RFEI. This will be included into the final draft.

There is a question about private or what may appear to be private meetings with contractors or businesses. The concern is the appearance of collusion, that may create challenges to the procurement process later. Chuck Wesselhoff was assigned to research and review the issue of one-on-one meetings with contractors in parallel to refining the RFEI for issuance. Among a few other things the dates and schedule of events are required to complete the document. The RFEI is scheduled to be on the street in about 4 weeks. It was suggested that the RFEI be advertised nationally.

The RFEI scope and status were covered on pages 7 through 9 of the handout, and the current draft scope was provided as an appendix to the handout.

9. Gordon Culp presented the recommendations for handling biosolids at the outlying facilities. In a previous workshop there was a request that each outlying facility be evaluated on an independent economic basis to determine the solids handling approach most suitable for each location. For each facility five options were investigated. These included: 1) haul to interceptor, 2) pump to interceptor, 3) thicken - haul to Ina Road, 4) digest/dewater onsite and haul to landfill, and 5) digest/dewater onsite and haul to Ina Road. In broad terms the haul option is O&M intensive, pipeline is capital intensive, and thicken and haul are, more or less, O&M and capital intensive. From the evaluation of each plant individually, thicken and haul was generally the most cost effective approach to handle solids in the future. Therefore, it was recommended that thicken and haul be utilized at each facility.

   Frank Gall asked if costs were included for receiving solids at Ina Road WPCF. The answer was yes. John Warner indicated that non-cost issues such as additional traffic, safety and environmental issues are something else to be considered.

   Mike Gritzuk asked if biosolids disposal was included in the request for expression of interest. The answer is yes. Houssam Eljerdi asked if Green Valley should abandon the existing dewatering process. The answer is no, that there is capital invested that needs to be used and it supports the mine reclamation projects in that area. The thicken and haul approach is the recommended option based on the current biosolids disposal plan, but a closer look is needed in conjunction with a long term county-wide biosolids disposal plan.

   The outlying facility biosolids options, assumptions and recommendations were covered on pages 10 through 16 of the handout.

10. Tim Bennett followed with a presentation of the preliminary architectural design concepts at the new Roger Road WRF and the expanded and upgraded Ina Road WPCF. Design concepts were centered around the Leadership in Energy and Environment Design (LEED) silver requirements including site selection, energy use, energy production and materials. The preliminary developments have a strong emphasis on natural indigenous materials. At Roger Road WRF the design features a public friendly image with a water campus type environment that is inviting and accessible. At Ina Road WPCF a single landscape and architectural theme harmonizes and unifies the appearance of existing and new facilities.

    It was noted that the centralized laboratory and department headquarters were located on the site plan at Roger Road WRF, although they were shown on land owned by the City of Tucson. Mike Gritzuk indicated that space at Ina Road WPCF, as well as, Roger Road WRF should be allocated for the centralized laboratory and department headquarters.

    Frank Gall indicated that more laboratory work will be required at Ina Road WPCF than Roger Road WRF. Jeff Prevatt indicated that location does not matter from a laboratory function perspective. There is land adjacent to the existing Sport Park property adjacent Ina Road WPCF that would be suitable for the laboratory, whereas the facility would encroach on city property at Roger Road WRF. Perhaps, it would be a little more convenient at Ina Road. Most likely land issues will be the driver for the final site location. The architect commissioned for the laboratory services will address both locations.

    At Ina Road WPCF it was noted that the plant is currently well lit at night, which could impact the vision screen concept. Could landscaping with berms aid in or augment the design of the 22 foot high vision screens at Ina Road?

    Ina Road vision screens must be multi-purpose to improve likelihood of approval incorporating:

    - VISION
    - GREEN (energy production, material reuse/recycle, etc)
    - SECURITY

    PCWMD has a security consultant that needs to be consulted for potential review of the vision screen concept for security purposes. The amount of hard security at the site also needs to be defined. The Ina Road WPCF vision screen concept was discussed as a possible help with dispersal/dilution of odors and sound. At a minimum the vision screen materials must be impervious to plant air emissions. Harlan Agnew asked if plantings could provide the same effect as the screens. In response, the screens unify the Ina Road WPCF architecture to a greater degree than landscaping. Moreover, landscaping takes years to be effective.

    Need additional study to arrive at recommendation for screens at Ina Road WPCF regarding materials, locations, size(s) and quantity. Architectural characteristics of other Pima locations are needed to determine applicability of vision screens elsewhere to aid in development of a uniform PCWMD facility image and identification. Green Valley was mentioned as a facility that currently shows a strong and well received PCWMD image.

The department headquarters program requirements are mostly unknown, as well as, its preferred location (Roger Road vs. Ina Road). Mike Gritzuk advised to simply show a reasonable footprint at both locations, and the details will be determined as the design process evolves.

Program requirements may include space for additional staff from other locations and agencies. For example, the Roger Road structure may be required to house the County Parks and Recreation administration staff of an unknown quantity. Mike suggested a discussion should be held with the appropriate personnel at Parks and Recreation to obtain a better idea of this concept. Other functions that need to be housed at Roger Road WRF include a warehouse and a maintenance building, sizes to be determined.

Melodee Loyer noted that on the Roger Road WRF site plan that the locations of the trees are where Tucson Water's facilities reside. Jackson Jenkins expressed concern over placing a crane on site under the canopy at Roger Road WRF to access equipment. It was noted that holes were deliberately placed in the canopy to allow for some of the crane access maintenance. It was suggested that photovoltaic cells in the canopy could augment electric power at the plant.

Ed Curley suggested that vehicle access to Ina Road WPCF be re-established off of the Interstate I-10 frontage road.

The preliminary architectural themes, concepts and designs for Roger Road WRF and Ina Road WPCF were covered on pages 24 through 32 of the handout.

11. Melodee Loyer presented a preliminary layout of Tucson Water's water reclamation facilities at Ina Road. The facilities are for 20 mgd with expansion to 40 mgd. The facilities were sited along Ina Road west of the IWC unit facilities and north of the plant outfall. According to Jackson Jenkins, this site is currently being used by solid waste. The site layout provided requires more than 10 acres previously discussed by Tucson Water.

    Actual facilities depend upon receipt by Tucson Water of Class B+ versus Class A+ effluent, UV disinfection versus chlorination disinfection, and where effluent accessibility is located at the site. The layout is preliminary and needs to be refined, but illustrates the need for land at Ina Road for Class B+ effluent and future high water quality treatment. Timing will be the same as the Ina Road 50 mgd expansion because of the availability of less effluent water at Roger Road.

    Tucson Water's peak demand is 33 mgd in July, but they are still waiting to hear from Oro Valley about their plans for more golf courses. Initially 20 mgd is required from Ina Road WPCF for Tucson Water's needs – 10 mgd pumped north, 10 mgd pumped south.

    Gary Blomstrom asked if there were needs for setbacks for the water reclamation facilities. The only setbacks needs are for solids handling systems. Costs of the water reclamation facilities for processing Class B+ effluent were unknown, but would be more than the $25 million identified for a reservoir and booster pump station if a Class A + effluent is provided.

    Mike Gritzuk asked if both facilities could be combined to save costs. Tucson water would want guarantees on water quantity and quality in order to meet the water reuse standards, if systems were consolidated with Pima County. Tucson Water would at a minimum need a reservoir, booster pump

station and booster disinfection facilities. Jackson Jenkins asked if a reservoir was necessary with 50 mgd being processed at the plant. The recommendation was made to look for synergisms in consolidation.

Melodee Loyer provided a preliminary layout of the Tucson Water facilities, which is included at the end of the notes

12. Gordon Culp presented the recommended wastewater treatment processes at each of the outlying treatment facilities. The recommendations were developed based on the current and future situation at each site in accordance with a request at a previous workshop. Future flows, potential wastewater treatment processes and estimated plant expansion dates were evaluated for each site. Three of the current lagoon systems will be phased out during the 25-year planning period. These include Arivaca Junction, Rillito Vista and the Pima County Fairgrounds. Jackson Jenkins indicated that there were some issues with the Fairgrounds lagoons and that Paul Bennett should be contacted to obtain the latest information. At this time there is no change in the wastewater system process forecast for the Mt. Lemmon operation, although this could change if growth of the service area is permitted by the County and the U.S. Forest service.

    The wastewater processes recommended for the outlying facilities were:

    - Avra Valley BNROD
    - Corona de Tucson CLR (BNROD derivative)
    - Green Valley BNROD
    - Marana BNROD
    - Southlands Bardenpho

    Frank Gall asked what type of aeration system would be utilized with the BNROD. Brush aerators is the traditional approach, however, other aeration systems are available. The aeration system will be dependent on how the BNROD is configured to achieve the desired treatment performance and for odor considerations (submerged type aerators versus brush aerators). Eric Wieduwilt indicated that odor control is a key factor in the process selection. It was noted that with the long aeration times associated with BNROD systems that odors are generally not a significant issue. However, within a BNROD system the areas of concern can be covered economically and the odors treated before release to the atmosphere.

    Dennis Rule reported that Avra Valley is projecting a large population increase and that that plant may become much larger than projected. This may be occurring because flood control is changing the designation of the Black Wash area which will permit additional build-out. Ed Curley also indicated that the nearby tribal lands planning activities may have an impact on growth of the Avra Valley service area. The table on flows may need to be updated based on the latest growth information. If future flows are projected to be more that 8 to 10 mgd, then the wastewater process recommendation may change.

    Jackson Jenkins pointed out that the current flow at Corona de Tucson was not 1.3 mgd, but closer to 0.1 mgd and the flow associated with the facility needs to be changed.

Since the Southland wastewater facilities are non-existent at this time, wastewater treatment facilities will start out as a small developer constructed facility (0.3 mgd package plant) with growth rapidly advancing the facilities needs to 2.0 to 2.5 mgd. When wastewater flows approach one mgd, or less, the first module of a Bardenpho system should be constructed to handle 2.0 to 2.5 mgd. The projected flows at this facility are forecast to be over 10 mgd by the end of the 25-year planning period.

Frank Gall cautioned that the facilities at each of the outlying treatment plants need to have one approach to wastewater treatment and not be like Roger Road or Ina Road where multiple processes exist at one site.

The outlying wastewater treatment process considerations were covered on pages 16 through 21 of the handout.

13. The current biosolids disposal program and recommendation for future actions were presented by Jerry Bish. The current disposal program is land application through one contract. Some biosolids removed from the wastewater lagoon systems are periodically taken directly to landfill. The biosolids disposal approach by the County is very cost effective, but is vulnerable because of one source for disposal. A strong biosolids program has multiple disposal options and outlets. The biosolids recommendation is continue producing Class B biosolids using mesophilic digestion, continue to land apply (cost effective in the short term), be prepared to quickly produce a Class A biosolids when required by regulations or demands of the public, and develop a long term biosolids management plan. In addition, the request for expression of interest (RFEI) will seek out possible third party interest in a public-private partnership to disposal of biosolids with a cost effective approach.

    Elements of the long term biosolids management plan include analysis of the current program, identify quantity and quality of biosolids, address regulatory and social issues that may impact disposal, develop and evaluate alternatives (includes determining market size and product need evaluation, and technologies required to achieve the market desired product), costs related to the probable disposal options, and lastly an implementation plan. Ron Riska requested that the biosolids management plan scope of services and deliverables be spelled out in the report.

    Gary Blomstrom indicated that over 2 years ago the Pima County Parks and Recreation department had a need for all the biosolids produced at the wastewater treatment plants, if it were of Class A+ quality. Houssam Eljerdi indicated that Parks and Recreation currently would like to start with a one ton test pilot of a Class A biosolids to determine suitability of the product. Also, it was reported that other area farmers are expressing a desire for the biosolids (Class B). Harlan Agnew asked about composting, since the City of Tucson was interested in the biosolids. Composting can provide Class A biosolids, but is land intensive and has associated odors which makes it an unattractive consideration.

    Ed Curley asked about going to thermophilic digestion now. There would be additional costs to build additional tanks for the thermophilic batch process and heat exchangers. Also, the thermophilic biosolids have a greater odor potential than the mesophilic product. Jim Doyle offered that the biogas system would also need to be revised to accommodate biogas from thermophilic digestion. Furthermore, there is no market analysis to demonstrate that Class A biosolids is more acceptable in

the marketplace than Class B, or that Class A has a higher market value to offset the additional costs of thermophilic digestion.

Harlan Agnew asked if the sludge storage bladders are to be replaced. The answer was affirmative with a storage tank, and this project could be advanced prior to the plant upgrade. Dave Garrett indicated that two of the centrifuges were 20 years old. The master plan is to replace all the centrifuges and their replacement could be advanced, as well as, the storage tank, funding permitting.

The TPAD system was selected as a conservative approach to provide Class A biosolids for master planning, because it is the most expensive and most land intensive. Heat drying requires less space and would be utilized if there were a substantial market for dried products. John Warner asked about co-generation of the biosolids and accumulating green credits. The County is looking for interest in this approach through the request for expression of interest activity.

Houssam Eljerdi expressed that creating a partial stream of Class A biosolids for marketing purposes and developing a potential for a southern region biosolids processing facility were good features for a biosolids plan.

The biosolids disposal approach and recommendations were covered on pages 21 through 24 of the handout.

14. The open session of the workshop covered unsettled issues and discussed topics relevant to the master plan development. Jerry Bish led the discussion by reviewing the possible operating modes for Roger Road WWTP and Ina Road WPCF after the completion of the plant interconnect pipeline and before the new, or expanded and upgraded, facilities were placed into service. Paul Bennett asked if grit and screenings were going to be removed at Roger Road for the plant interconnect pipeline. The response was only the flow processed at Roger Road WRF will have grit and screenings removed. The remaining flow will receive preliminary treatment at Ina Road WPCF. This makes cost effective use of the existing headworks facilities at the Ina Road WPCF.

    The waste activated sludge from Roger Road WWTP will be transported to Ina Road WPCF through the existing dedicated sludge line. The backup service will be the plant interconnect pipeline.

    Jim Doyle offered that at the Ina Road WPCF 3 of 4 digesters are currently required, and 4 digesters would be needed for a flow of 37.5 mgd (but there would be no slack for cleaning). The plant could use another digester in the next 4 to 5 years to cover the increase in flows. Ina Road WPCF will complete the cleaning of 2 digesters in next 6 to 9 months so could it could go 4 to 5 years without cleaning another digester. Also, the disinfection contact tanks are serviceable for flows up to 37.5 mgd.

    The information available suggests that over the next seven to eight years that an additional digester, replacement of old centrifuges, and thickener upgrades are needed at the Ina Road WPCF. Jackson Jenkins also added the need for a fourth emergency overflow basin. Dave Garrett added that gas cleaning equipment is also needed to burn more of the available biogas.

At Roger Road WWTP a new gravity belt thickener is going into service. In addition Digester # 5 is being converted primary service, new backup aeration system is to be installed and electrical system upgrades will be constructed.

During the construction at the two plants, where flow is treated should be kept flexible, depending on the needs of each plant for operation and maintenance. In general, flows should be directed to the facility with the lowest operating costs and still meet permit requirements. At this time the lowest per unit treatment costs would be at the Roger Road WWTP. Jim Doyle reminded the group that Tucson Water has a reclaimed water need at Roger Road that must be satisfied. In addition, it needs to be recognized that Roger Road WWTP is out of wet weather capacity, which will need to be factored into the operating plan. Jackson Jenkins indicated that a schedule is needed for the transitional steps, beginning with the plant interconnect pipeline followed by next step and so forth.

Harlan Agnew offered that infiltration restrictions will be placed into new permits.

Houssam Eljerdi indicated that an upgraded sludge loading system at Ina Road WPCF was in design. Whether it had odor control features was unknown. Also, there is a need to pre-screen sludge before centrifuge dewatering.

Ed Curley stated the CIP for the wastewater department includes more than the facilities described in the Regional Optimization Master Plan (ROMP). The reason for smoothing the annual capital cost burden is to fit in the other project costs required to keep the infrastructure viable.

Smoothing the capital cost burden "hump" options were discussed in general terms. Paul Bennett suggested that maybe Ina Road WPCF is upgraded and expanded first, followed by the new Roger Road WRF. This would keep Roger Road WWTP running four years longer and would place that plant into possible non-compliance for approximately four years. This would reduce the annual capital cost burden.

Costs for odor control in the conveyance are assumed to be included in the conveyance system rehabilitation and replacement costs program in place for the County. No additional line item is provided for conveyance system odor control in the CIP. Odor control is to be mentioned in the ROMP report.

Helen Rhudy asked how the comments from the request for expression of interest (RFEI) are to be incorporated into the report. The comments are expected to be received before the final report is accepted and issued by the County and that pertinent comments will be incorporated where they fit into the document. Melodee Loyer asked by when were the comments needed on the RFEI. The response is as soon as possible, but within a week.

The open issues were covered on pages 33 through 35 of the handout.

15. From the meeting a list of actions items was identified and reviewed with the group. The actions were:

    - Action Items

- ADEQ agenda development (Harlan Agnew)
- CL_2/deCL_2 team – benchmarking data (Greeley and Hansen)
- RFEI – (Chuck Wesselhoff) – Need dates, steps
- Outlying plants – meetings to fill in steps (Ron Riska)
- Biosolids scope (Greeley and Hansen)
- Small group meeting with Tucson Water about merging facilities (Ron Riska)

16. The meeting was closed with a reminder that the next workshop is scheduled for May 9th at the public library downtown. In a response to a question from Melodee Loyer a copy of the final report would be available before the meeting..

Agenda
Workshop #15 – Miscellaneous ROMP Issues
March 21, 2006

Time	Topic	Presenter
8:00 am	*Tucson Main Library, Basement Meeting Room, 101 N. Stone*	
8:15 am	Opening Session	
	• Welcoming Remarks	Mike Gritzuk
	• Review Agenda	Andy Richardson
	• Workshop Goals	
8:30 am	Updates	Jerry Bish
	• Biogas Utilization	
	• Enhanced Chlorination	
	• Request for Expression of Interest	
9:00 am	Biosolids Handling at Outlying Facilities	Gordon Culp
10:00 am	Wastewater Treatment Process at Outlying Facilities	Gordon Culp
11:00 am	Break	
11:15 am	Biosolids Disposal	Jerry Bish
12:15 pm	Lunch	
1:00 pm	Site Layout at Roger Road WRF	Tim Bennett
1:30 pm	Site Layout at Ina Road WPCF	Tim Bennett
2:00 pm	Open Session	
3:15 pm	Summary Wrap-Up	Andy Richardson
	• Comments by Group	
	• Closing Remarks	Mike Gritzuk
3:30 pm	Adjourn	

Flip Chart Notes – March 21, 2007

ADEQ

- Develop agenda for BADCT meeting
  - Team to develop
  - Why 4 out of 7
  - Site Specific Standard
  - Discuss approach to CL_2/deCL_2
  - Testing problem – overdosing sodium bisulfite
  - Talk to other states & Phoenix on their approach
    1st task Go/No-Go "Can It Be Done"
  - Who is being held to the 4 of 7 non detect standard
  - Need to bring information to discuss rule

Jeff Prevatt
Byron McMillan
Chuck Wesselhoff
Harlan Agnew
Ron Riska
Jackson Jenkins

BIOGAS

- Need to do some gas conditioning now
- Will add final fix to Ina Road WPCF Project
- *Air permit is important
  - could trigger replacement of all engines
  - put in a different building does not trigger replace
  - Does gas need to be cleaned?
- Move forward as a transition project

CL_2-DECL_2

- If one agency could all of this be incorporated into one site answer - maybe
- Should we look at a consolidate concept
- Start Monday – end date 07-07-07
- For bench marking determine what are the permit requirements
- Need to know test methods and how tested
- Also, look at rules in each state when conducting the benchmarking.
- Coordinate dates for workshops

RFEI

- Add design-bid-build to list in section 4
- RFEI – final next two weeks
  - Meeting to review RFEI
  - Concern w/individual meetings after RFEI submitted
  - Need to think about how to design in "Private Meetings"
  - Chuck take lead on how process will unfold
  - Need to determine where and how to advertise
  - Get Chuck Lake Pleasant meeting information.

OUTLYING BIO SOLIDS

- Marana has growth around plant - may want to consider not hauling biosolids
- What is the cost of lost time for hauling, risk factors and growth in those areas.
- Have not looked at private hauling yet
- Pipeline from Marana- should this be looked at for bi-directional flow

ARCHITECTURAL PROGRAM

- Need Additional Information
  - Admin Bldg.
    - Provide a foot print.
    - HQ Dept.
  - Central Lab Bldg. – could be at Roger Road
  - Need to program Central Lab and HQ Dept. at both sites.
  - May also need space for Parks & Recreation staff.
  - Need to meet w/Parks & Rec.
  - Need space for noise & odor control
  - For Roger Road add maintenance shop & warehouse

INA ROAD WPCF

- May want to consider a theme for PCWMD facilities
  - At Ina Road WPCF consider the high mast lighting.
  - Use vegetation to achieve same affect
  - Screens need to be multi-purpose
    - Green & Security
- Tucson water site layout assumes 20 mgd with expansion to 40 mgd. $25 million does not include filters. If A + received by Tucson Water the need for filters, and backwash and solids handling go away.
- Facilities installed at same time as 50mgd at Ina Road

TUCSON WATER

- If one agency, could all of this be incorporated into one site? Answer - maybe
- Should we look at a consolidated concept
- Tucson Water – permit compliance
- Need to have meeting w/Tucson Water to develop consolidated site plan w/cost saving – coordinate w/Ron

OUTLYING AREA

- Need to address fairground issue – send email to Paul Bennett to get answer

OUTLYING PLANT PROCESS

- Avra Valley - Process BNROD
  - What type of aeration system
  - Pima Co. looking at 180,000 people for Avra Valley
  - At what size do we look at other WW processes
- Corona de Tucson WWTP Process - CLR
  - Current flow vs. future flow?
- Green Valley WWTP Process - BNROD

- Marana – Process BNROD – maybe bigger
- Southlands – Process Bardenpho
  - First size may be 300,000 gpd (package plant)
  - Next step 2 mgd
- Indicate how outlying plants can be expanded – first have a small group meeting to discuss each facility.
- Is there a policy needed to say at:
  - 0.5 mgd or 1 mgd it is a package plant - bigger than that is a decision.

BIO SOLIDS

- Suggested that Parks & Recreation will take all the solids at Class A
- Would like to ramp-up using a ton or less to pilot how it will work
- Now have a 2 year contract to continue disposal on agricultural lands
- Need to make sure we multi-disposal outlets – add to program – need a contingency plan
- Knowing if there a secondary market for a Class A Biosolids?
- Need to have in report – produce some Class A (thermophilic digestion) at Ina Road
- Need to have potential for outlying bio solids disposal concentrated in one spot.
- Place time limit on effort and how biosolids should be implemented. What are the "Triggers" that have PCWMD do something relative to biosolids.
- Pre-screen before centrifuge dewatering

OPEN ISSUES

- How to handle screening and grit removal at Roger? – Answer – Ina Road will handle
- WAS from Roger – put in sludge line to Ina Road
- Who should use sludge line if PCWMD does not use it?

TRANSITIONAL OPERATIONS

- Plant interconnect – Ina Road can handle 37.5 mgd of flow – but on the edge would be better to add a new digester
- Once back-up power is at Ina Road will stress system to see capacity.
- Additional digestion and centrifuges – Ina Road.
- Add 4th EOB at this time.
- Gas cleaning system on burning gas, gas condition system Roger Road/Ina Road
- Roger Road - convert number 5 digester to primary service
- Roger Road - clean all digesters and assess condition of # 3
- Provide back-up aeration system at Roger Road
- Plant capacity analysis – need to be flexible in how flows will be transferred – but look at baseline on how it should be operated based on "cost to transfer"
- Sludge loading facility being appraised - a fix is being done.
- Need to state rehab of pumping system

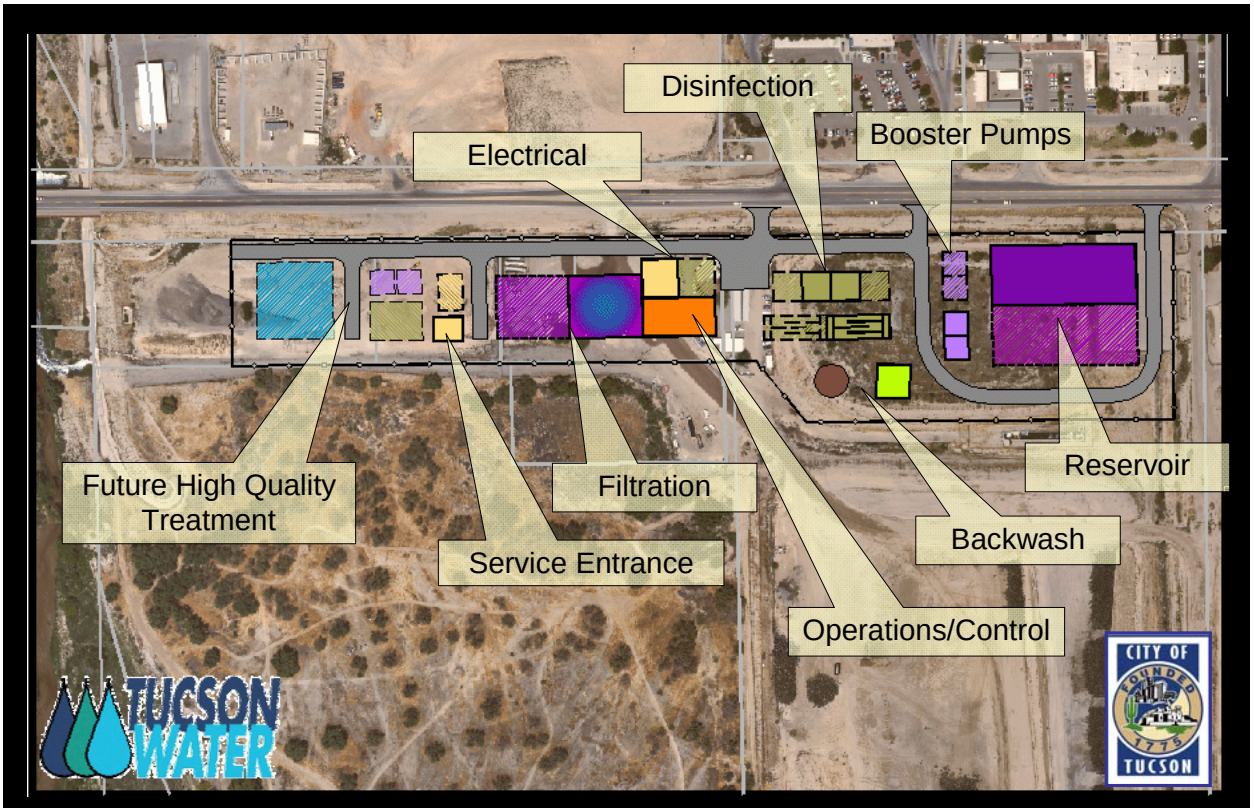
SMOOTHING THE HUMP

- 4 year delay on Roger to meet Tucson Water needs until Ina Road is up and running.
- What would we do without regulatory requirements
- Use bond financing instead of "pay as we go"

ACTION ITEMS

- ADEQ – Agenda develop team - Harlan
- Meeting with Tucson Water to review site plan consolidation.
- CL_2/deCL_2 – End 7-7-07 – want benchmarking
- RFEI – need dates for event – Chuck
- Outlying facilities small group meeting to deal with expansion program.
- Biosolids need scope of service in report
- Final Report – implementation plan

Tucson Water Facilities Layout at Ina Road WPCF



Pima County
Regional Optimization
Master Plan

Workshop #15 Miscellaneous ROMP Issues

March 21, 2007

Workshop Presenters

- Mike Gritzuk — Welcome / Closing
- Andy Richardson — Facilitator
- Jerry Bish — Updates / Biosolids Disposal
- Gordon Culp — Outlying Biosolids Handling / Processes
- Tim Bennett — Site Layouts

2

Welcoming Remarks

Mike Gritzuk

Overview

Andy Richardson

Agenda

- Updates
- Solids handling at outlying facilities
- Wastewater treatment process at outlying facilities
- Biosolids disposal
- Site layout at Roger WRF / Ina WPCF

5

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extend of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

6

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

7

Role of Facilitator

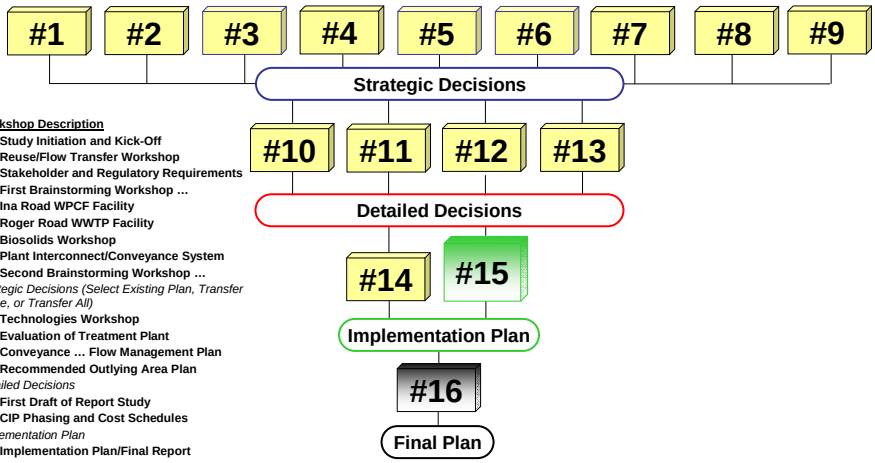
- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

8

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

Objective

- Review Project Elements
- Advance open / unsettled ROMP issues to closure
- Identify who, what and when necessary for issue closure

11

Pima County Wastewater Management Department

GREELEY AND HANSEN

Updates

Jerry Bish

Update Issues

- Biogas utilization
- Enhanced chlorination
- Expression of Interest

13

Biogas Use

- 500 million cubic feet per year
- Options
  - Continue biogas for power / heat generation with engine-driven equipment
  - Sell biogas to third party for commercial use
  - Purchase power from local utility and use biogas for heating and cooling functions

14

Biogas Utilization Economics

Biogas Utilization System	X $1,000			
	Capital Cost	Energy Savings	Operating Costs	Annual Savings
Combined Heat / Power	12,000 to 16,000	3,595	1,475	2,125

15

Engine Cost Considerations

- Capital costs
  - Value of existing power plant
    - Central cooling
    - Cooling distribution
    - Central process and space heating
    - Heating distribution
    - Engine heat rejection systems
    - General infrastructure
  - Changes needed
    - New generators and synchronization
    - New electrical addition and remodeling
    - Gas conditioning (hydrogen sulfide/siloxane)

16

UV Disinfection vs. Enhanced Chlorination – Systems

- UV requirements
  - Lift pump station
  - Filtration
  - High intensity UV
- Enhanced chlorination
  - Contact tank (longer retention)
  - Higher sodium hypochlorite dosages
  - Higher sodium bisulfite dosages

17

UV Disinfection vs. Enhanced Chlorination – Cost Impacts

- UV Costs $91.0 million
  - Construction/Contingency/ Engineering
- Enhanced Chlorination $17.6 million
  - Construction/Contingency/ Engineering

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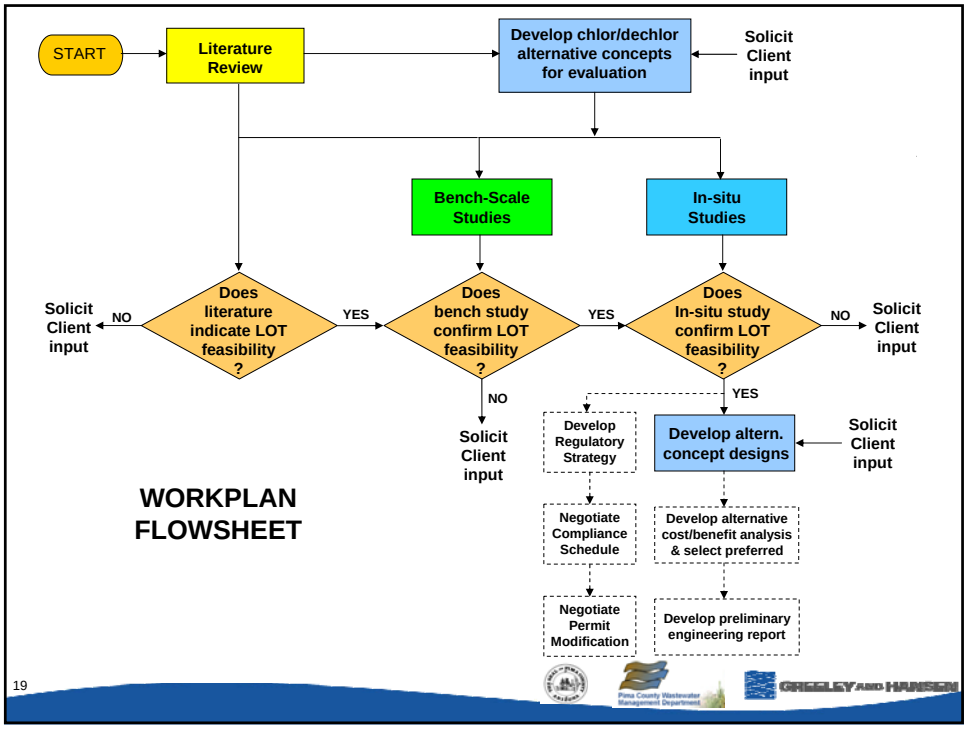
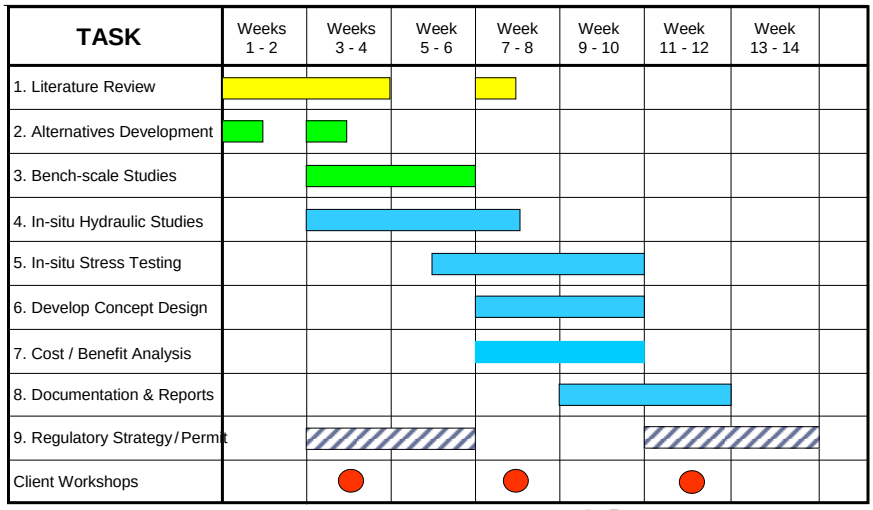


Study/Investigations Schedule



Request for Expression of Interest

- 1.0 Introduction
- 2.0 Facilities, Operations and Budget
- 3.0 Proposed Projects
- 4.0 Alternative Project Delivery Methods
- 5.0 Questions and Comments
- 6.0 RFEI Submittals

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RFEI Content – (1)

- 1.0 Introduction
  - 1.1. Overview
  - 1.2. RFEI Objectives
  - 1.3. Pima County Wastewater System
  - 1.4. Regional Optimization Master Plan (ROMP) Study
  - 1.5. ROMP Capital Improvement Plan
  - 1.6. County Retained Responsibilities
  - 1.7. Timetable
  - 1.8. Individual Meetings
  - 1.9. Communications
  - 1.10. Costs
  - 1.11. Respondents
  - 1.12. County Team

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RFEI Content – (2)

- 2.0 Facilities, Operations and Budget
  - 2.1. Description of the Department and Its Responsibilities
  - 2.2. Existing Facilities and Practices
  - 2.3. Recent Improvements and Optimization Efforts
  - 2.4. Interface with City of Tucson Water Department
  - 2.5. Economic and Financial Matters
  - 2.6. Regulatory Matters

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RFEI Content – (3)

- 3.0 Proposed Projects
  - 3.1. New Roger Road WRF
  - 3.2. Ina Road WPCF Expansion/Upgrade
  - 3.3. Biogas/Power Facilities
  - 3.4. Biosolids Disposal Services
  - 3.5. Outlying Treatment Facilities

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RFEI Content – (4)

- 4.0 Alternative Project Delivery Methods
  - 4.1. Overview
  - 4.2. Requests for Qualifications
  - 4.3. Requests for Proposals
  - 4.4. Design-Build and Related Project Delivery Methods
  - 4.5. Construction-Manager-at-Risk

RFEI Content – (5)

- 5.0 Questions and Comments
  - 5.1. Preferred Project Delivery Method and Procurement Process
  - 5.2 Business Terms and Conditions Generally
  - 5.3. Construction-Manager-At-Risk
  - 5.4. Design-Build
  - 5.5. Design-Build-Operate
  - 5.6. Private Financing

RFEI Content – (6)

- 6.0 RFEI Submittals
  - 6.1. RFEI Response Format
  - 6.2. Respondent Information
  - 6.3. Projects of Interest
  - 6.4. Project Delivery Method Commentary
  - 6.5. Institutional, Contractual and Legal Considerations
  - 6.6. Economic and Financial Considerations
  - 6.7. Answers to Questions

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Pima County Wastewater Management Department

GREELEY AND HANSEN

Outlying Facilities – Biosolids Handling

Gordon Culp

Biosolids Options

- Haul to interceptor
- Pump to interceptor
- Thicken – haul to Ina Road
- Digestion / dewater – haul to landfill
- Digestion / dewater – haul to Ina Road

29

Haul to Landfill or Interceptor

- Tanker truck
- Driver / operator ($35/hr)
- Operator intensive

30

Pump to Interceptor

- Pumping station
- Pipeline (6” minimum, $11/inch/foot)
- Capital intensive

31

Thicken and Haul to Ina Road

- Thickening facilities
- Tanker truck
- Driver / operator ($35/hr)
- Less capital intensive but more labor intensive than pipeline

32

Digestion / Dewater and Haul to Landfill or Ina Road

- Dewater / stabilize capabilities
- Dump truck
- Driver/operator
- Capital Intensive

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Assumptions

- BOD_5 loading = 2,800 lbs of BOD_5 per 1 mgd per day
- 1 lb of total solids per lb of BOD_5 load
- 33,000 gal per day of 1% biosolids per mgd of wastewater treated

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Outlying Biosolids

Location	Current, tpd(1)	Future, tpd(1)	Current Processing, Disposal
Marana	0.28	6.16	storage, hauled ⇒ regional facility
Rillito Vista	0.014	0.00	---
Avra Valley	2.2	5.26	storage, hauled ⇒ regional facility
Green Valley	5.7	6.79	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Arivaca Junction	0.09	0.00	---
Corona de Tucson	0.16	3.77	storage, hauled ⇒ regional facility
Pima Co. Fairgrounds	0.004	0.00	---
Mt. Lemmon	0.018	0.003	storage, hauled ⇒ regional facility
Southlands	0.0	14.7	separate processing and disposal
Total	8.47	36.68	

(1) Based on 2,800 dry lbs/day raw biosolids produced per mgd of flow treated

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Biosolids Truck Trips

Biosolids	Truck Trips per Day in Year 2030				
	Avra Valley	Corona de Tucson	Green Valley	Marana	Southlands
Haul Liquid	18	12	26	26	36
Haul Thickened	4	3	5	5	12
Haul Dewatered	1	0.6	1.3	1.3	3

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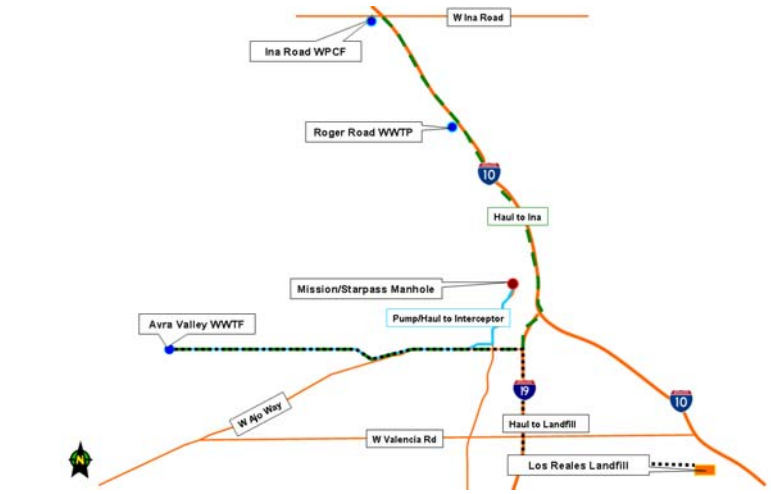
Handling Options – Avra Valley



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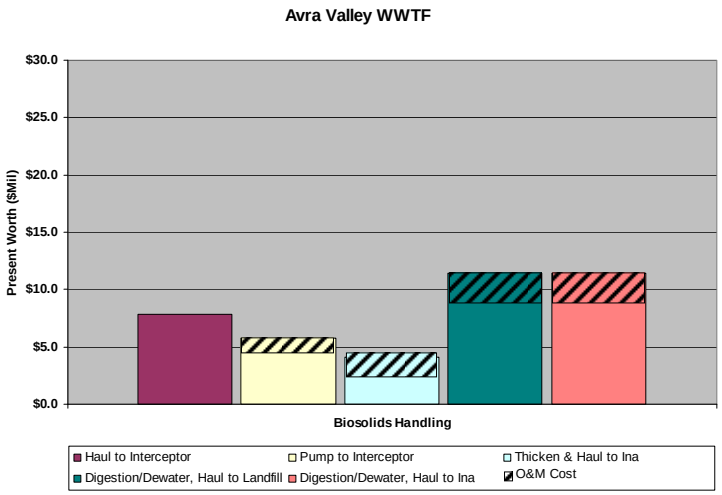
Avra Valley



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Handling Options – Corona de Tucson

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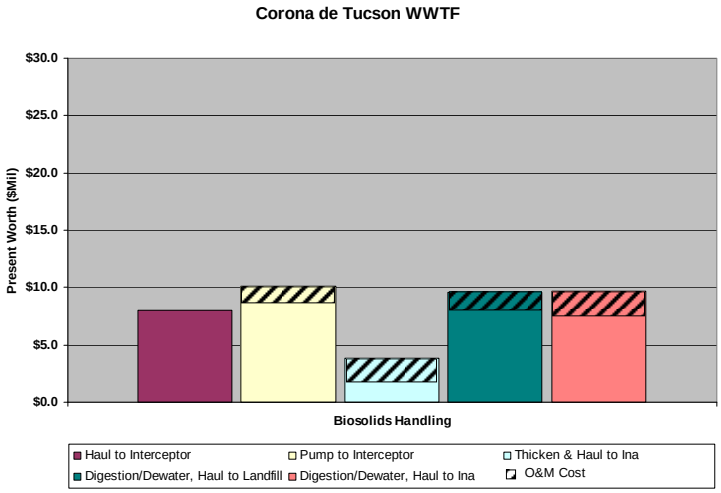
Corona de Tucson



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Handling Options – Green Valley

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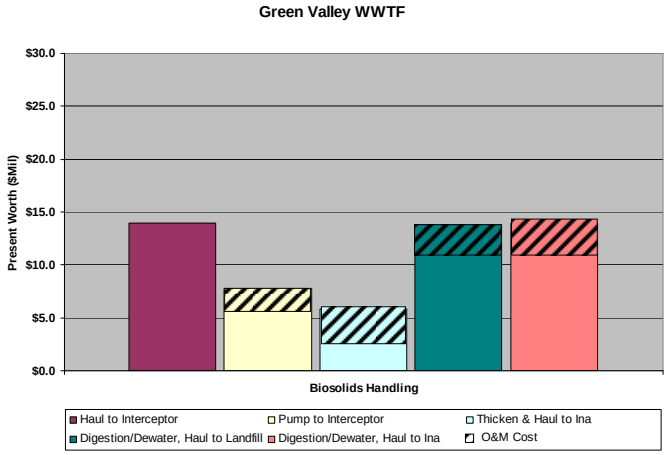
Green Valley



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Handling Options – Southlands

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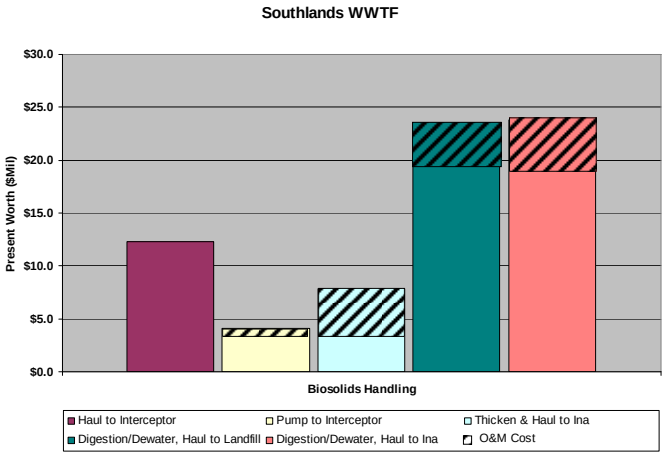
Southlands



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Handling Options – Marana

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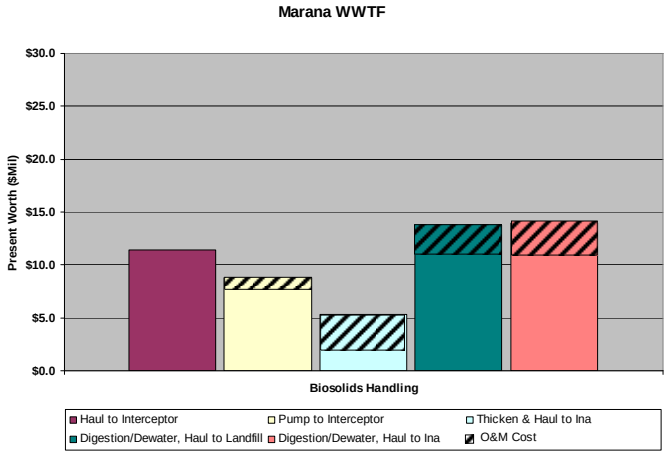
Marana



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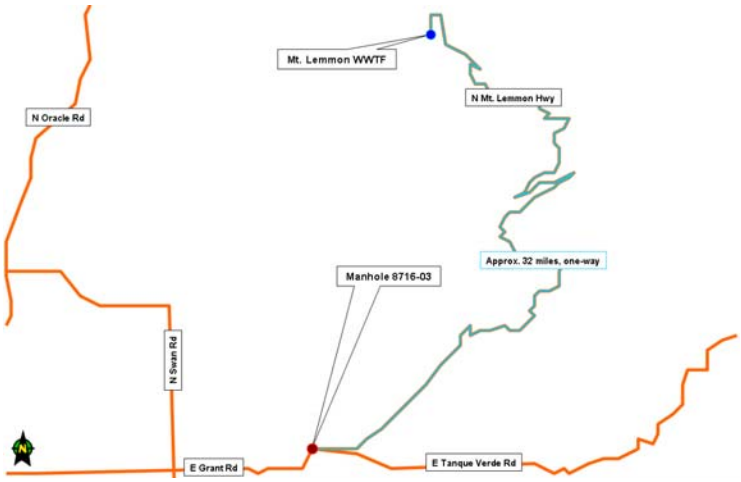
Handling Options – Mt. Lemmon



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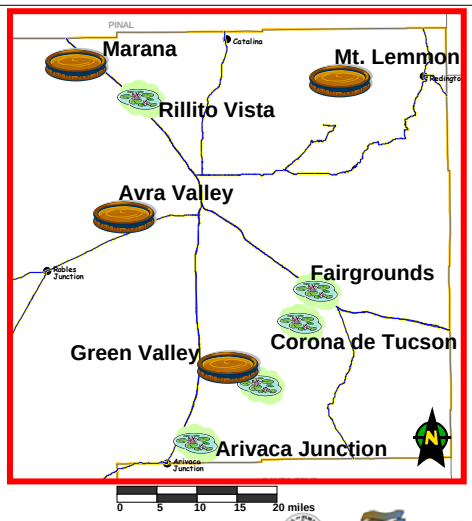
Wastewater Treatment Process at Outlying Facilities

Gordon Culp

Current Outlying Facilities



Flow Projections

Facility	2006	2010	2015	2020	2025	2030
Avra Valley	1.1	1.4	1.8	2.2	2.6	3.0
Corona de Tucson	0.1	0.5	0.9	1.3	1.7	2.1
Green Valley	1.8	2.7	3.1	3.6	4.0	4.4
Marana	0.1	1.6	2.3	3.0	3.7	4.4
Mt. Lemmon	0.002	0.002	0.002	0.002	0.002	0.002
Southlands (excludes Corona)	-	1.2	3.6	6.0	8.2	10.5

Weighted System Evaluation Matrix

Criteria	WF	Rank					Weighted Rank				
		Bardenpho	BNROD	MBBR	SBR	MBR	Bardenpho	BNROD	MBBR	SBR	MBR
Cost	5	4	4	3	5	2	20	20	15	25	10
Environmental Impact	4	4	4	3	3	3	16	16	12	12	12
Feasibility	3	3	5	4	3	3	9	15	12	9	9
Operational Capability	4	4	4	3	2	4	16	16	12	8	16
Land Required	2	4	3	4	4	5	8	6	8	8	10
Maintenance	4	5	5	3	3	2	20	20	12	12	8
Public Acceptability	5	3	3	3	5	5	15	15	15	25	25
Reliability	4	3	4	3	3	2	12	16	12	12	8
Sludge Production	1	3	5	3	3	3	3	5	3	3	3
Water Reuse Potential	4	4	4	4	4	4	16	16	16	16	16
Odor Control	5	4	3	4	3	4	20	15	20	15	20
Sum of Weighted Ranks							**155**	**160**	**137**	**145**	**137**

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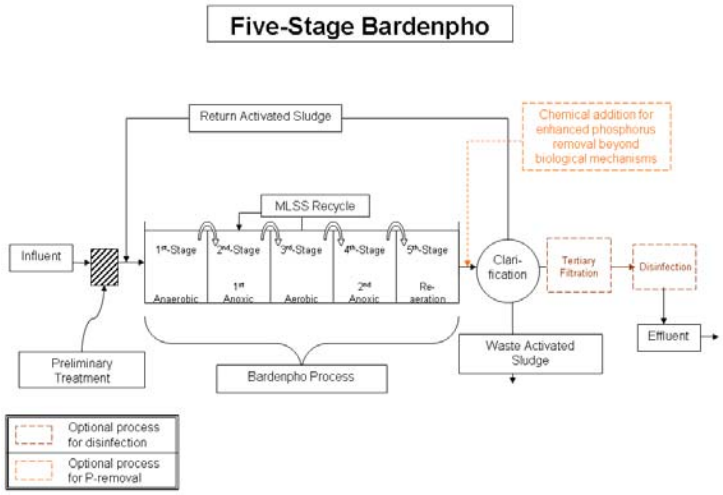
Bardenpho Process



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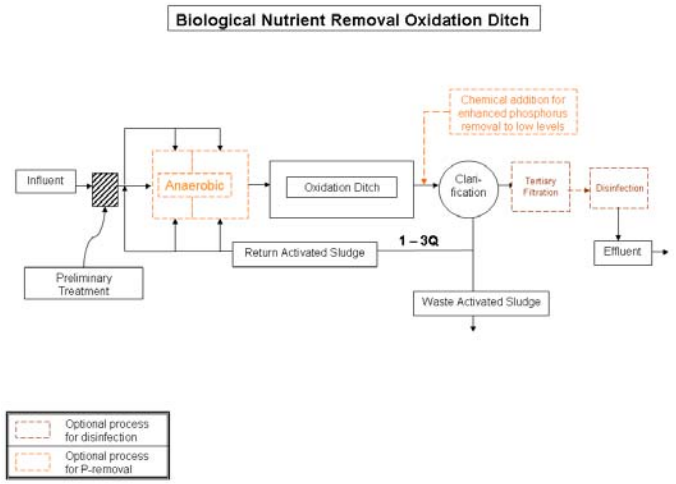
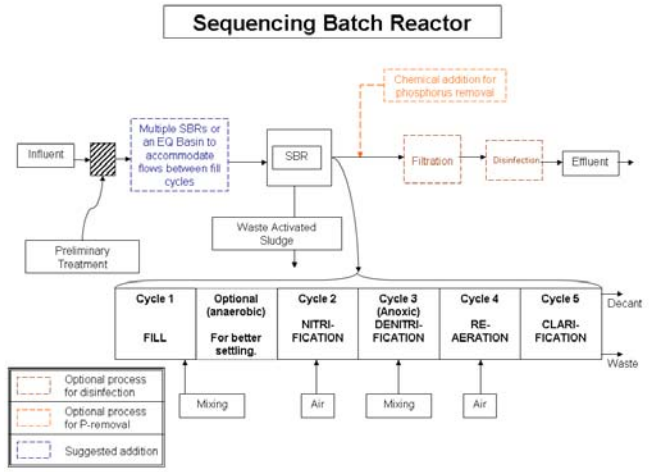
BNROD



53

SBR



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Phase Out Lagoons (Clean Closure)

- Arivaca Junction
- Rillito Vista
- Pima County Fairgrounds

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Treatment Process Considerations

- Avra Valley
- Corona de Tucson
- Green Valley
- Marana
- Southlands

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Outlying Facility Expansion Completion Dates

Facility	Expansion 1	Expansion 2	Expansion 3
Arivaca Junction	To be decommissioned	-	-
Avra Valley	2006 / 2007	2008 / 2009	-
Corona de Tucson	2006 / 2007	2018 / 2019	2027 / 2028
Southlands	2008 / 2009(1)	2014 / 2015	2022 / 2023
Green Valley	2011 / 2012		-
Marana	2006 / 2007	2008 / 2009	2011 / 2012
Mt. Lemmon(2)	TBD	TBD	TBD
PC Fairgrounds	To be decommissioned	-	-
Rillito Vista	To be decommissioned	-	-

(1)To be completed by others
(2)Long range planning study in progress

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Avra Valley WW Process

- Currently BNROD
- BNROD expansion underway
- Selecting different process introduces complexity
- Loss of investment
- Avra Valley = BNROD
- Q_6 = 1.1 mgd; Q_{30} = 3.0 mgd

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Corona de Tucson WW Process

- Closed loop reactor nearly finished
- Selecting different process introduces complexity
- Corona de Tucson = CLR
- Q_6 = 1.3 mgd; Q_{30} = 2.1 mgd

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Green Valley WW Process

- Currently BNROD
- Plan to construct additional BNROD
- Selecting different process introduces complexity
- Green Valley = BNROD
- Q_6 = 1.8 mgd; Q_{30} = 4.4 mgd

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Marana WW Process

- BNROD system design complete, ready for bid
- Selecting different process requires additional investment
- Marana = BNROD
- Q_6 = 0.1 mgd; Q_{30} = 4.4 mgd

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Southlands WW Process

- Does not exist
- 2030 capacity above 10 mgd (upper bounds of BNROD and SBR)
- Southlands = Bardenpho
- Q_6 = 0.0 mgd; Q_{30} = 10.5 mgd

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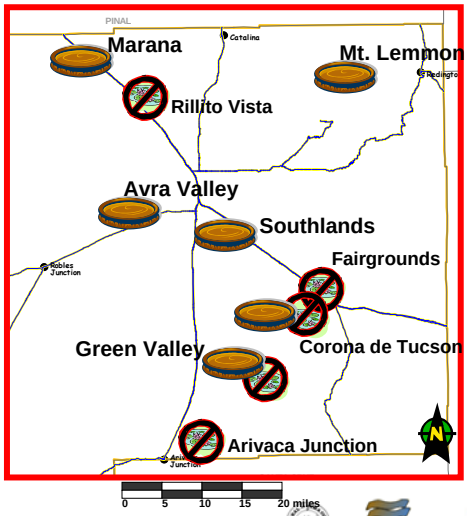
Future Outlying Facilities



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Biosolids Disposal

Jerry Bish

Biosolids Disposal Options

- Class B
  - Agricultural land (current operations)
  - Landfill
- Class A
  - Market requires study
    - Liquid / dry forms
  - D/B/O ?

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Future Solids Streams

- Roger Road WRF

Solids Stream	Flow, mgd	% Solids	Solids Mass, lb/day	VSS Mass, lb/day
Waste Activated Sludge	1.72	0.7	100,600	76,400
Thickened WAS (to Ina Road Digestion)	0.36	3.0	90,500	68,800
Thickener Overflow	1.36	0.1	10,100	7,600

- Ina Road WPCF

Solids Stream	Flow, mgd	% Solids	Solids Mass, lb/day	VSS Mass, lb/day
Primary Sludge	1.15	1.0	95,300	72,400
Waste Activated Sludge	1.35	0.7	78,800	59,900
Thickened Sludge (WAS + Primary)	0.42	4.5	156,600	119,000
Thickener Overflow	2.07	0.1	17,400	13,200

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Master Plan Recommendation

- Produce Class B biosolids using mesophilic digestion at Ina Road
- Continue to apply Class B biosolids to agricultural land (cost effective in short term)
- Modify process to produce Class A biosolids when required by regulatory agencies or public pressure
- Develop a long-term biosolids management plan (w/ multiple disposal options/outlets)

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Class A Processes

Process	Requirements
Thermophilic Aerobic Digestion 1	MCRT of 10 days @ 55-60°C
Heat Drying 1	Direct or Indirect Gas Drying to $\leq$ 10% moisture content and solids temperature of 80°C
Heat Treatment 1	MCRT of 30 minutes @ 180°C
Composting 1	3 days @ 55°C for in-vessel or static pile 15 days @ 55°C for windrow
Pasteurization 1	30 minutes @ 70°C
Alkaline Stabilization 2	pH 12 and maintained for 72 hours with biosolids $\geq$ 52°C for 12 hours, followed by air drying to 50% TS
Time/temperature 3	Process meets detention time at temperature requirements by solids concentrations given in 503 regulations or has been given equivalency by USEPA (TPAD and batch thermophilic digestion for example)

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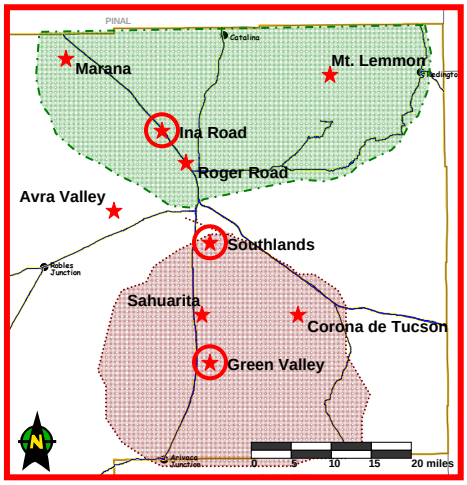
Regional Solids Processing



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Elements of Long-Term Biosolids Management Plan

- Analysis of current program
  - Establish baseline conditions
- Projected quantity and quality of biosolids
  - Effects of liquid treatment process changes
- Regulatory and social issues
  - Regulatory pressures
  - Public concerns
  - Increased urbanization
  - National trends

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Elements of Long-Term Biosolids Management Plan

- Development and evaluation of alternatives
  - Market assessment for biosolids
  - Technology identification and screening
  - Development of preliminary alternatives
  - Screening of preliminary alternatives using economic and non-economic criteria
  - Evaluation of shortlisted alternatives
  - Recommended long-term plan

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Elements of Long-Term Biosolids Management Plan

- Cost summary
- Implementation plan

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Site Layouts –
Preliminary Architectural Design Concepts

Tim Bennett

Preliminary Architectural Design Concepts: Roger Road

- Architectural basis of design
  - Cost effective
  - Friendly public image
  - "Water Campus" concept
  - Unconstrained by existing designs
  - Inviting and accessible
  - Use of indigenous materials
  - Energy consumption
  - Environmental impact

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PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD

SIGNIFICANT LOCAL ORGANIC AND STRUCTURAL FORMS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD

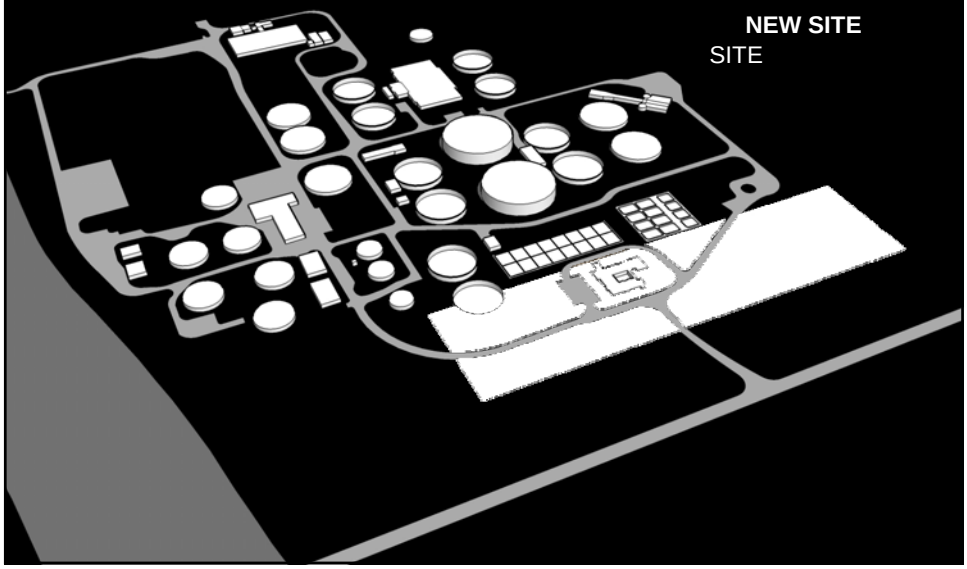
SIGNIFICANT LOCAL ORGANIC AND STRUCTURAL FORMS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD

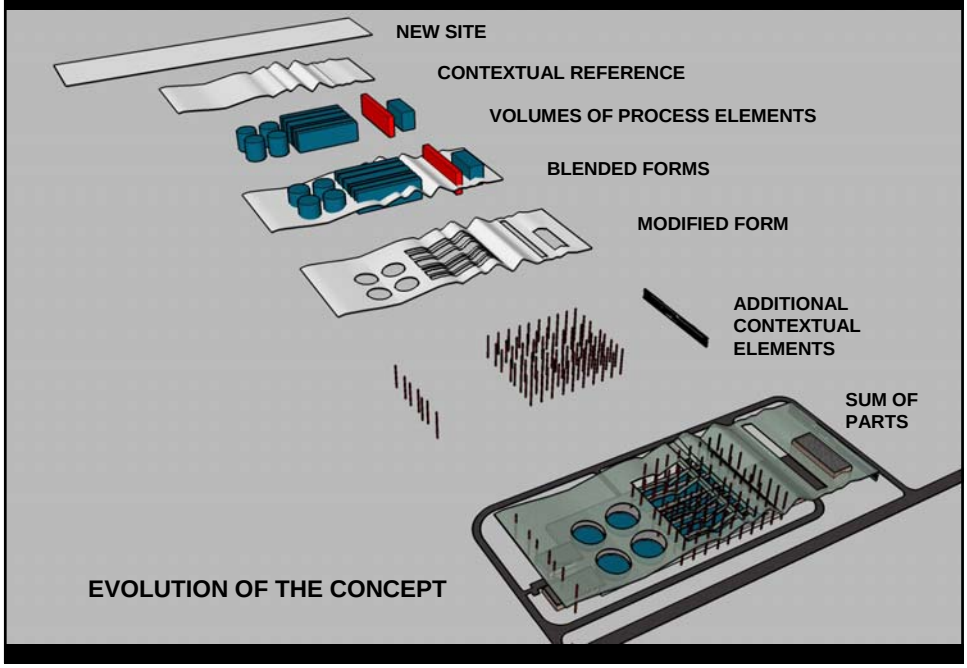
- CONCEPTUAL SKETCH

- CONTEXTUAL RELATIONSHIP OBJECTIVE

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD

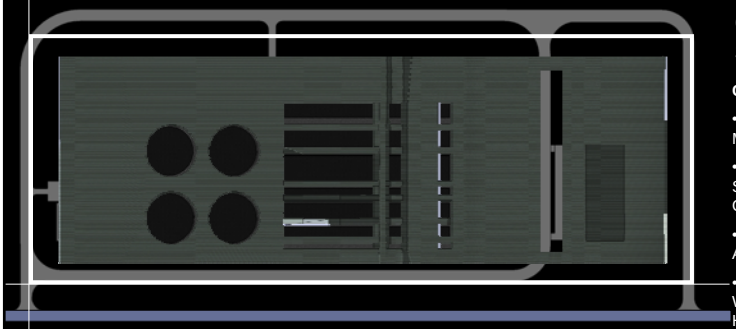


PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



EVOLUTION OF THE CONCEPT

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



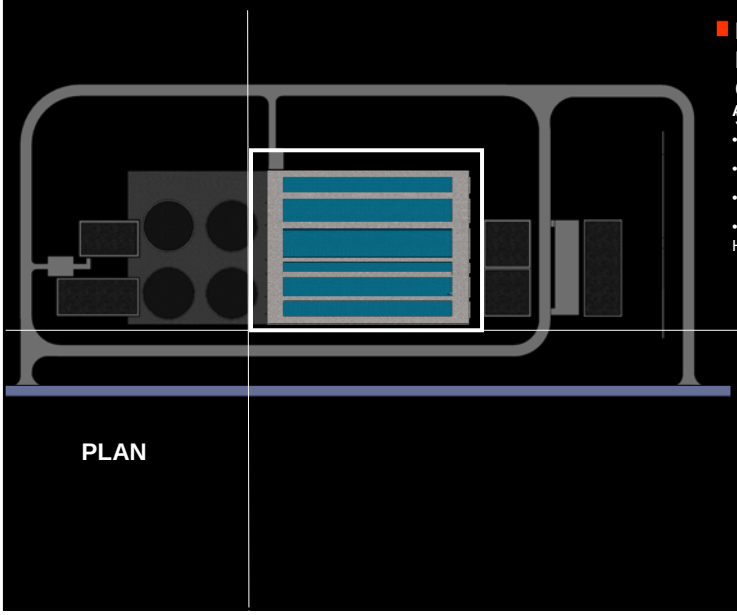
CANOPY PLAN

- **CONTEXTUAL ELEMENTS CHARACTERISTICS**

CANOPY:

- CLEAR REFERENCE TO MOUNTAINOUS HORIZONS
- METAL FABRIC TENSILE STRUCTURE SUPPORTED ON MASTS
- SHADE PRODUCING, WITH ACCESS VOIDS AS SHOWN
- POSSIBLE SOLAR AND WIND ENERGY HARVESTING CAPABILITY
- PROJECTS THE IMAGE OF TUCSON

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



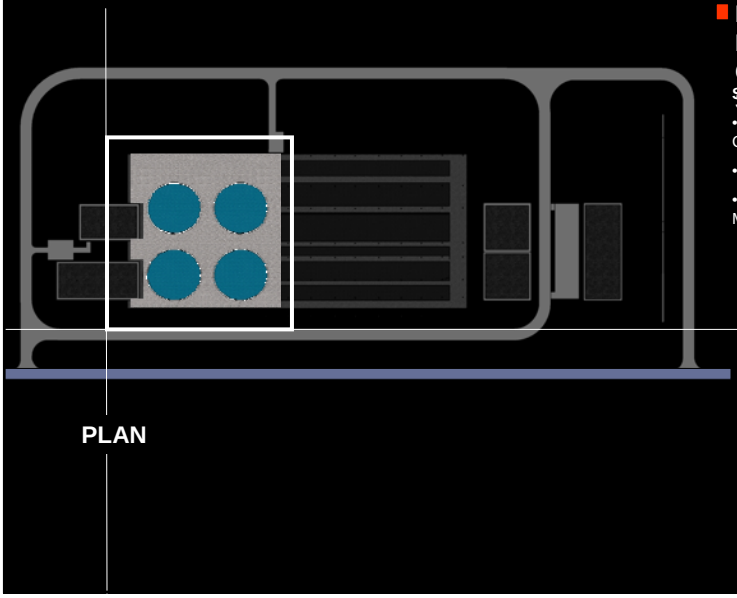
PLAN

- **PROCESS ELEMENTS CHARACTERISTICS**

AERATION TANKS:

- CORE OF THE PROCESS
- CENTRALIZED LOCATION
- LOW VERTICAL MASS
- VERY SIGNIFICANT HORIZONTAL MASS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



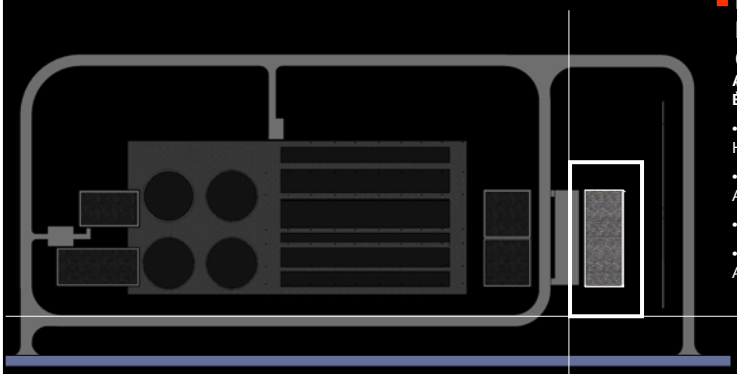
PLAN

- **PROCESS ELEMENTS CHARACTERISTICS**

SEDIMENTATION TANKS:

- PRECISE GEOMETRIC CIRCULAR ARRAY
- LOW VERTICAL MASS
- SIGNIFICANT HORZONTAL MASS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



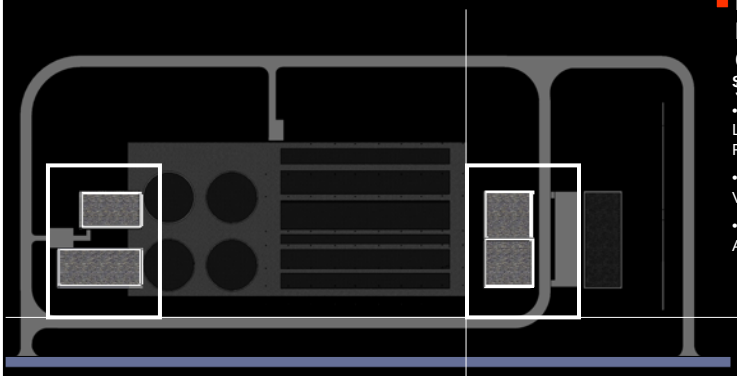
PLAN

- **PROCESS ELEMENTS CHARACTERISTICS**

ADMINISTRATION BUILDING:

- PERSONNEL AND VISITOR HOME BASE
- VEHICULAR TRAFFIC ACCOMMODATIONS
- MAJOR VISUAL ELEMENT
- SIGNIFICANT HORIZONTAL AND VERTICAL MASS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



PLAN

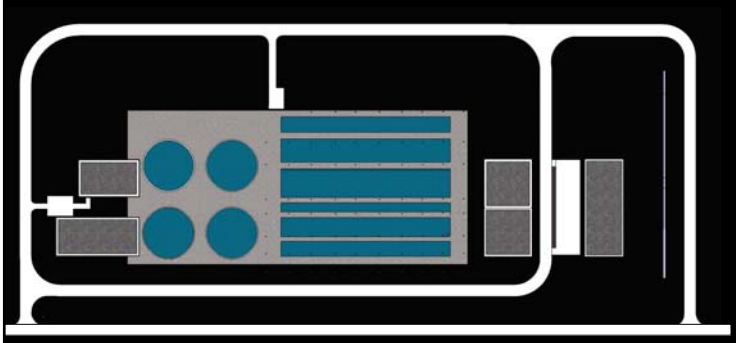
- **PROCESS ELEMENTS CHARACTERISTICS**

SUPPORT STRUCTURES:

- RANDOM VARIATIONS IN LOCATIONS AND FOOTPRINTS
- STRONG REPEATING VISUAL ELEMENTS
- VARYING HORIZONTAL AND VERTICAL MASS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD

PLAN VIEW



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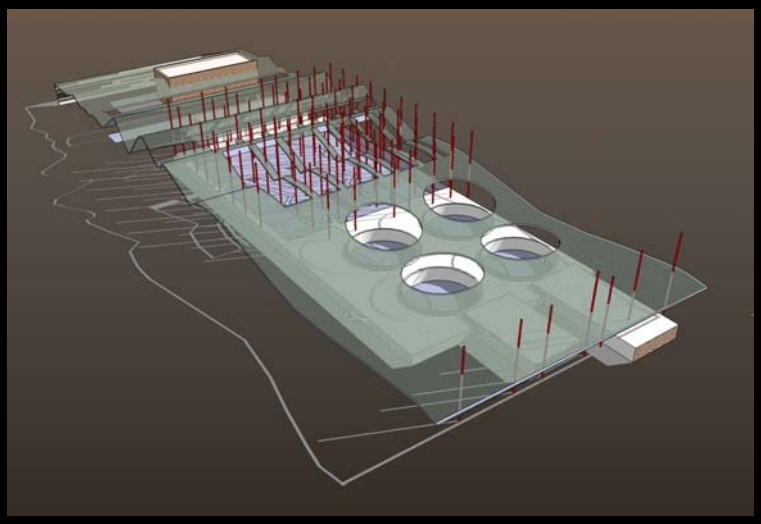

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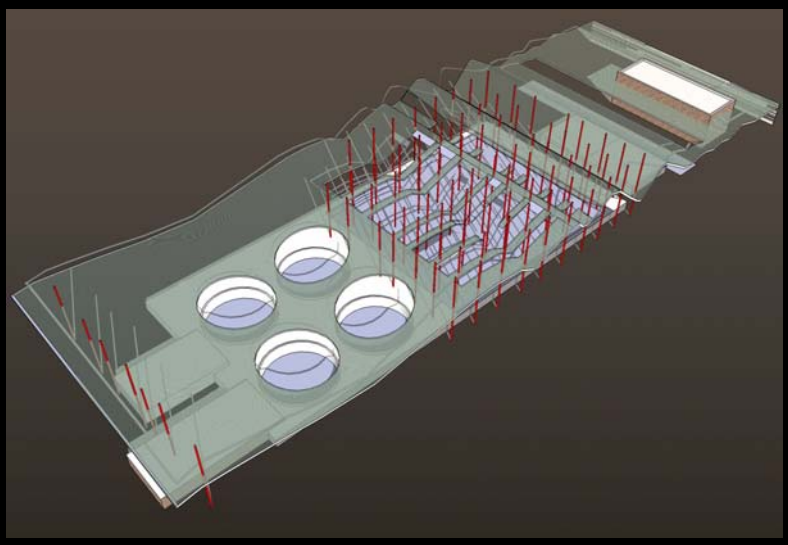

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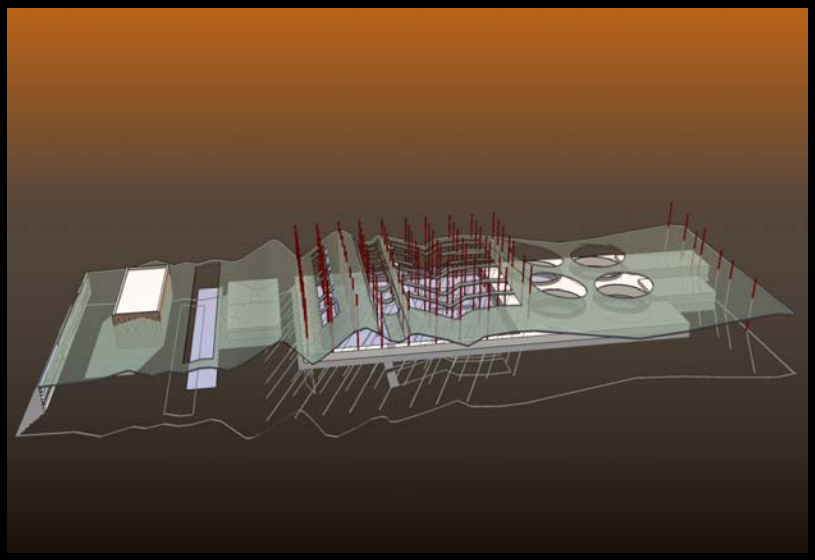
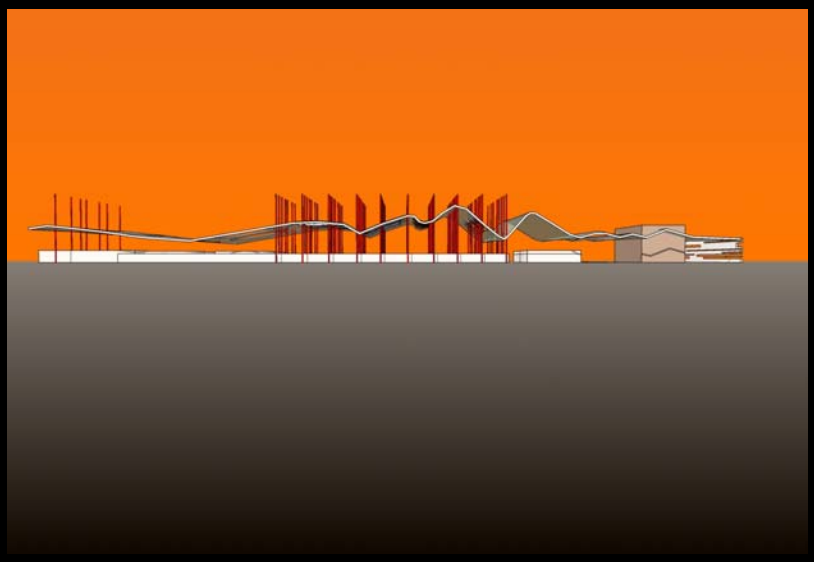


PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: ROGER ROAD



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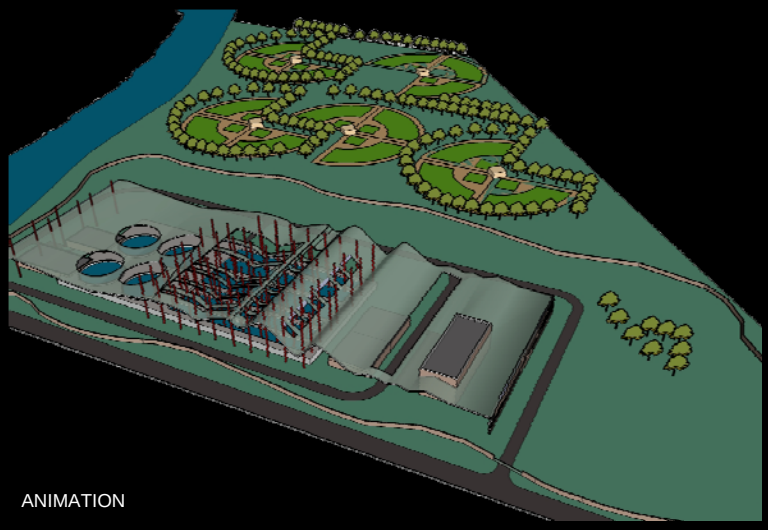

ANIMATION

Preliminary Architectural Design Concepts: Ina Road

- Architectural basis of design
  - Single landscape and architectural theme to harmonize existing and new facilities
  - Cost effective
  - Relationships to other plants
  - Unifying appearance overall
  - Use of indigenous materials
  - Energy consumption
  - Environmental impact

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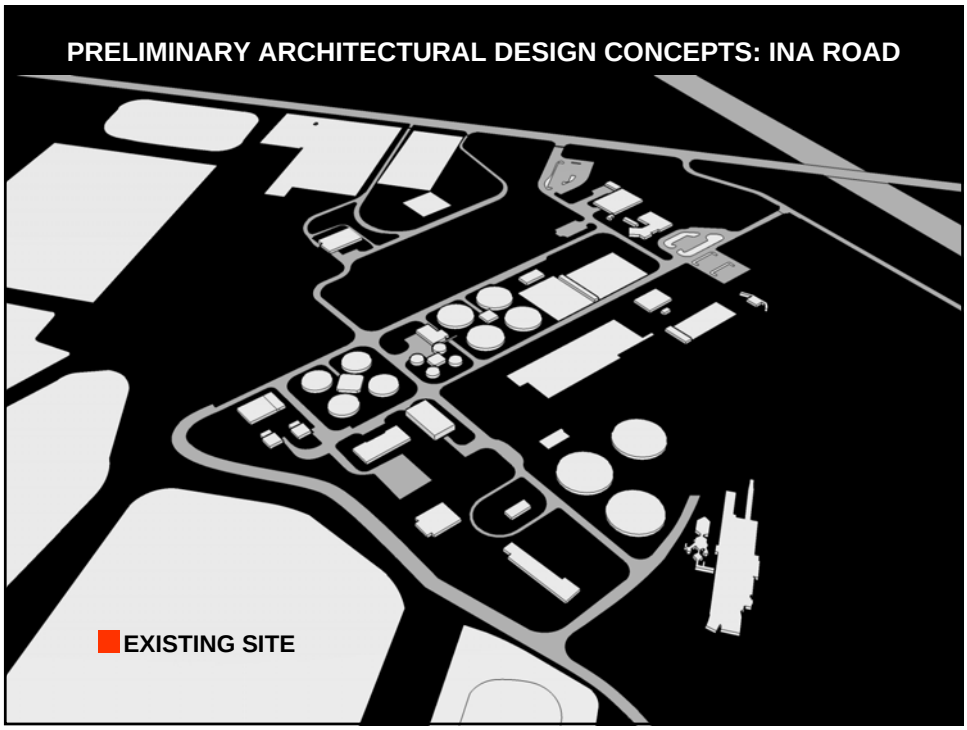
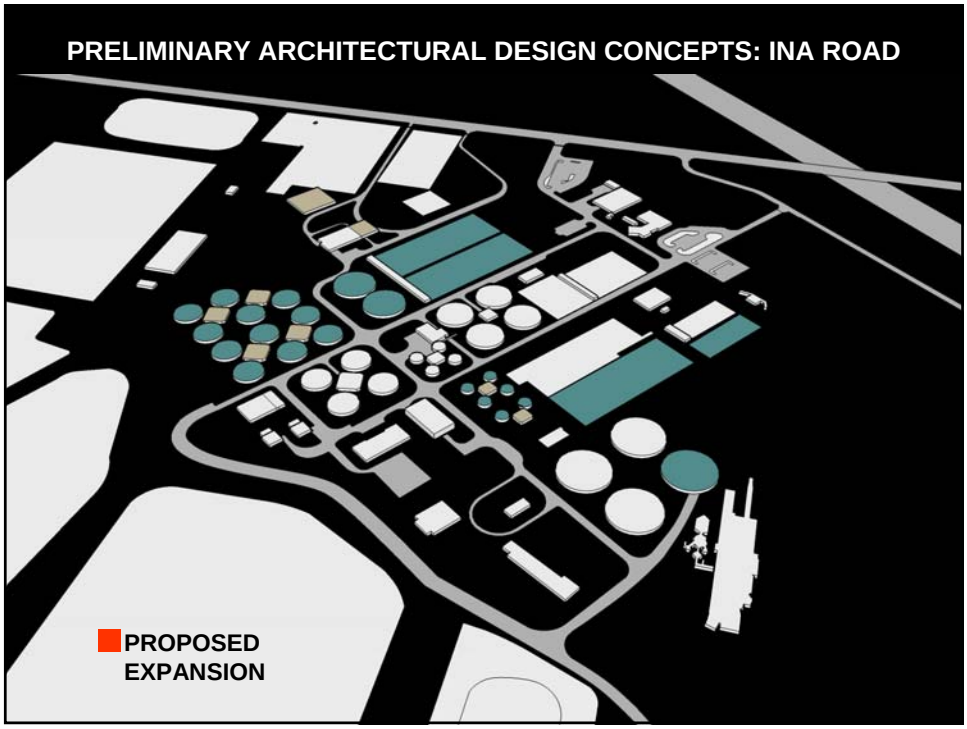
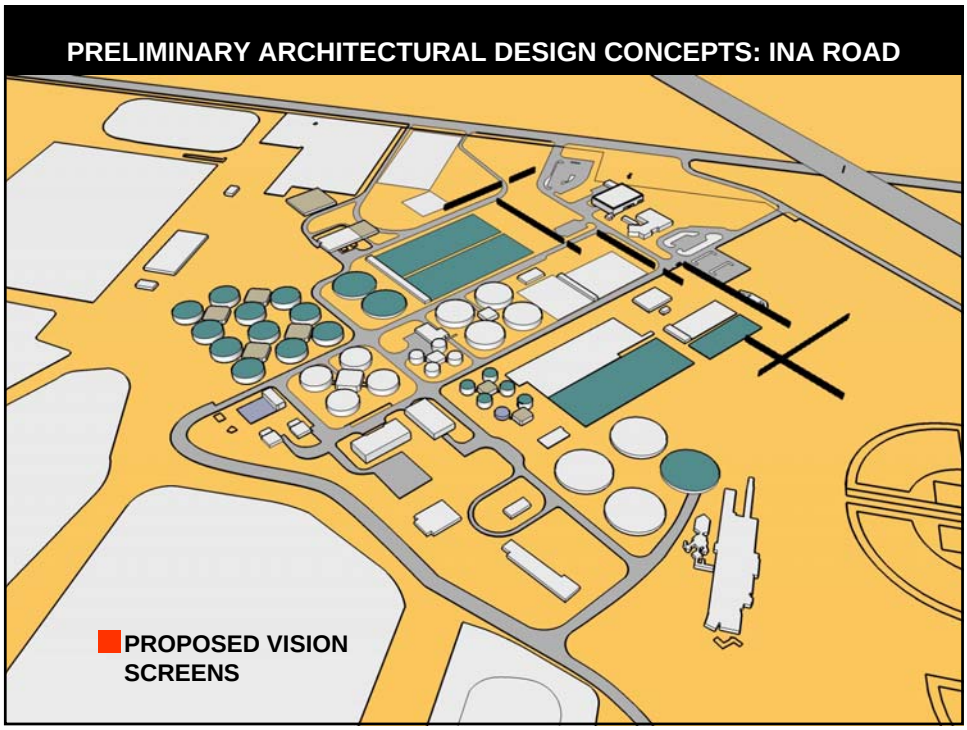
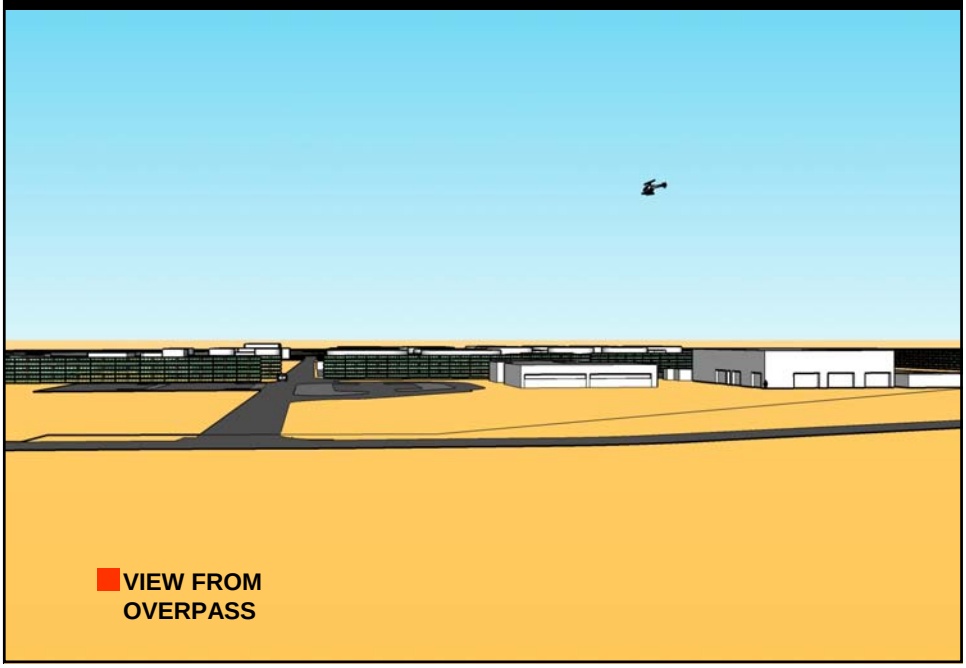



PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: INA ROAD
PROPOSED EXPANSION

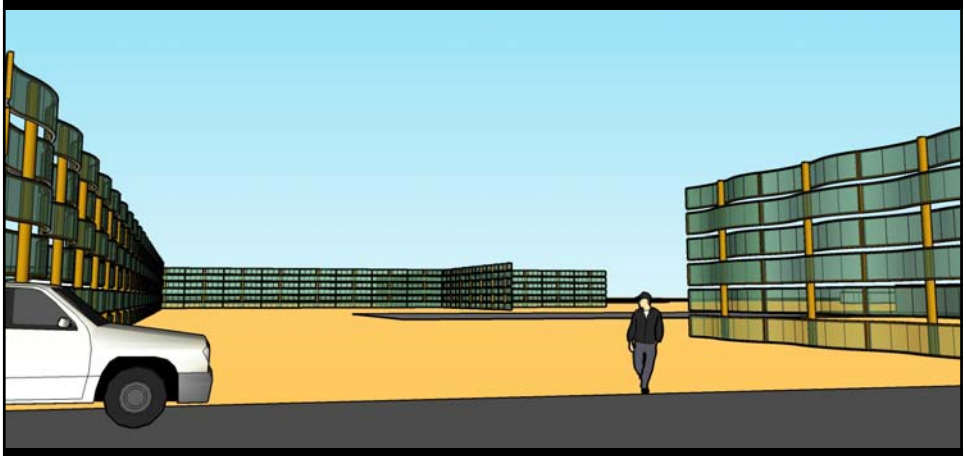

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: INA ROAD
PROPOSED VISION SCREENS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: INA ROAD



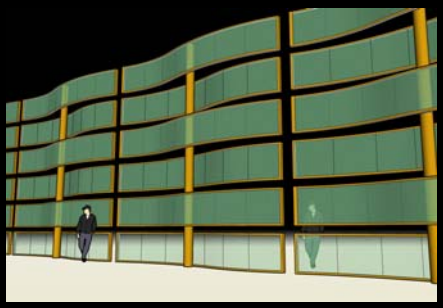
- VIEW FROM OVERPASS

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: INA ROAD



- VIEW ONSITE

PRELIMINARY ARCHITECTURAL DESIGN CONCEPTS: INA ROAD



- VISION SCREEN DETAIL

Pima County Wastewater Management Department

GREELEY AND HANSEN

Open Session

Jerry Bish

Transitional Operations

- Construction of plant interconnect by 2010
- 2010 to 2015 flows at Ina Road
- 2010 to 2015 flows at Roger Road

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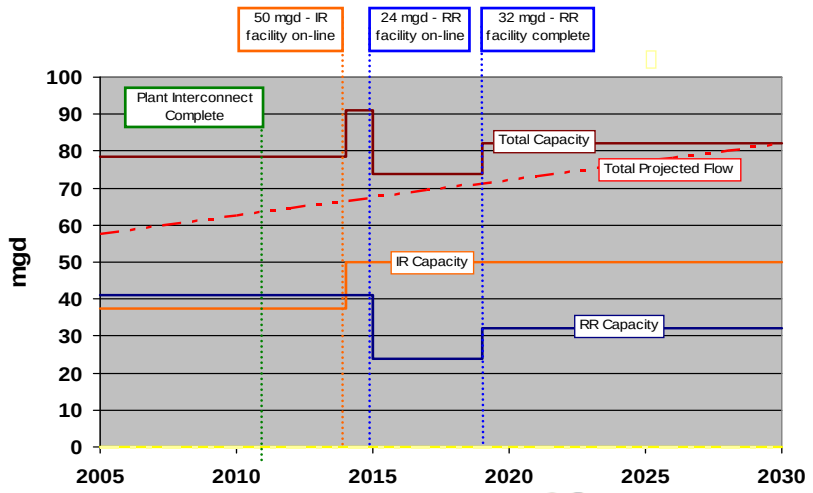
Plant Capacity Analysis



100

Transitional Operations

- Digester at Ina Road
- Thickener upgrades
- Centrifuge upgrades
- Sludge storage upgrade
- Sludge loading facility upgrade

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Transitional Operations

- Power Supply – Ina Road WPCF
  - Plant is served from two utility sources with multiple service drops and on site generators
  - Original treatment plant constructed during the 1970's and Centrifuge Building added in the 1980's is powered by generators at the plant power generation facility
  - Plant expansion is powered from three separate Tucson Electric Power (TEP) incoming utility electric services

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Transitional Operations

- Power Supply – Ina Road WPCF *(continued)*
  - A unified power distribution system will be implemented as plant is expanded
  - Unified system will feature redundant power sources; this will consist of dual utility sources, on site generators or combinations of both

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Other Issues

- Program management
- Smoothing CIP "hump" scenarios
  - Finance over different periods 15, 20, 30 years
  - Existing program – defer more project elements
  - Extend time for compliance
  - What is the ideal "sweet spot" financing plan
- Odor control – conveyance system

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Summary and Wrap-Up

Andy Richardson

Closing Remarks

Mike Gritzuk

GREELEY AND HANSEN

Workshop #16 Meeting Notes
Implementation Plan / Pre-Final Draft of ROMP Report Workshop

1. The Implementation Plan and Pre-Final Draft of the ROMP Report Workshop for Pima County Regional Optimization Master Plan was held on May 9, 2007. The agenda is attached. The following were in attendance:

PCWMD
Director
Michael Gritzuk
Deputy Directors
Paul Bennett
Mike Bunch
Jackson Jenkins
Jeff Nichols
PCWMD Staff
Ed Curley
Laura Fairbanks
Jim Doyle
Frank Gall
Mary Hamilton
Michael Kostrzewski
Byron McMillan
Jeff Prevatt
Karen Ramage
Helen Rhudy
Ron Riska, Project Manager
Prakash Rao
Mandley Rust
John Sherlock
Jack Van Riper
John Warner
Eric Wieduwilt
Legal
Chuck Wesselhoff

TUCSON WATER
Tucson Water Staff
Pat Eisenbach
Melodee Loyer
Ralph Marra
Tim Thomure

BUREAU OF RECLAMATION
Deborah Tosline

GREELEY AND HANSEN PROJECT TEAM
Jerry Bish
Joe Popeck

2. Major topics of the workshop were:
   - Workshop #16: Implementation Plan / Pre-Final Romp Report Review
     - Review of Chapters – 1 through 13 + Executive Summary
     - Updates
       - Enhanced Chlorination
       - Request for Expression of Interest

A set of handouts were provided to each attendee at the workshop. Throughout the workshop one comment was recorded on a "flip-chart." That comment is incorporated into the summary provide below.

3. Mike Gritzuk welcomed the attendees to the workshop. He stated a job well done by all of those in the Pima County Wastewater Management Department who have participated in the Regional Optimization Master Plan process. Tucson Water was recognized as contributor and major stakeholder in all the workshops. Also, it was requested that the department collectively review every page of the Report to make sure it reflects the needs of PCWMD.

4. Jerry Bish outlined the meeting topics and objectives. All were encouraged to fully participate with comments or questions on the ROMP Report as it was reviewed chapter-by-chapter during the workshop. The primary workshop objective was to review the draft of the ROMP Report, including the financing plan, delivery methods, implementation plan and executive summary which were only outlined in the previous draft of the Report. Attendees were reminded to send their comments to Ron Riska who will compile and forward them to Greeley and Hansen. Comments are due to Ron by May 21, 2007.

   Overview, agenda, meeting objectives, and ground rules were covered on pages 1 through 4 of the handout.

5. The meeting began with a review of an open and unsettled issue with Tucson Water regarding filtration of the plant effluent at the new Roger Road Water Reclamation Facility and the upgraded and expanded Ina Road WPCF. If PCWMD is required to filter the effluent, Tucson Water will recognize this as A+ water and will receive, disinfect and distribute as reclaimed water. This is similar to the Randolph Park WRF operation, where the effluent is A+ water. However, at Randolph Park WRF PCWMD also disinfects and delivers that water to the reclaimed water distribution system. If Class B+ is provided by PCWMD and filtration is provided by PCWMD, Tucson Water wants a guarantee of water quality. It was agreed that this would be discussed further in a future meeting with Tucson Water.

6. Jerry Bish reviewed the purpose and summarized the contents of the Executive Summary and Chapter 1. For the Executive Summary if was stated that while brief, that this will serve as a stand alone document that summarizes the master plan purpose and recommendations. It is important that this reflect the future planning needs of the Department. For example, it was suggested that unresolved issues that were identified under ROMP be listed in the Executive Summary. Since this was the first presentation of this section, it is important that everyone review it and provide comments on whether it correctly states with clarity the future needs of the Department.

   Chapter 1 sets forth the purpose of the Regional Optimization Master Plan and establishes the basis of the report. This chapter sets the stage for the chapters to follow. The purpose of the report is to provide the 25-year road map for the department to follow in its continued mission and stewardship of the environment in Pima County.

   Summaries of the Executive Summary and Chapter 1 were covered on pages 5 and 6 of the handout.

7. Chapter 2 was reviewed by Jerry Bish. This chapter covers regulatory requirements and customer issues. It is recognized that the permits required by the State environmental agencies are not static, but are periodically being renewed. For example, the APP permit summarized in the chapter is outdated and has been replaced with a new permit. Based on this fact, tables in the chapter which summarizes the permits will be moved to the appendix, as previously requested by Byron McMillan. In addition, it was indicated that ADEQ is considering new and more stringent rules on ammonia removal in the discharges from wastewater treatment plants, which should be referenced in the Chapter. Further the chapter needs to stress the impacts of cultural resources at the sites along the Santa Cruz River, where ancient cultures once inhabited.

   Jack Van Riper asked if the report identifies how the riparian habitat downstream of Roger Road will be maintained. The response is that the report does not explicitly state how to maintain the riparian habitat, but addresses it in general terms by providing up to 7 mgd of effluent into the river. There are other entities in the County that are addressing the riparian habitat issue along the Santa Cruz River, such as the Tres Rios del Norte study by the Corps of Engineers. Mike Gritzuk commented that no firm commitment has been made to how much water is allotted for riparian habitat. Further, it was stated that the ownership of the effluent from the treatment facilities should be addressed, but an exact amount of effluent ownership need not be included in the Report. In addition, there is no known regulatory requirement that any amount of effluent be discharged to the Santa Cruz River.

   John Warner asked if CMOM was included in Chapter 2. It was affirmed that CMOM was included in this section of the report. It was also suggested that the future Corps of Engineers river restoration study project between Prince and Congress should be referenced in the report along with the current Tres Rio del Norte project. Finally, the possible presence of asbestos at the existing Roger Road WWTP should be noted as a clean closure issue at the site. It was noted that there is a report on asbestos issues at the site that should be referenced.

   The Board of Supervisors has adopted new County sustainability initiatives that will need to be utilized in future facilities. The date of the resolution is dated May 1, 2007 and supports sustainable development and the continual emphasis on sustaining a livable community. A copy of the County resolution is attached at the end of the notes.

   Summary of Chapter 2 was covered on page 7 of the handout.

8. The treatment plant evaluation is covered in Chapter 3 and was reviewed by Joe Popeck. The chapter addresses existing treatment capacity, facility condition and assessment of processes and systems at the existing Roger Road WWTP and Ina Road WPCF. At Roger Road WWTP due to age, condition and functional risk of future operations, the existing facilities are deemed marginal for conversion to BNR service. Since Ina Road WPCF is a much newer facility, much of the existing systems and can be utilized in the future nitrification and denitrification (BNR) operation. At both Roger Road WWTP and Ina Road WPCF near-term planned improvements are necessary to maintain wastewater treatment effectiveness until the modifications are completed to upgrade the plants for ammonia (nitrogen) removal.

   It was requested that an additional section be added to Chapter 3 to address the evaluation of the plants via the risk factors, such as contractual, unforeseen/unknown, etc. As stated above ADEQ is

considering new proposed rules for ammonia limits which are more stringent. The new rules will be pH dependent. The proposed new rule should be addressed in the development of the future treatment processes.

Summary of Chapter 3 was covered on pages 8 through 10 of the handout.

9. Overall wastewater treatment strategy is developed in Chapter 4. The chapter was summarized by Joe Popeck and includes: information on future flows, wastewater characteristics, future treatment requirements, flow split options, treatment process alternatives, and reclaimed water considerations. An initial screening of system alternatives was developed, which reduced the candidate wastewater systems to three. Through application of technical, financial, risk and non-cost criteria a wastewater treatment system recommendation was provided for the Roger Road and Ina Road facilities. The final recommendation is to use Bardenpho process at both plants, use a flow split arrangement of 32 mgd at Roger Road and 50 mgd at Ina Road. All new facilities would be located at Roger Road, while Ina Road WPCF will be expanded and upgraded to meet the future requirements.

   The chapter should state that the treatment plant design is set to achieve a nitrogen limit of less than 8 mg/L and a phosphorus limit of less than 2 mg/L. Jackson Jenkins indicated that Randolph Park WRF is a nominal 3 mgd facility. Its actual capacity is less than that. Also, if thicken biosolids from the outlying facilities are to be received at Ina Road, they should be discharged directly to the digesters.

   Frank Gall asked about diurnal flows at Roger Road. The Roger Road WRF will be able to operate in a steady-state or on diurnal flow mode. The final operational mode is a strategic operational decision based a number of factors. This will be evaluated at the time of startup, or early operation of the new, and expanded and upgraded facilities.

   As a site location consideration, moving the new Roger Road Water Reclamation Campus to along the Santa Cruz River needs to be evaluated. This relocation may better suit the environmental and park themes considered for the surrounding area.

   Summary of Chapter 4 was covered on pages 11 through 17 of the handout.

10. Biosolids handling and treatment for the County wastewater treatment facilities were covered in Chapter 5. The summary was provided by Jerry Bish and included a review/assessment of current practices, review of biosolids regulations, projection of future biosolids quantities and a recommendation to deal with near-term and future biosolids challenges. In addition, the recommendation for the use of biogas from current and future digesters at Ina Road is to generate electricity and heat to satisfy the energy needs of the plant, or to sell the biogas for green credits and purchase utility power. This is being addressed through the request for expression of interest process currently underway. The recommendation for biosolids handling and disposal is to take the current biosolids assessment and recommendation in the Report as a base, and develop a long term biosolids management plan. The plan needs to include a comprehensive biosolids market study and economic feasibility analysis of Class A biosolids. It was noted that biosolids handling and disposal was one of the items in the request for expression of interest. It was further noted that prospective biosolids management firms need to be informed of the expression of interest process.

Comments of the Chapter 5 content include the following. Since new gravity belt filters have been recently installed and placed into service at Roger Road, they should be included in the process diagram. In the Ina Road WPCF process diagram, dissolved air flotation thickeners should be shown in parallel with the gravity thickener tanks. For Mt. Lemmon show biosolids as stored and hauled to an interceptor of the Ina Road WPCF. Also, since the new facilities at Corona de Tucson WWTP will be in service soon, show biosolids as stored and hauled. Also, it was offered that the sludge quantities at each site needs to be checked for correctness.

Prakash Rao stated that the biosolids from Green Valley will continue to be disposed of at the mines for two more years. At that time a decision will be made as to whether to continue the program on a permanent basis.

Further, Byron McMillan indicated that the County Board if Supervisors have passed a resolution on "green power – renewable energy" which should be referenced in the report.

Summary of Chapter 5 was covered on pages 17 through 25 of the handout.

11. Chapter 6 reviews and makes an assessment of the conveyance interceptor systems within the Roger Road WWTP and Ina Road WPDF service areas. Jerry Bish summarized the chapter contents. The contents include a hydraulic capacity analysis of future flows, wet weather impacts, CMOM considerations, Roger Road WRF and Ina Road WPCF service interconnect and a listing of interceptor capacity projects over the next 25 years. John Warner suggested and the group accepted that the pipeline interconnecting Roger Road WRF to Ina Road WPCF be called the Santa Cruz Interceptor Phase IV.

    Summary of Chapter 6 was covered on pages 25 through 28 of the handout.

12. The recommended treatment plant is described in Chapter 7. Joe Popeck summarized the features of both the new Roger Road WRF and the expanded and upgraded Ina Road WPCF. The chapter covers land use and area development, and location and configuration of future treatment facilities and associated utilities. It was noted that the future facilities at Roger Road will be identified as the Roger Road Water Reclamation Facility. Melodee Loyer stated that the reclaimed water volumes indicated in the presentation (30 mgd at Roger Road WRF and 20 mgd at Ina Road WPCF) were estimated for the year 2030. Actual effluent quantities allotted to Tucson Water for reclaim water use is prescribed in IGAs.

    Jackson Jenkins asked if a fourth emergency overflow basin was shown at Ina Road WPCF. Since Roger Road can use the new Santa Cruz Interceptor Phase IV (plant interconnect pipeline) to transfer flow under emergency conditions, it will not be necessary to provide emergency overflow basins there in the future. But since that additional flow will be transferred to Ina Road additional storage may be required there. The conclusion is to provide an allocated space for a fourth basin, but to improve standby power capabilities and not include an additional basin in the expansion and upgrade program at Ina Road WPCF at this time.

    Summary of Chapter 7 was covered on pages 28 through 33 of the handout.

13. Existing outlying wastewater facilities permits, capacities, service areas and operations are described in Chapter 8 and were reviewed by Jerry Bish. Pima County operates eight outlying treatment facilities. A ninth facility is the Randolph Park WRF which is included within the Roger Road Service Area. Comments on the chapter include: combine Figures 8-10 and 8-11into one figure, check capacity at Marana WWTP (current capacity is 200,000 gpd), check capacity at Pima County Fairgrounds WWTP, and change Corona de Tucson WWTP's biosolids handling to store and haul. Pima County growth has recently slowed and flows are not increasing as rapidly as predicted using the PAG and TAZ population data. PCWMD planning group tracks the growth and flows separately to provide timely services.

    Where biosolids are thickened and hauled at the outlying facilities, indicate that those thickened biosolids are transported to Ina Road WPCF and fed directly into digesters.

    Summary of Chapter 8 was covered on pages 34 through 36 of the handout

14. The strategic wastewater management plan for the outlying facilities is described in Chapter 9. A summary of the chapter contents was provided by Jerry Bish. The chapter examines future needs, treatment plant capacities and facilities consolidation potential. From an evaluation of the future needs and population growth patterns, it is recommended that the current eight facilities be organized into six future facilities. One of the future facilities, Southlands, does not currently exist. In the consolidation process three lagoon facilities will be phased out of operation. Each of the future facilities will be an oxidation ditch system, or a variant thereof, except for the Southlands. The Southlands facility is recommended to be a Bardenpho process, because that facility is expected to grow at a rapid pace to a capacity over 10 mgd within the 25-year planning horizon of the master plan. The Bardenpho process is a more cost effective treatment choice at higher flows.

    Comments on Chapter 9 include: change the effluent TN requirement to less than 8 mg/L, change plant expansion dates to one year (e.g. 2008 not a fiscal year designation - 2007/2008), and on Table 9-1, footnote 2 add /TAZ.

    Since the Board of Supervisors has approved the Canoa Ranch facility, it needs to be added to the listing of outlying facilities.

    All outlying facilities are to be identified in the future as sub-regional facilities. For example, slide 119 of the handout should read "Future Arrangement of Sub-Regional Facilities."

    Summary of Chapter 9 was covered on pages 36 through 40 of the handout

15. Chapter 10 identifies the ROMP CIP elements by plant. In addition, the Santa Cruz Interceptor Phase IV (plant interconnect pipeline) and support facilities are identified as ROMP CIP elements. Other CIP items identified were the conveyance system augmentation and outlying facilities expansions. Jerry Bish reviewed the contents of the chapter. A comment was made to include text regarding the integration of the ROMP CIP with other PCWMD CIP elements.

    Summary of Chapter 10 was covered on pages 40 through 42 of the handout.

16. Chapter 11 addresses available methods of project delivery methods in the State of Arizona. There were no comments on this chapter. Chapter was reviewed by Jerry Bish.

    Summary of Chapter 11 was covered on pages 42 and 43 of the handout.

17. Chapter 12 addresses the financing methods and plan for the ROMP CIP elements and other PCWMD CIP elements. No substantive comments were received on this chapter. Chapter was reviewed by Jerry Bish.

    The summary of Chapter 12 was covered on pages 43 and 44 of the handout

18. Chapter 13 is the implementation plan for the ROMP CIP. This chapter covers the CIP elements, implementation schedule, project delivery approach, funding source and rate impacts. Contents of the chapter were reviewed by Jerry Bish. Comments on the chapter include: there is a bust in Tables 13-3 and 13-4 on the Pima County rates, to the engineering for Roger Road WRF projects add D/B, change all D/B/O to D/B, place presentation slides 137, 138 and 139 into the Chapter 13 text, on slide 139 add turnkey to procurement method, on slide 139 biogas generation add D/B/O to procurement method, and Figure 13-3 is not the most recent information (see Ed Curley for the latest information).

    Summary of Chapter 13 was covered on pages 45 and 50 of the handout

19. Several appendices will be included with the report to support the master plan development. Jerry Bish reviewed the appendices planned for the report. Comments on the appendices include: how will the public meetings be addressed in the report, how will he enhanced chlorination study be addressed, add a basis of design section to the appendices, and place the specific permit summaries from Chapter 2 in the appendices.

    Listing of appendices is provided on page 51 of the handout.

20. Update on the enhanced chlorination investigations/study and status of the requests for expression of interest were provided by Jerry Bish. Enhanced chlorination can provide considerable savings to Pima County, if effective. Initial investigations look promising. A workshop is scheduled for May 23, 2007 to review the initial findings.

    The request for expression of interest from the private sector marketplace has been advertised by Pima County. The information received will assist in public policy decisions regarding project delivery, private financing, green power and biosolids disposal. The pre-submittal meeting date is May 23, 2007 with submissions due on June 22, 2007.

    Summary of the updates was covered on pages 51 through 55 of the handout

21. Mike Gritzuk again thanked all the participants, including Tucson Water for their involvement throughout the master planning process. Based on the comments received the Report will be finalized over the next month or two. The project team thanked the County and Tucson Water for their assistance, counsel and advice in development of the master plan. The workshop ended with a request to send comments on the pre-final chapters to Ron Riska.

Agenda
Workshop # 16 – Implementation Plan / Pre-Final Draft of ROMP Report
May 9, 2007

Time	Topic	Presenter
8:45 am	*Tucson Main Library, Basement Meeting Room, 101 N. Stone*	
9:00 am	Opening Session • Welcoming Remarks • Review Agenda • Workshop Goals	 Mike Gritzuk Jerry Bish
9:15 am	Chapters 0 - 4 Review (Strategic Development) 0. Executive Summary 1. Introduction 2. Regulatory and Customer Requirements 3. Treatment Plant Evaluation 4. Overall Treatment Strategy	Joe Popeck/Jerry Bish
10:45 am	Break	
11:00 am	Chapters 5 -9 Review (Strategic Development) 5. Biosolids/Biogas 6. Conveyance 7. Recommended Treatment Plant Plan 8. Outlying Facilities Overview 9. Outlying Facilities' Strategic Management Plan	Jerry Bish/Joe Popeck
12:30 pm	Lunch	
1:00 pm	Chapters 10-13 Review (CIP Development) 10. CIP Elements 11. Alternative Project Delivery Methods 12. Financing Methods / Plan 13. Implementation Plan	Jerry Bish
2:30 pm	Updates • Enhanced Chlorination Investigation/Study • Request for Expression of Interest Update	Jerry Bish
2:45 pm	Summary Wrap-Up • Comments by Group • Closing Remarks	Jerry Bish Mike Gritzuk
3:00 pm	Adjourn	

Board of Supervisors Memorandum

May 1, 2007

Resolution In Support of New County Sustainability Initiatives

Background

The current drought, rising fuel prices, and climate change, are topics discussed daily in our news. Without action, all three have the ability to dramatically change our current lifestyles. That said, our community is known for rising to the occasion and supporting progressive changes. Whether it be coming together to finally pass a regional transportation plan that contains significant funding for transit improvements, or showing great conservation ethic and leadership by supporting the Sonoran Desert Conservation Plan. Many in this community enjoy a high quality of life, and we continue to implement initiatives in the areas of health, safety, education, job assistance, affordable housing, and neighborhood reinvestment, to assist those in need.

We need to continue to sustain and improve the quality of life of this community, without jeopardizing the ability for future generations to do the same. A sustainable and livable community requires investments in the environment, the economy, and the social fabric. We can continue this ethic by focusing efforts on the built environment, lessening our impact on non-renewable resources, and joining forces with other communities confronting global climate change.

As one of the largest employers in Southern Arizona, Pima County can be a leader in this effort. The County designs and constructs buildings as part of our voter-approved bond programs, and is therefore also one of the largest builders in Southern Arizona. This includes facilities like community centers and libraries within our cities and towns. In addition, through our development approval process, the County has the ability, through incentives, education, and regulation, to impact the private development process in unincorporated Pima County.

As you know, the topic of this year's State of the County event on May 4, 2007, is "Sustaining a Livable Community". In preparation for this event, I've placed the attached resolution on the Board's addendum for May 1, 2007. If approved, the resolution would commit Pima County to new initiatives in the areas of alternative fuel vehicles for our County fleet, energy conservation, water conservation, waste reduction, and green purchasing. This memorandum describes these new initiatives and how the County can continue its commitment to fostering sustainability.

Water, Energy, and Climate Change

Water resources are inextricably related to other resources such as energy. Each kWh of thermoelectric generation requires approximately 25 gallons of water with additional amounts used for operating pollution control devices. The United States Geological Survey estimates that in 2000, 346 billion gallons of freshwater were used per day for energy production in the United States accounting for approximately 39 percent of total freshwater withdrawals. While only 9 percent of these withdrawals are actually consumed by the generation process, they still account for approximately 38 billion gallons per day in 2006. Hence buildings with inefficient energy use, and the manufacture of building materials requiring large amounts of energy, contribute indirectly to taxing our water resources.

In addition, the built environment has complex and potentially devastating impacts on the biosphere. While only representing 8 percent of the United States gross domestic product, the construction industry consumes 40 percent of raw materials extracted or harvested in this country and generates about half a ton of waste per person each year. Regarding impacts on greenhouse gases, buildings account for 40 percent of global carbon dioxide emissions, with transportation accounting for another 33 percent. Expansion of the built environment has resulted in: lower land carrying capacity, loss of biodiversity, rise in air quality toxicity, water supply shortages, and greater energy requirements. Our long-term survival in the Sonoran Desert depends upon our ability to reduce transportation emissions and move toward green or sustainable building.

Alternative Fuel Vehicles

Motor vehicle use is a major contributor to air pollution and global climate change. At the same time, we are facing higher and higher fuel prices at the gas pump. The County has over a thousand vehicles in its fleet, excluding patrol vehicles and heavy trucks. By approving this resolution, the County would be committing to an aggressive timetable to phase those vehicles to alternative fuel vehicles.

Waste Reduction and Green Purchasing

Emphasis will also be placed on moving the County toward waste reduction and green purchasing to include Energy Star equipment and materials of low embodied energy and of recyclable content whenever possible. Energy Star is a joint program of the Environmental Protection Agency (EPA) and the Department of Energy, which certifies appliances, office equipment, light fixtures, home electronics, and other products as meeting certain energy efficiency standards. The EPA estimates that in 2006 alone, the Energy Star program has saved Americans $14 billion on their utility bills and has avoided greenhouse gas emission equivalent to that generated by 25 million automobiles. Materials of low embodied energy are those that require little energy to produce, manufacture, and transport to their destination.

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Water Conservation

Through implementation of the riparian element of the Sonoran Desert Conservation Plan, and amendments underway to the Water Resources Element of our Comprehensive Plan, the County is already making significant efforts to conserve our limited water resources. Approval of this resolution would take these efforts further by making commitments to reduce water consumption in County facilities, increase our use of effluent, and maximize the water resources we do have to protect our natural environment.

Green Building and LEED Standards

The most prominent green building standard in use today is produced by the United States Green Building Council under the name of LEED (Leadership in Energy and Environmental Design). The LEED rating system provides obtainable points in six distinct categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation & design process. Depending on the number of points obtained, buildings can be built and maintained meeting LEED certified, silver, gold, and platinum in escalating levels of performance.

Approval of this resolution means that Pima County will adopt LEED silver, already adopted by the City of Tucson and the State of Arizona. Since the County builds many facilities for other jurisdictions through voter-approved bond programs, this is a very significant commitment region wide.

Building to LEED has seen capital cost increases of over 10 percent a decade ago recently drop to below 0 percent in certain projects as designers and builders have become savvy in taking an integrative approach to sustainable construction. A 2003 study by Gregory Kats reported that the average construction premium for 33 LEED buildings across the country was 1.84 percent. The following year, Matthiessen and Morris of Davis Langdon Consulting compared 45 buildings attempting LEED certification to 93 conventional buildings, finding that there was no difference in costs per square foot. The United States General Services Administration reported that LEED silver federal courthouses cost premiums range from a negative 0.03 percent to 4.4 percent compared to their conventional counterparts. The low numbers are typically attributable to larger buildings and the high ones to small ones. While it is clear that there will be some initial capital cost increases to the County until such time that greater expertise in green building is obtained, these will be quickly offset through energy savings, and increases in productivity.

The United States Department of Energy's Pacific Northwest National Laboratory (PNNL), the National Renewable Energy Laboratory (NREL) and other organizations have compared the cost/benefit of investing in high performance commercial buildings. Although a few years old, and therefore capital cost increases have since dropped, findings generally reflect the following patterns:

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- While capital costs increase in the order of 2 percent or $2 to $5 per square foot for silver/gold rated LEED buildings, the total net present value (TNPV) of the energy savings over a 20-year life cycle is $5.79 per square foot.

- Additional per square foot savings for reduced emissions ($1.18), water ($0.51), and operations and maintenance savings from proper building commissioning ($8.47) bring the aggregate TNPV to $15.95 per square foot. Added to this number are yet further potential savings gleaned from improvement of interior environments.

- More efficient and healthy interiors reduce medical costs and produce a gain in productivity estimated by researchers as high as $36.89 TNPV per square foot for a certified/silver and $55.33 for a gold/platinum rated buildings.

It is in the best interest of the County to adopt LEED silver for its facilities. While initial capital costs may increase slightly, this amount would be rapidly recovered simply in terms of energy saved, not counting the large savings resulting from increased productivity, quality of life, and environmental benefits.

Additional Energy Conservation Commitments

In addition to committing to a LEED silver standard for County built facilities, adoption of this resolution will also commit the County to constructing one medium size building with a net zero energy consumption, to ensuring that 15 percent of County facilities' electrical energy consumption come from renewable resources, and that the County maximize renewable resources from the production of methane in County wastewater treatment land landfill operations.

Green Building, Energy and Water Conservation and the Private Sector

The County has the ability to pursue strategies to further conservation practices on private property in unincorporated Pima County through the County's development approval processes. Among these strategies is the development of green building programs currently in the planning stage. Pima County proposes to endorse green building standards by providing incentives to builders who select to build to recognized standards.

Opportunities will also be sought to incorporate solar elements into County planning to take advantage of our greatest local energy resource. These will include requiring that a minimum of 50 percent of homes constructed after 2010 include direct solar assisted energy through solar hot water or photovoltaic elements. Adoption of the resolution will also commit the County to amending land use regulations to require all new housing discharging to septic systems also be provided with a grey water reuse system.

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In addition, a draft memorandum of understanding is being negotiated with the United States Green Building Council whereby the County would be one of three national pilot jurisdictions with authority to certify structures to LEED within both the County and its incorporated jurisdictions. LEED certification could thus be provided to the community at lower cost by reducing the paperwork documentation effort through field verification of construction conformance to the target design. The pilot program would also provide an opportunity for large-scale educational promotion of sustainable development to designers, builders and the public at large by way of the building permitting process. Finally, this effort would allow the County as well as regional American Institute of Architects and United States Green Building Council groups to play a critical role in establishing procedures and methods to be deployed at a national level.

Organizational Approach

In conclusion, departments and organizational units within Pima County will be identified to contribute to these efforts and an organizational structure facilitating the coordination of efforts established. This group will seek opportunities to further sustainable goals, while looking to resolve current procedural and code requirements which conflict with sustainable practices. Pima County will also continue to work with other jurisdictions to strive for consistent policies and programs so as to maximize the potential for success, which can only be truly realized on a regional level.

Recommendation

It is recommended that the Board adopt the attached resolution in support of these new County sustainability initiatives.

Respectfully submitted,

C

C.H. Huckelberry
County Administrator
(April 26, 2007)

Attachments

Pima County
Regional Optimization
Master Plan

Workshop #16
Implementation Plan/
Pre-Final Draft of ROMP Report

May 9, 2007

Workshop Presenters

- Mike Gritzuk…… Welcome/Closing
- Jerry Bish…….....Facilitator/ Chapters 0,1, 2, 5, 6, 8-13 Updates
- Joe Popeck…….. Chapters 3, 4, 7
- Jerry Bish…….. Wrap-Up

2

GREELEY AND HANSEN

Welcoming Remarks

Mike Gritzuk

GREELEY AND HANSEN

Overview

Jerry Bish

Agenda

- Review Pre-Final Draft ROMP Report
- Topics update
  - Enhanced chlorination investigation/study
  - Request for Expression of Interest

5

Objective

- Receive critical comments on Pre-Final Draft Report
- Identify open/unsettled issues
- Identify who, what and when necessary for issue closure

6

Groundrules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

7

Groundrules *(continued)*

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these groundrules and hold each other accountable

8

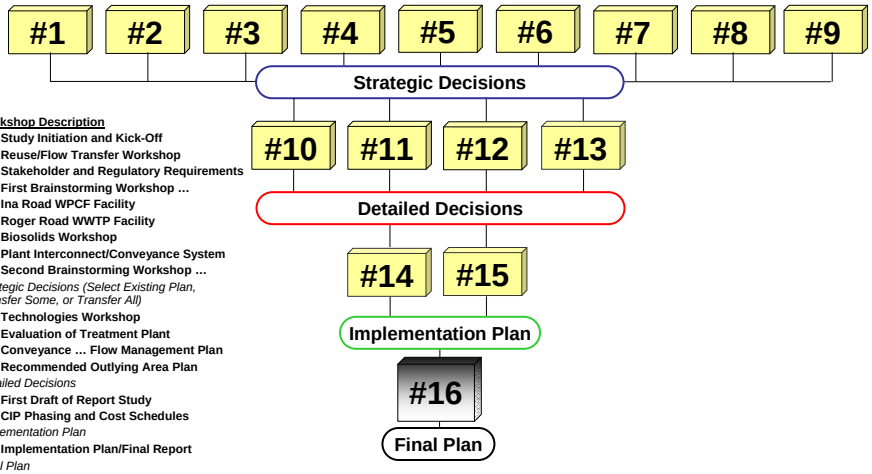
Role of Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in “parking lot”

Role of Facilitator *(continued)*

- Remind all of groundrules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Study Process



Workshop Description

1 Study Initiation and Kick-Off
2 Reuse/Flow Transfer Workshop
3 Stakeholder and Regulatory Requirements
4 First Brainstorming Workshop …
5 Ina Road WPCF Facility
6 Roger Road WWTP Facility
7 Biosolids Workshop
8 Plant Interconnect/Conveyance System
9 Second Brainstorming Workshop …

Strategic Decisions (Select Existing Plan, Transfer Some, or Transfer All)

10 Technologies Workshop
11 Evaluation of Treatment Plant
12 Conveyance … Flow Management Plan
13 Recommended Outlying Area Plan

Detailed Decisions

14 First Draft of Report Study
15 CIP Phasing and Cost Schedules

Implementation Plan

16 Implementation Plan/Final Report

Final Plan

11

GREELEY AND HANSEN

GREELEY AND HANSEN

Pre-Final Draft of Regional Optimization Master Plan

Jerry Bish/Joe Popeck

Executive Summary

Jerry Bish

Executive Summary

- Provides overview
- Brief summary of purpose and recommendations
- Highlights key elements
- Can serve as stand alone document.

GREELEY AND HANSEN

Chapter 1 – Introduction

Jerry Bish

Chapter 1 – Introduction

- Sets forth purpose of master plan and establishes basis for report
- Identifies strategic issues / sets strategic direction
- Integrates Capital Improvement Plan

16

GREELEY AND HANSEN

Purpose

- Identify optimal strategy for wastewater treatment
- Identify optimal biosolids treatment / disposal
- Identifies conveyance capacity needs
- Sets outlying facilities strategic plan

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Purpose *(continued)*

- Develop key decisions through consensus process
- Outlines CIP program and funding methodology
- Provides 25-year road map

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Chapter 2 – Regulatory and Customer Requirements

Jerry Bish

Regulatory and Customer Requirements

- Governing agencies
  - US EPA
  - ADEQ
  - Pima County Department of Environmental Quality
- Permit summaries (go to Appendix)
  - AZPDES
  - APP (new for Marana)
  - Air quality
  - Reclaimed water

20

Regulatory and Customer Requirements *(continued)*

- Water reuse
  - Intergovernmental agreements
  - Underground storage recharge / recovery
- Cultural / historic preservation
- Regulatory closure requirements at Roger Road

21

GREELEY AND HANSEN

GREELEY AND HANSEN

Chapter 3 – Treatment Plant Evaluation

Joe Popeck

Existing Treatment Capacity

- Roger Road WWTP
  - Permitted capacity = 41 mgd
    - Preliminary and primary treatment
    - Biotowers with Activated sludge, final clarifiers
    - Chlorine disinfection
    - Anaerobic digestion

23

Condition Assessment – RR WWTP

- Summary of condition assessment
  - Most major structures appear in generally good condition
    - However, clarifiers and aeration tanks are not functionally optimal for conversion to BNR process
    - Flow distribution is marginal and cannot be readily improved
  - Most major equipment appear in generally good condition
    - However, major equipment may not be of required capacity for BNR process

24

Condition Assessment – RR WWTP

- Summary of condition assessment
  - Most major electrical components appear in generally good condition
    - However, system is ungrounded Delta – not optimal for equipment such as VFD's
  - Significant lack of I&C

25

Condition Assessment – RR WWTP

- Summary of condition assessment
  - Roger Road facilities, due to condition and functional risk are deemed marginal for conversion to BNR
  - Planned improvements for several areas of the plant are necessary to maintain treatment effectiveness regardless of the final decision on the long-term continued use of Roger Road WWTP

26

Existing Treatment Capacity

- Ina Road WPCF
  - Permitted capacity = 37.5 mgd
    - Preliminary and primary treatment
    - 25-mgd HPO activated sludge, final clarifiers
    - 12.5-mgd BNRAS, final clarifiers
    - Chlorine disinfection
    - Anaerobic digestion

27

Background / Condition Assessments

- Summary of condition assessment
  - Most Major Structures appear in generally good condition
  - Most Major Equipment appear in generally good condition
  - Most Major Electrical Components appear in generally good condition
  - Significant lack of I & C

28

Background / Condition Assessments

- Summary of condition assessment
  - Much of the Ina Road Facility that would be used either as a NdeN process component or support process is viable.
    - However, HPO tanks are not functionally optimal for conversion to BNR process

29

Condition Assessment – IR WPCF

- Summary of condition assessment
  - Planned Improvements for several areas of the plant are necessary to maintain treatment effectiveness prior to modifications for plant-wide NdeN.

30

Chapter 4 - Overall Treatment Strategy

Joe Popeck

Overall Treatment Strategy

- Future wastewater flows and characteristics
- Treatment strategy alternatives with three flow-split options
- Reclaimed water program
- Biological nutrient removal (BNR) treatment alternatives
- Alternative evaluation criteria
- Evaluation of alternatives
- Selection of recommended alternative
- Preliminary sizing facilities
- Summary

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Future Wastewater Flows

Wastewater Flow Split Options Used for Plant Evaluations

Flow Split Options *	Flow to Roger Road, mgd			Flow to Ina Road, mgd		
	Current	Future	Total	Current	Future	Total
Existing Plan	22.6	9.4	32.0	36.5	13.5	50.0

* Randolph Park WRF capacity of 3.0 mgd is not included.

Future Wastewater Flows and Characteristics

Selected Year 2030 Wastewater Characteristics

Based on Complete Mass Balance

Parameter	Units	RRWWTP		IRWPCF	
		Primary Influent	Primary Effluent	Primary Influent	Primary Effluent
Flow	mgd	33.2	32.6	52.6	51.4
COD	mg/L	659	443	689	456
BOD_5	mg/L	301	214	324	229
$sBOD_5$	mg/L	121	123	123	126
TSS	mg/L	310	126	358	146
VSS	mg/L	243	104	282	123
TKN	mg/L	47	46	63	61
TP	mg/L	10	10	15	14

Treatment Strategy Alternatives with Three Flow-Split Options

- Existing Plan
  - At both Roger Road and Ina Road, continue to follow present long-range CIP project schedule to address capacity and regulatory needs of both RRWWTP and IRWPCF
- Transfer Some
  - Maintain a facility at the RRWWTP to continue to provide effluent to the adjacent Tucson Reclaimed Water Treatment Plant (TWTP), and direct remainder of influent flows to IRWPCF
- Transfer All
  - Transfer all wastewater flow from the RRWWTP service area to IRWPCF and decommission RRWWTP

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Reclaimed Water Program

- Reclaimed water program
  - Effluent water will be made available to Tucson Water for reclaimed water service at the future RRWRF and IRWPCF. Plan allows for approximately 30 mgd at RRWRF and approximately 20 mgd at IRWPCF based on allocated effluent water shares.
  - Up to 7 mgd would be made available for discharge into the Santa Cruz River at the RRWRF site.
  - This may require that up to 5 mgd (existing plan) and as of the IRWPCF effluent be transferred to the RRWRF site via a pumping station/force main system.

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Biological Nutrient Removal (BNR) Treatment Alternatives

- Treatment process alternatives were developed to meet the goal of future effluent limits for nutrients with the following criteria:
  - Ammonia nitrogen concentration of 2 mg/L or less
  - Total nitrogen concentration of 8 mg/L or less
  - Total phosphorus concentration of 1 mg/L or less

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Biological Nutrient Removal (BNR) Treatment Alternatives

- Initial screening of BNR process alternatives
  - Modified Ludzack-Ettinger (MLE)
  - Bardenpho
  - Step-feed nitrification and denitrification (NDN)
  - Integrated fixed-film activated sludge (IFAS)
  - Membranes (MBR)
  - Biostyr and Biofor systems
  - Activated sludge/nitrifying trickling filter (AS/NTF)
  - Biotowers/nitrifying activated sludge (BT/NAS)
  - Moving bed bioreactor (MBBR)

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Biological Nutrient Removal (BNR) Treatment Alternatives

- Processes carried forward for detailed evaluation:
  - Bardenpho
  - MLE
  - IFAS
  - BT/NAS for RRWWTP and Bardenpho for IRWPCF

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Alternative Evaluation Criteria

- Technical criteria
  - Operability
  - Proven process
  - Life cycle cost
  - Site compatibility
  - Resource consumption
  - Ease of operation and maintenance during construction

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Alternative Evaluation Criteria

- Financial criteria
  - Capital costs
  - Operation and maintenance (O&M) costs
  - Present worth of capital and O&M costs

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Selection of Recommended Alternative

- Recommendation
  - Use Bardenpho process at both plant locations
  - Flow split of 32 mgd for RRWRF and 50 mgd for IRWPCF
  - New facilities design for RRWRF plant and rehabilitation for the IRWPCF facilities
  - New facilities design at RRWRF without primary treatment

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Preliminary Sizing Facilities

- Preliminary sizing of facilities
  - Facilities for RRWRF and IRWPCF were sized to adequately treat the future wastewater loads and to consistently meet the future effluent requirements meeting the treatment goals.
  - Hydraulic capacity for the RRWRF and IRWPCF is based on a peak hourly flow rate of 2.0 Average Daily Flow.

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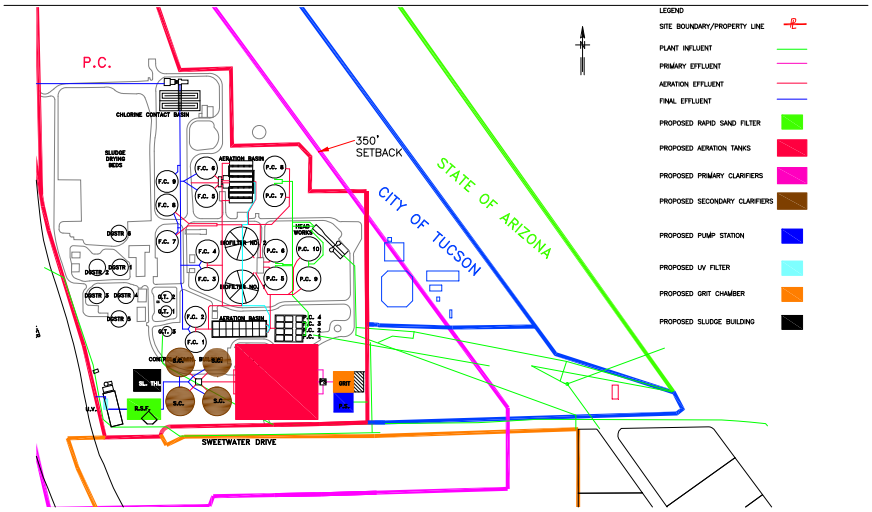
Roger Road – 32-mgd NdeN Facility



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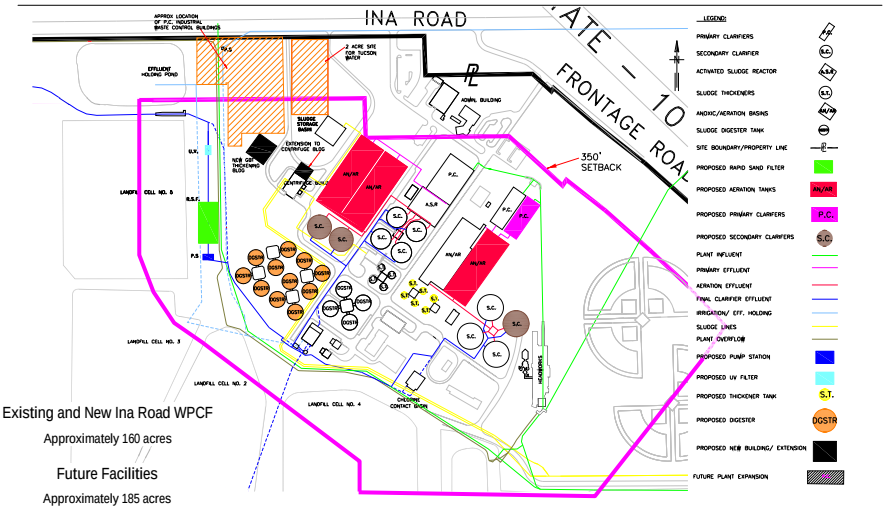
50-mgd Ina Road WPCF



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Summary

- 2030 wastewater flows in the Roger Road and Ina Road service areas were estimated based on population projections and flow estimates. The year 2030 total flow is approximately 85 mgd.
- Wastewater characteristics were determined based on information contained in 2004-2005 GPS-X modeling, future loadings predicated on water conservation, and mass balance with recycle flows from expected future biosolids operation. Because of higher recycle contribution, nutrient concentrations in IRWPCF influent were substantially higher than RRWRF influent.

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Summary

- High degree of treatment is required - effluent goals were set at:
  - Ammonia nitrogen concentration of 2 mg/L or lower
  - Total nitrogen concentration of 8 mg/L or lower
  - Total phosphorus concentration of 1 mg/L or lower (when required)
- Combination of biological nitrogen removal processes and biological phosphorus (Bio-P) removal was found to be most cost effective.
- A review of biological nutrient removal (BNR) processes for nitrogen and phosphorus removal resulted in consideration of nine processes which were screened based on economic and non-economic criteria.

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Summary

- Bardenpho process was determined as most reliable and cost effective process for both treatment plants.
- Using Bardenpho, flow split options were analyzed based of technical and economic criteria. Flow-split of 32 mgd to RRWRF and 50 mgd to IRWPCF was determined as most cost effective.
- New facility option for replacing the existing RRWWTP with a new treatment plant at Roger Road was evaluated. Considering cost uncertainties involved in rehabilitating and modifying the RRWWTP and considering non-economic factors, the new facility was determined to be most viable option for Roger Road.

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Summary

- Preliminary sizing was made for both treatment plants. No chemical use is required for new RRWRF, but some amount of alum (or ferric chloride) will be required at the IRWPCF when phosphorus removal becomes a requirement in the future. This is due to relatively high nutrient concentration in the IRWPCF influent and insufficient carbon source to support both denitrification and Bio-P. After Bio-P removal, chemical will remove additional P to meet future effluent requirement.

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Chapter 5 – Biosolids

Jerry Bish

Chapter 5 – Biosolids

- Existing Class B facilities
- Mesophilic digesters at Roger Road
  - Sludge transfer pipeline to Ina Road
- Mesophilic digesters at Ina Road
- Centralized sludge loading operation

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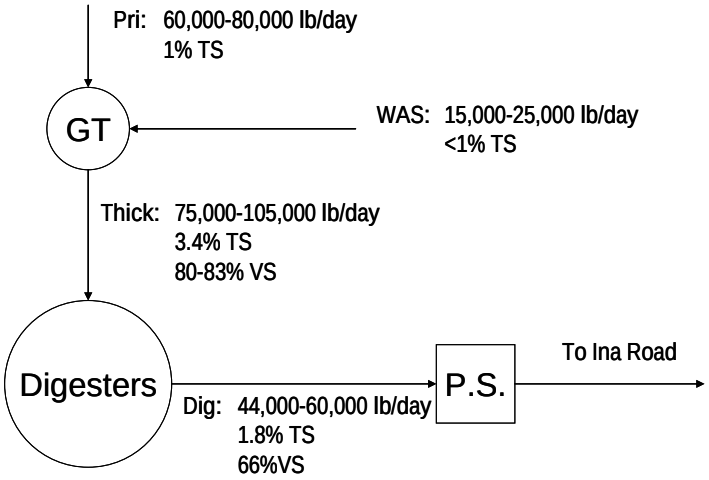
Existing Roger Road WWTP Biosolids Diagram (at 38.3 mgd)



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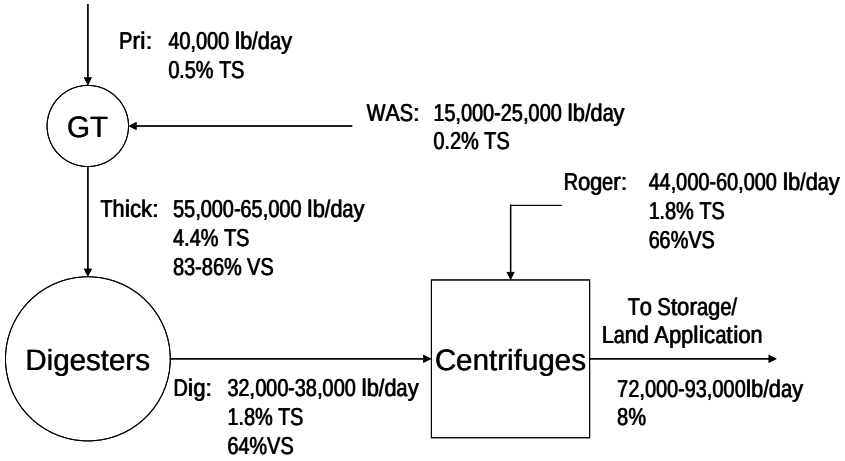
Existing Ina Road WWTP Biosolids Diagram (at 23.4 mgd)



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Outlying Facilities

Location	Current, tpd(1)	Processing, Disposal
Marana	0.28	storage, hauled ⇒ Ina
Rillito Vista	0.014	---
Avra Valley	2.2	storage, hauled ⇒ Roger Road
Green Valley	5.7	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Arivaca Junction	0.09	---
Corona de Tucson	0.16	Evaporation, hauled to landfill when pond is cleaned
Pima Co. Fairgrounds	0.004	Evaporation, hauled to landfill when pond is cleaned
Mt. Lemmon	0.018	storage, hauled ⇒ Ina
Southlands	0.0	---
Total	8.47	

(1) Based on 2,800 dry lbs/day raw biosolids produced per mgd of flow treated.

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Future Solids Streams

- Roger Road WWTP

Solids Stream	Flow, mgd	% Solids	Solids Mass, lb/day	VSS Mass, lb/day
Waste Activated Sludge	1.72	0.7	100,600	76,400
Thickened WAS (to Ina Road Digestion)	0.36	3.0	90,500	68,800
Thickener Overflow	1.36	0.1	10,100	7,600

- Ina Road WPCF

Solids Stream	Flow, mgd	% Solids	Solids Mass, lb/day	VSS Mass, lb/day
Primary Sludge	1.15	1.0	95,300	72,400
Waste Activated Sludge	1.35	0.7	78,800	59,900
Thickened Sludge (WAS + Primary)	0.42	4.5	156,600	119,000
Thickener Overflow	2.07	0.1	17,400	13,200

Outlying Facilities - Biosolids

Location	Future, tpd(1)	Processing, Disposal
Marana	6.16	storage, hauled ⇒ regional facility
Rillito Vista		---
Avra Valley	5.26	storage, hauled ⇒ regional facility
Green Valley	6.79	GBTs, Aerobic Dig., BFPs, Drying ⇒ Mine
Arivaca Junction		---
Corona de Tucson	3.77	storage, hauled ⇒ regional facility
Pima Co. Fairgrounds		---
Mt. Lemmon	0.003	storage, hauled ⇒ regional facility
Southlands	14.7	separate processing and disposal
Total	36.68	

(1) Based on 2,800 dry lbs/day raw biosolids produced per mgd of flow treated

Class B Processes

Process	Requirements
Aerobic Digestion	MCRT of 40 days at 20°C or MCRT of 60 days at 15°C
Air Drying	Dry on beds for 3 months, with 2 months ≥ 0°C
Anaerobic Digestion	MCRT of 15 days at 35-55°C or MCRT of 60 days at 20°C
Composting	5 days at 40°C and 4 hours of the 5 days at 55°C
Lime Stabilization	Lime addition to pH 12 and maintained for 2 hours

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Class A Processes

Process	Requirements
Thermophilic Aerobic Digestion 1	MCRT of 10 days at 55-60°C
Heat Drying 1	Direct or Indirect Gas Drying to ≤ 10% moisture content and solids temperature of 80°C
Heat Treatment 1	MCRT of 30 minutes at 180°C
Composting 1	3 days at 55°C for in-vessel or static pile 15 days at 55°C for windrow
Pasteurization 1	30 minutes at 70°C
Alkaline Stabilization 2	pH 12 and maintained for 72 hours with biosolids ≥ 52°C for 12 hours, followed by air drying to 50% TS
Time/temperature 3	Process meets detention time at temperature requirements by solids concentrations given in 503 regulations or has been given equivalency by USEPA (TPAD and batch thermophilic digestion for example)

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Available Markets

- Agricultural land application
- Landfilling
- Mine tailing reclamation
- Dedicated land disposal
- Alternative land application option (Class A) – landscaping products
- Feed as fertilizer (Class A with amendments)
- Waste-to-energy

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Class A Drivers

- Regulations (state/federal)
- National biosolids partnership – environmental management system participation
- Local community pressure

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Class A Facilities Arrangement

- Temperature phased anaerobic digestion
- Heat drying
- Cambi process

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Recommendations

- Centralize biosolids handling / treatment
- Continue with Class B / land apply
- Develop additional product outlets
- Develop long-term biosolids management plan
- Be ready to adapt to changes in disposal market

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Major Issues/Concerns

- Concerns about California spillover issues for land application
- Currently single land applicator controls majority of land around Pima County
- Can not produce Class A biosolids now if Class B became unacceptable to public

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Elements of Long-Term Biosolids Management Plan

- Analysis of current program
  - Establish baseline conditions
- Projected quantity and quality of biosolids
  - Effects of liquid treatment process changes
- Regulatory and social issues
  - Regulatory pressures
  - Public concerns
  - Increased urbanization
  - National trends

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Elements of Long-Term Biosolids Management Plan

- Development and evaluation of alternatives
  - Market assessment for biosolids
  - Technology identification and screening
  - Development of preliminary alternatives
  - Screening of preliminary alternatives using economic and non-economic criteria
  - Evaluation of shortlisted alternatives
  - Recommended long-term plan

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Elements of Long-Term Biosolids Management Plan

- Cost summary
- Implementation plan

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Land Application

- Current contractor does not foresee interest in Class A biosolids in area
  - Hauling of liquid is well contained so no mess or odors in populated areas
  - Current liquid (up to 10%) directly incorporated = low odors at sites
  - Hauling/incorporating cake = more odors
  - Class A more odorous in contractor's opinion

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Single Land Contractor Locally

- Current land application cost relatively low
- Other contractors have bid in the past
- Synagro and Solid Solutions are contractors working in the Phoenix area
- <u>County should have a backup plan</u>
  - Recommend ability to make cake that could be landfilled as backup
  - Explore future dedicated land application
  - Could install one thermophilic digester to see if product is more marketable and gain experience in operation

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Class A vs. Class B

- Opposition to land application does not appear limited to Class B
  - Converting to Class A may not help with this market
- Type of Class A process to use depends on available markets
  - Liquid (TPAD) best option if land applying
  - Drier product desired for mine reclamation, bagging/landscaping or energy generation

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Class A vs. Class B

- Class A processing is more expensive in capital cost and O&M cost
- Stable market for Class A unknown at this time
- Do not want to invest significant $ before knowing viable market – market analysis
  - Arrange site to have space for a future Class A process
  - Could be a fit for future DBO project

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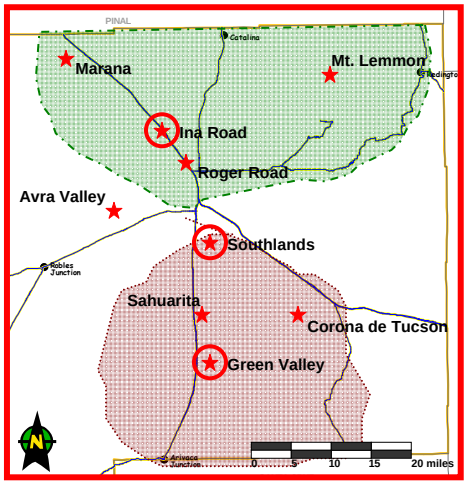
Regional Solids Processing



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Biogas Use

- 500 million cubic feet per year
- Options
  - Continue biogas for power generation / engine-driven equipment
  - Sell biogas to third party for commercial use
  - Purchase power from local utility and use biogas for heating and cooling functions

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Biogas Recommendation

- Operate power generation for electricity and heating load needs,

  or

- Sell biogas for green credits – purchase power (RFEI process)

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Chapter 6 – Conveyance System Evaluation

Jerry Bish

Chapter 6 – Conveyance System Evaluation

- Comprehensive system review
- Hydraulic capacity analysis
  - Existing
  - Future
- Wet weather capacity impacts
- Plant interconnect pipeline
- CIP capacity projects

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Regulatory Standards – CMOM

- Convey peak dry and wet weather flows
- Convey 10-year-24-hour rain event
- Upgrade deficient system elements within 10 years
- Prevent SSOs
- Capital Improvement Plan

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Regulatory Standards – Other

- Max Dry Weather d/D = 0.75
- Appropriate peaking factor
- Wet weather allowance based on:
  - Percentage of peak dry weather flow
  - Gallons per acre
- Minimum depth of cover = 3 feet
- V_d = 2 – 10 feet/second

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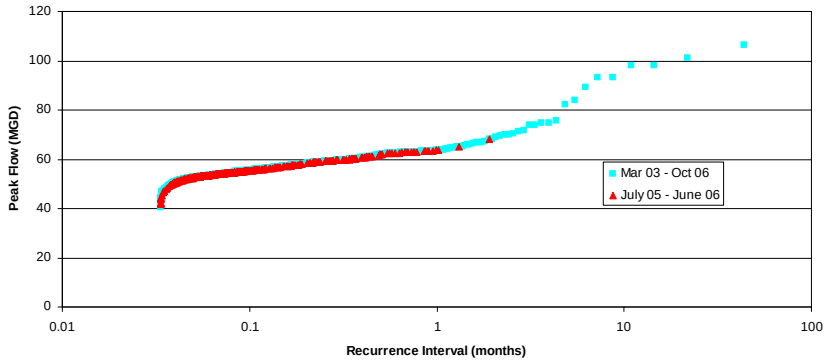
Roger Road Peak Flow Analysis

Results in 264 gpd/acre



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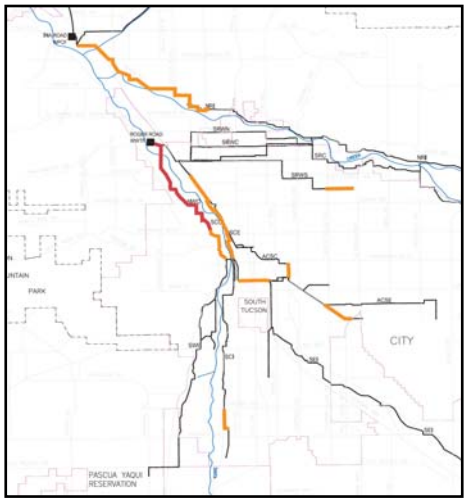
Existing Capacity Issues



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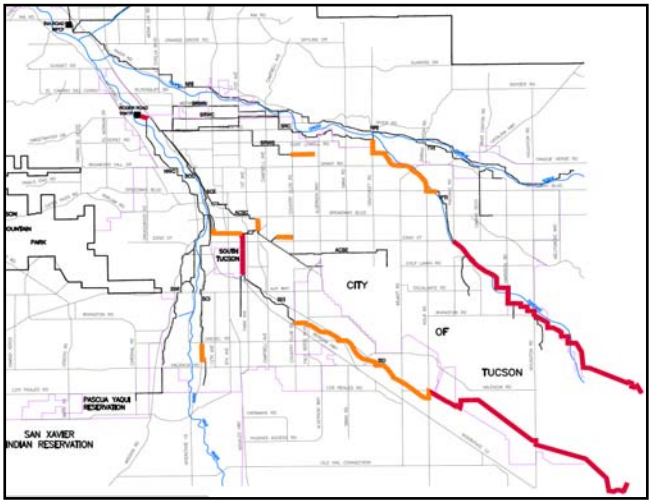
2030 Capacity Issues



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CIP Projects

Project	MH Start	MH End	Year	Item	Qty.	Units
1	4636-30A	4190-05A	2020	Replace 18" pipe with 21"	10,336	FT
				Project 1 Subtotal		
2	6036-21	3979-101	2015	Replace 18" pipe with 24"	1,183	FT
	3919-01	8031-01		Replace 18" pipe with 24"	5,486	FT
				Project 2 Subtotal	*6,669*	
3	8635-11	8635-10	2020	Replace 18" pipe with 21"	620	FT
				Project 3 Subtotal	*620*	
4	5627-08A	9907-49	2010	Replace 18" pipe with 21"	5,050	FT
				Project 4 Subtotal	*5,050*	
5	8130-01	1779-02	2015	Replace 30" pipe with 42"	1,153	FT
	9917-20	9910-21		Replace 33" pipe with 36"	5,402	FT
	5667-01	5662-01		Replace 30" pipe with 42"	3,875	FT
	1779-02	5667-01		Replace 30" pipe with 42"	1,415	FT
	9910-21	9910-19		Replace 36" pipe with 42"	550	FT
				Project 5 Subtotal	*12,395*	
6	8149-05	1726-29	2010	Replace 15" pipe with 21"	3,943	FT
	3983-05	8149-05		Replace 15" pipe with 24"	887	FT
	1726-29	1726-26		Replace 18" pipe with 24"	1,388	FT
	1726-26	1726-19		Replace 24" pipe with 30"	3,776	FT
				Project 6 Subtotal	*9,994*	
7	4630-09	4630-02	2015	Replace 21" pipe with 24"	3,013	FT
				Project 7 Subtotal	*9,994*	
8	1751-09	1751-01	2010	Replace 18" pipe with 24"	4,712	FT
				Project 8 Subtotal	*4,712*	
9	8626-01	6804-15A	2010	Replace 8" pipe with 15"	100	FT
				Project 9 Subtotal	*100*	
10	9521-02	9549-05	2020	Replace 15" pipe with 18"	1,006	FT
				Project 10 Subtotal	*1,006*	
11			2010	Fully Open Gate at Manhole 9910-21 Diversion		
	1708-22	6804-15A		36" Reverse Sewer	2,150	FT

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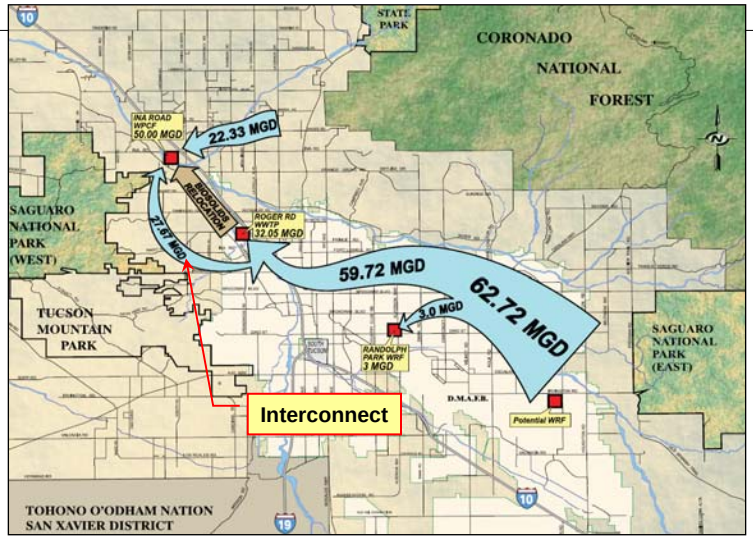
Plant Interconnect



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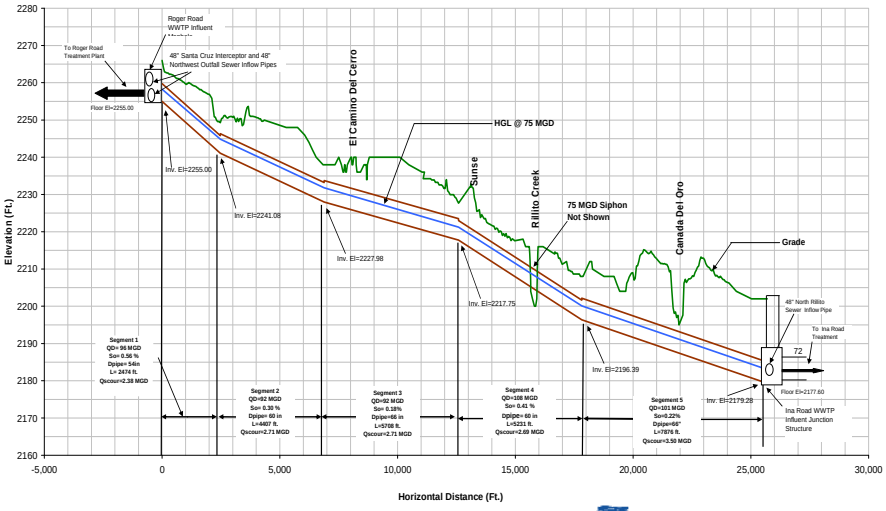
Plant Interconnect – Route 1



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Chapter 7 – Recommended Treatment Plant Plan

Joe Popeck

Recommended Treatment Plant Plan

- Land use and area development
- Location of future treatment expansions
- Expansion of treatment utilities and utility corridors
- Year 2030 master plan layout for selected alternative

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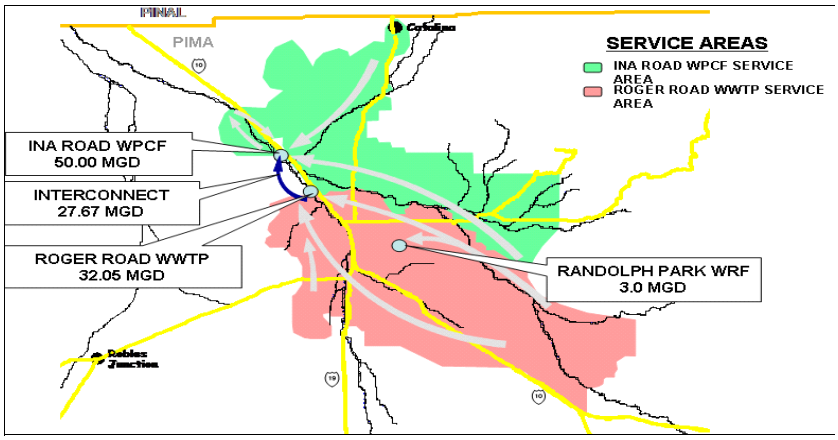
Recommended Treatment Plant Plan

Year 2030 Location of Major WWTPs Relative to the Metropolitan Tucson Service Area



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Land Use and Area Development

- Current Land Use
  - Current land use is limited to existing treatment facilities at both treatment plant locations, except sports complex with baseball diamonds at the southeast side of Ina Road WPCF facilities

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Land Use and Area Development

Future Area Development Site Plan for RRWWTP

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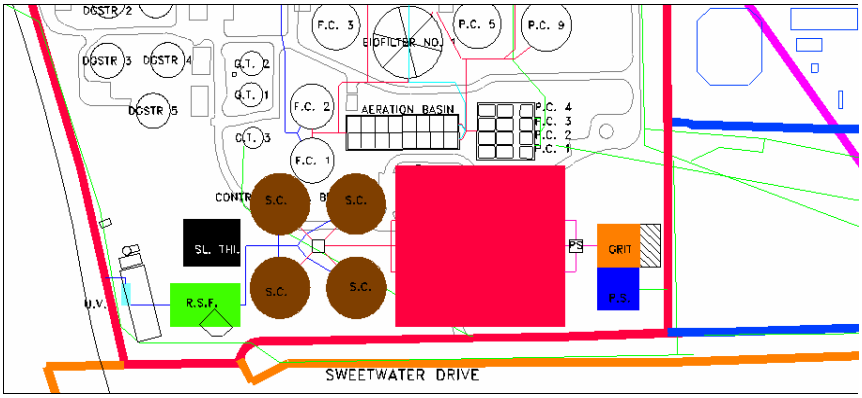
Location of Future Treatment RRWWTP

Roger Road – 32 MGD Facility



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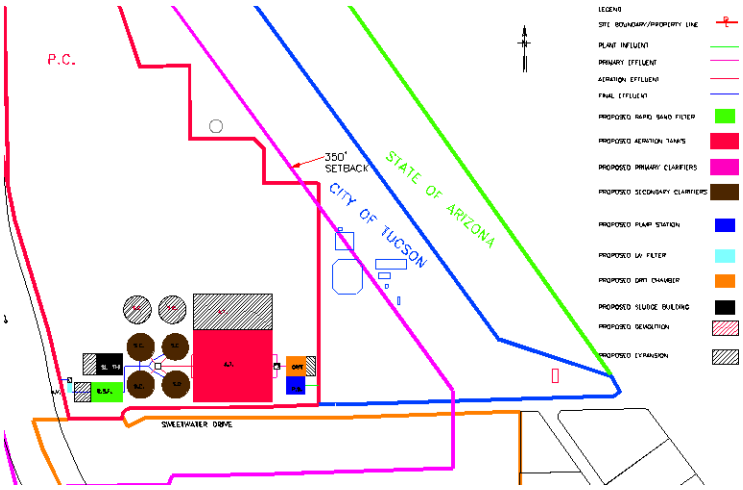
Roger Road WRF Future Expansion Beyond Year 2030



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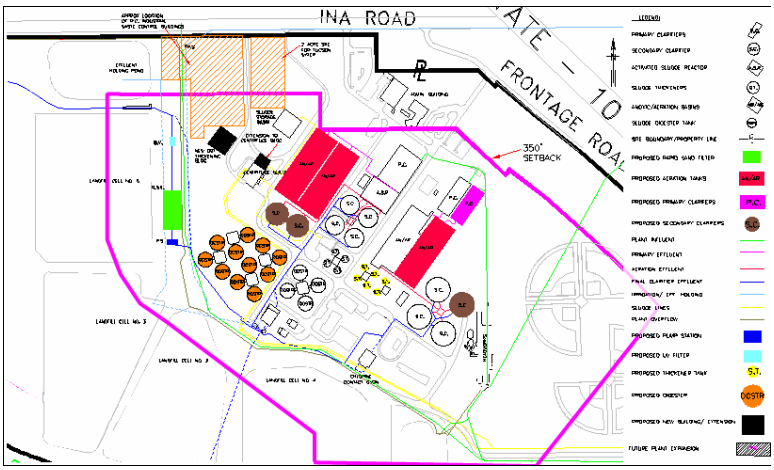
Location of Future Treatment IRWPCF

Ina Road WPCF 50 MGD Site Plan for Year 2030



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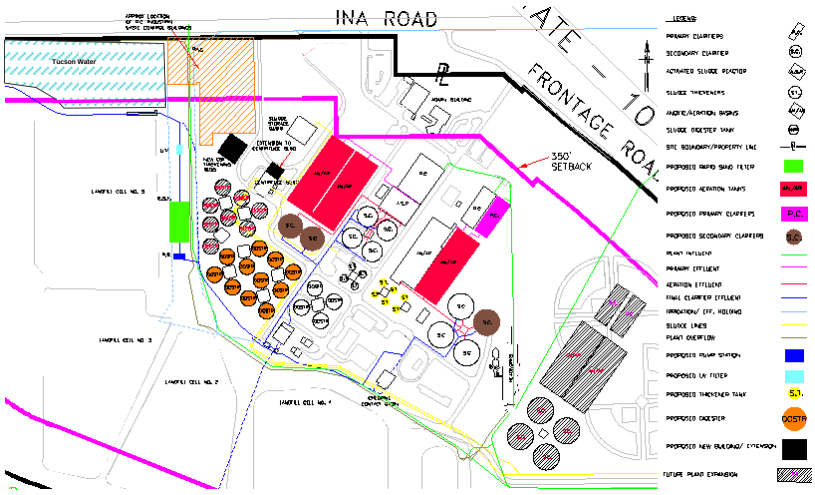
Ina Road WPCF 50-mgd Site Plan with Future Expansion Beyond Year 2030



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Water Reuse

- Reuse Water Supply
  - At RRWRF up to 30 mgd of plant effluent will be available to Tucson Water from new Plant
  - At IRWPCF up to 20 mgd of plant effluent will be made available to Tucson Water
    - New supply, (filtration), reservoir system, distribution disinfection system and distribution piping will be constructed by Tucson Water on a parcel of land at IRWPCF, provided by Pima County

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Architecture and Landscape

- Existing facilities consist of a wide variety of architectural styles and landscape types, reflecting independent decisions made at each plant expansion
- Through the year 2030 planning horizon, architectural and landscaping design will be guided by architectural and landscape themes to harmonize existing and new facilities consistent with new land use plan

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Support Facilities

- Odor Control
  - Year 2030 plan will provide a long-term solution for potential odors from both collection system and wastewater treatment plants. Odor control measures will include:
    - Minimize odor potential in collection system with pH adjustment, chemical addition and vapor treatment
    - Cover openings and channels
    - Collect and treat odorous air
    - Disperse treated air into atmosphere in a manner to minimize odor impact to surrounding communities

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Support Facilities

- Personnel Facilities
- Maintenance Facilities
- Laboratory Facilities
- Parking
- Support Facilities
- SCADA
- Chemical Handling
- Security
- Plant Stormwater Plan

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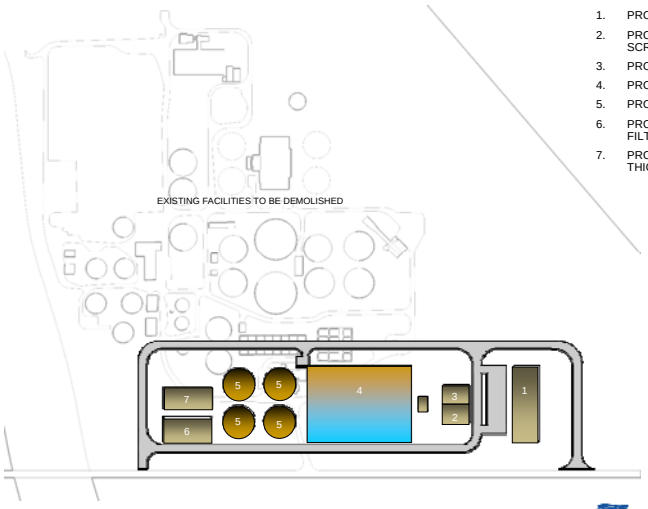
Roger Road WRF – Year 2030 Master Plan Layout



1. PROPOSED ADMINISTRATION FACILITY
2. PROPOSED HEADWORKS (INFLUENT PS, SCREENS)
3. PROPOSED GRIT REMOVAL FACILITY
4. PROPOSED BARDENPHO AERATION TANKS
5. PROPOSED FINAL CLARIFIERS
6. PROPOSED EFFLUENT FILTERS/DISINFECTION FACILITIES
7. PROPOSED SLUDGE THICKENING/TRANSFER FACILITY

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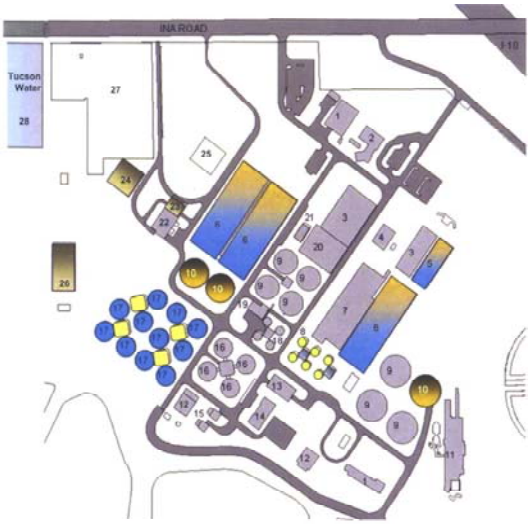
Ina Road WPCF – Year 2030 Master Plan Layout



1. WAREHOUSE
2. ADMINISTRATION BUILDING
3. EXISTING PRIMARY CLARIFIERS
4. NEW BLOWER BUILDING
5. NEW PRIMARY CLARIFIERS
6. NEW AERATION TANKS
7. EXISTING AERATION TANKS
8. NEW SLUDGE THICKENERS
9. EXISTING SECONDARY CLARIFIERS
10. NEW SECONDARY CLARIFIER
11. HEADWORKS
12. CHLORINE CONTACT BASIN
13. ENERGY RECOVERY BUILDING
14. TRAINING CENTER
15. CHLORINATION BUILDINGS
16. EXISTING DIGESTORS
17. NEW DIGESTORS
18. EXISTING SLUDGE THICKENERS
19. EXISTING VACUUM FILTRATION BUILDING
20. EXISTING ACTIVATED SLUDGE REACTOR
21. OXYGEN PRODUCTION
22. EXISTING CENTRIFUGE BUILDING
23. EXTENSION TO CENTRIFUGE BUILDING
24. NEW GBT THICKENING BUILDING
25. SLUDGE STORAGE BASIN
26. FILTER / DISINFECTION
27. PIMA COUNTY INDUSTRIAL WASTE
28. TUCSON WATER

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GREELEY AND HANSEN

Summary

- Recommended treatment plant plan for the year 2030 provides a new plant at Roger Road and expansion of existing plant at Ina Road WPCF
  - New multi-faceted recreational, commercial and ecological development adjacent to the RR WWTP
  - Provision for future expansion beyond the year 2030 at both treatment facilities
  - Existing infrastructure to be expanded, upgraded or demolished
  - Expansion of infrastructure to accommodate the increased flows to be handled at both plant locations
  - Provision for new and/or expansion of the utilities including power, potable water, reuse water and plant air supply.
  - Architecture and landscape amenable to provide public friendly image
  - Complete plant-wide odor control at each facility and the conveyance system

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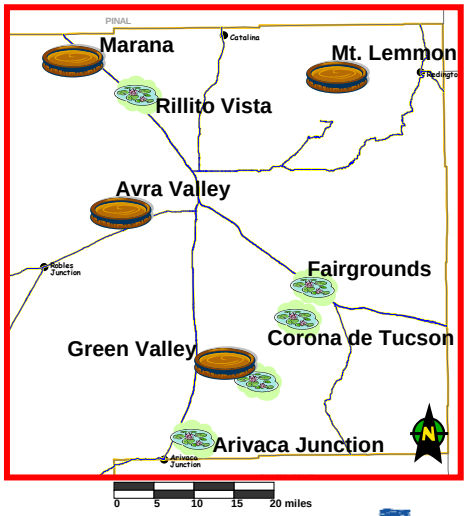
Chapter 8 – Outlying Facilities' Overview

Jerry Bish

Outlying Facilities



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GREELEY AND HANSEN

Reclaimed Water Permits

Facility	Permit
Arivaca Junction	Class C
Avra Valley	Class B+
Green Valley	Class A+ (BNROD) Class B (lagoon)
Marana	Class B+
Mt. Lemmon	Permit (AZPDES)

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GREELEY AND HANSEN

Summary of Outlying Facilities

Facility	Facility Parcel Area (acres)	Design Capacity (mgd)	Current Treatment Technology	Current Effluent Utilization
Arivaca Junction	10.5	0.1	Partially mixed, aerated lagoon	Percolation/evaporation. Class C delivered to Reventone Ranch.
Avra Valley	139*	1.2	BNROD	Plant irrigation (Class B+). Percolation/evaporation.
Corona de Tucson	200	0.3	Partially mixed aerated lagoons	Evaporation, SAT.
Green Valley	68	2.0 BNROD 2.1 lagoon	Primarily BNROD. Excess inflow sent to aerated lagoons.	Delivered to Quail Creek for irrigation (Class A+). Plant irrigation (Class B). Percolation.
Marana	156	0.2	Smith & Loveless BNR package plants. Interim Parkson Biolac.	Plant irrigation (Class B+). Possible riparian restoration.
Mt. Lemmon	1.7	0.015	Enclosed extended air package plant.	Spray field irrigation.
PC Fairgrounds	8.8	0.035	Stabilization ponds.	Percolation/evaporation.
Rillito Vista	-	0.02	Stabilization ponds.	Percolation/evaporation.

*Additional 140-acres of land adjacent to facility parcel.

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Flow Projections

Facility	2010	2015	2020	2025	2030
Avra Valley	1.4	1.8	2.2	2.6	3.0
Corona de Tucson	0.5	0.9	1.3	1.7	2.1
Green Valley	2.7	3.1	3.6	4.0	4.4
Marana	1.6	2.3	3.0	3.7	4.4
Mt. Lemmon	0.002	0.002	0.002	0.002	0.002
Southlands (excludes Corona)	1.2	3.6	6.0	8.2	10.5

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Current Water Reuse

Current Water Reuse		
Facility	**Permit**	**Use**
Arivaca Junction	Class C	Reventone Ranch (Agriculture)
Avra Valley	Class B+	Spray Field Disposal
Green Valley	Class A+	Robson/Quail Creek, Inc. (Turf Irrigation)
Marana	Class B+	Plant Turf Irrigation
Mt. Lemmon	AZPDES	Spray Field Disposal

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Current Biosolids Production

Current Biosolids Production		
Location	**Produced (tpd)**	**Processing, Disposal**
Arivaca Junction	0.09	Dry, scrape and haul to landfill
Avra Valley	2.2	Store and haul to conveyance system
Corona de Tucson	0.16	Dry, scrape and haul to landfill
Green Valley	5.7	GBTs, Aerobic Digesters, BFPs, Drying, Sent to Asarco Mines
Marana	0.28	Store and haul to conveyance system
Mt. Lemmon	0.018	Store and haul to conveyance system
PC Fairgrounds	0.004	Dry, scrape and haul to landfill
Rillito Vista	0.014	Dry, scrape and haul to landfill
Total	**8.47**	

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Future Biosolids Production

Future Biosolids Production		
Location	**Produced (tpd)**	**Processing, Disposal**
Arivaca Junction	-	-
Avra Valley	4.20	Thicken and haul to conveyance system
Corona de Tucson	2.94	Thicken and haul to conveyance system
Green Valley	6.16	GBTs, Aerobic Digesters, BFPs, dry and send to mine reclamation
Marana	6.16	Thicken and haul to Ina Road
Mt. Lemmon	0.003	Store and haul conveyance system
PC Fairgrounds	-	-
Rillito Vista	-	-
Southlands	14.70	Master plan is under development
Total	**34.16**	

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Chapter 9 – Outlying Facilities' Strategic Management Plan

Jerry Bish

Influent Wastewater Characteristics

Characteristic	Outlying Facility Influent Concentrations (mg/L)
BOD_5	300
$SBOD_5$	125
COD	590
TSS	270
VSS	220
TKN	57
TP	10

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Probable Effluent Quality

Parameter	Effluent Quality
BODs	< 6 mg/L
TSS	< 10 mg/L
NH4-N	< 1 mg/L
TN	< 10 mg/L
TP	< 1 mg/L
Pathogen removal	No detect in 4 of 7 samples/week. None exceeding 23cfu/100ml
pH	6.8 – 7.2

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Weighted System Evaluation Matrix

Criteria	WF	Rank					Weighted Rank				
		Bardenpho	BNROD	MBBR	SBR	MBR	Bardenpho	BNROD	MBBR	SBR	MBR
Cost	5	4	4	3	5	2	20	20	15	25	10
Environmental Impact	4	4	4	3	3	3	16	16	12	12	12
Feasibility	3	3	5	4	3	3	9	15	12	9	9
Operational Capability	4	4	4	3	2	4	16	16	12	8	16
Land Required	2	4	3	4	4	5	8	6	8	8	10
Maintenance	4	5	5	3	3	2	20	20	12	12	8
Public Acceptability	5	3	3	3	5	5	15	15	15	25	25
Reliability	4	3	4	3	3	2	12	16	12	12	8
Sludge Production	1	3	5	3	3	3	3	5	3	3	3
Water Reuse Potential	4	4	4	4	4	4	16	16	16	16	16
Odor Control	5	4	3	4	3	4	20	15	20	15	20
Sum of Weighted Ranks							**155**	**160**	**137**	**145**	**137**

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Treatment Process Considerations

- Avra Valley
- Corona de Tucson
- Green Valley
- Marana
- Southlands

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Outlying Facility Expansion Completion Dates

Facility	Expansion 1	Expansion 2	Expansion 3	Expansion 4
Arivaca Junction	-	-	-	-
Avra Valley	2006 / 2007	2008 / 2009	-	-
Corona de Tucson	2006 / 2007	2018 / 2019	2027 / 2028	-
Southlands(1)	2009 / 2010(2)	2010 / 2011	2012 / 2013	2014 / 2015
Green Valley	2011 / 2012		-	-
Marana	2006 / 2007	2008 / 2009	2018 / 2019	2027 / 2028
Mt. Lemmon(3)	TBD	TBD	TBD	TBD
PC Fairgrounds	-	-	-	-
Rillito Vista	-	-	-	-

(1)Additional expansion in 2022/2023
(2)By others
(3)Long range planning study in progress

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Avra Valley WW Process

- Currently BNROD
- BNROD expansion underway
- Selecting different process introduces complexity
- Loss of investment
- Avra Valley = BNROD

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Corona de Tucson WW Process

- Closed loop reactor nearly finished
- Selecting different process introduces complexity
- Corona de Tucson = CLR

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Green Valley WW Process

- Currently BNROD
- Plan to construct additional BNROD
- Selecting different process introduces complexity
- Green Valley = BNROD

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Marana WW Process

- BNROD system design complete, ready for bid
- Selecting different process requires additional investment
- Marana = BNROD

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Southlands WW Process

- Does not exist
- 2030 capacity above 10 mgd (upper bounds of BNROD and SBR)
- Southlands = Bardenpho

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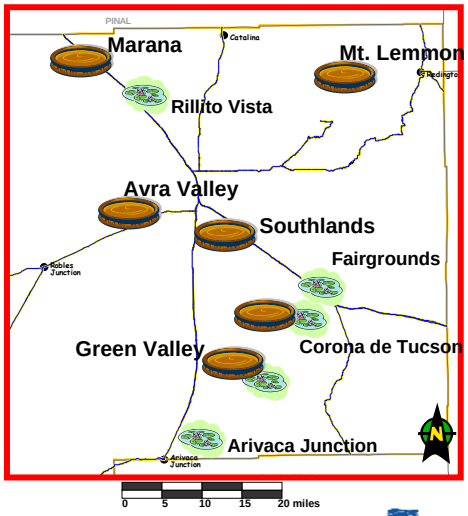
Future Outlying Facilities



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Chapter 10 – CIP Elements

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CIP Elements

- Plant interconnect
- Roger Road
- Ina Road
- Support Facilities
- Outlying Facilities Expansions

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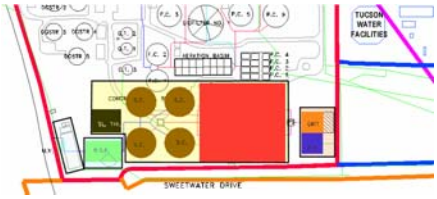
Roger Road WWTP

- Site preparation (temporary administration building)
- Headworks
- Bardenpho treatment (including clarifiers, solids thickening/pumping)
- Disinfection
- Administration/control building
- Standby power generation
- Future 8-mgd Bardenpho system (including clarifier)
- Future gravity belt thickeners
- Existing Roger Road Facility demolition



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Ina Road WPCF

- Site preparation
- Primary clarifier
- Bardenpho treatment (including clarifiers)
- Demolish HPO and oxygen system
- Mesophilic digestion (4 new, 4 existing)
- Gravity thickening (primary sludge)
- Gravity belt thickening (WAS sludge)
- Centrifuge dewatering
- Sludge storage
- Disinfection
- Centralized laboratory
- Power unification/biogas power generation
- Future mesophilic digester
- Future centrifuge thickener
- Future thermophilic digesters

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Outlying Facilities Expansion

- Southwest Region
  - Avra Valley WWTF
    - Expansion 1 (from 1.2 to 2.2 mgd)
    - Expansion 2 (from 2.2 to 4.0 mgd)
- Southeast Region
  - Corona de Tucson WWTF
    - Expansion 1 (from 0.3 to 1.3 mgd)
    - Expansion 2 (from 1.3 to 2.3 mgd)
    - Expansion 3 (from 2.3 to 3.3 mgd)
- Southland WWTF
  - Expansion 1 (from 0 to 2.0 mgd)
  - Expansion 2 (from 2.0 to 3.0 mgd)
  - Expansion 3 (from 3.0 to 4.0 mgd)
  - Expansion 4 (from 4.0 to 8.0 mgd)
  - Expansion 5 (from 8.0 to 12.0 mgd)

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Outlying Facilities Expansion

- South Region
  - Green Valley WWTF
    - Expansion 1 (from 4.1 MGD to 6.1 MGD)
- Northwest Region
  - Marana WWTF
    - Expansion 1 (from 0.5 to 1.5 MGD)
    - Expansion 2 (from 1.5 to 3.0 MGD)
    - Expansion 3 (from 3.0 to 4.5 MGD)
    - Expansion 4 (from 4.5 to 6.0 MGD)
- Mt. Lemmon WWTF
  - No change unless changes in area restrictions

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Chapter 11 – Alternative Project Delivery Methods

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Alternative Delivery Methods

- Design-Build
- Design-Build-Operate
- Construction-Manager-At-Risk
- Design-Bid-Build

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Procurement Method Selection Considerations

- Procurement process
- Design and construction
- Operation and maintenance

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Chapter 12 – Financing Methods / Plan

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CIP Components

- Capital Projects
  (ROMP projects and costs)
- Other Capital Projects
  (Include 15-year CIP information)
- Total Capital Plan
  (Include 15 year CIP information)

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Financing Options

- Baseline Financing Plan
  - Revenue Bonds
  - Current revenue/reserve funds

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Recommendations

- Use alternative charges to increase revenue
- Optimize current rates/charges
- Issue bonds – terms consistent with life of assets
- Investigate use of WIFA funds
- Use short term instruments…
- Explore private financing (RFEI process)

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Chapter 13 – Implementation Plan

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Implementation Details

- Scheduled implementation
- Project delivery
- List of CIP projects
  - Treatment Facilities
  - Conveyance
- Funding source
- Rate impacts

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Implementation Schedule

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Interconnect	**$22,300,000**															
Design																
			$1,338,000													
Construct																
				$20,962,000												
Ina Rd	**$243,900,000**															
Design 50 mgd																
			$14,634,000													
Construct 50 mgd																
						$212,193,000										
Construct Thermophilic Digestion																
															$17,073,000	
Roger Rd	**$234,800,000**															
Design 32 mgd																
				$12,660,000												
Construct 24 mgd																
							$148,755,000									
Demo Existing Plant																
										$23,800,000						
Construct 8 mgd																
												$49,585,000				

Total ROMP Projects Cost $501,000,000

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Project Delivery

- Benefits / Challenges
  - Design - Bid - Build
  - Construction Manager at Risk
  - Design / Build
  - Design / Bid / Operate

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Roger Road Projects

Phase	Scope	Start	Complete	Project Delivery
1	Engineering – 24-mgd + 8-mgd Facilities	2007/08	2010	Professional
2	Construct – 24-mgd Facility	2011	2015	CMAR or D/B/O
3	Engineering – Demolition Existing Facilities	2014	2015	Professional
4	Demolition – Existing Facilities	2015	2017	CMAR or D-B-B
5	Construct – 8-mgd Facility	2017	2020	CMAR or D-B-B

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Ina Road Projects

Phase	Scope	Start	Complete	Project Delivery
1	Engineering – 50-mgd + Biosolids + Future Biosolids (Class B)	2007/08	2010	Professional
2	Construct – 50-mgd Facility	2010	2014	CMAR or D-B-B
3	Construct – Biosolids Facilities	2010	2014	CMAR or D-B-B
4	Eng/Arch – Central Laboratory	2007/08	2010	Professional
5	Construct Central Laboratory	2010	2012	CMAR or D-B-B
6	Construct Biosolids Facilities	2017	2020	CMAR or D-B-B
7	Engineering – Class A Biosolids	2018/19	2020	Professional
8	Construct Class A Biosolids	After 2020	After 2020	D/B/O or D/B or CMAR

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Electrical Service Modifications

Phase	Scope	Start	Complete	Project Delivery
1	Engineering – Roger Road WRF Standby Power	2010	2012	Professional
2	Construct – Power Services for New Facility	2013	2015	CMAR or D-B-B
3	Engineering – Ina Road Electrical Modification	2007/08	2010	Professional
4	Construct – Power Unification Facilities	2010	2012	CMAR or D-B-B
5	Construct – Biogas Power Generation Facilities	2012	2014	CMAR or D-B-B

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Plant Interconnect Pipeline

- Immediate need
- Engineering procurement underway
- Project delivery – CMAR
- Construction Complete no later than 2010

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Sewer Augmentation Projects

Project No.	Description (Manhole to Manhole)	Project Cost (in 2006 $)
Year 2010		
4	5627-08A to 9907-49	$2.76 million
6	8149-05 to 1726-29	$2.30 million
	3983-05 to 8149-05	$0.48 million
	1726-29 to 1726-26	$0.87 million
	1726-26 to 1726-19	$2.35 million
8	1751-09 to 1751-01	$2.57 million
9	8626-01 to 6804-15A	$0.04 million
Year 2015		
2	6036-21 to 3979-101	$0.74 million
	3919-101 to 8031-01	$1.32 million
5	8130-01 to 1779-02	$0.45 million
	9917-20 to 9910-21	$3.95 million
	5667-01 to 5662-01	$3.31 million
	1779-02 to 5667-01	$1.21 million
	9910-21 to 9910-19	$0.40 million
7	4630-09 to 4630-02	$0.73 million
Year 2020		
1	4636-30A to 4190-05A	$4.35 million
3	8635-11 to 8635-10	$0.31 million
10	9521-02 to 9549-05	$0.46 million
11	1708-22 to 6804-15A	$1.57 million

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Sewer Augmentation Summary

- CIP Costs in 5-year increments
  - 2010 $12.94 million
  - 2015 $12.11 million
  - 2020 $ 5.12 million

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Outlying Facilities Projects

- Southwest Region
  - Avra Valley WWTF
    - 2006/2007 Expansion 1 (from 1.2 to 2.2 mgd)
    - 2008/2009 Expansion 2 (Phase out existing BNROD and start up two new BNROD trains providing a total treatment capacity of 4.0 mgd)
- Southeast Region
  - Corona de Tucson WWTF
    - 2006/2007 Expansion 1 (from 0.3 to 1.3 mgd)
    - 2018/2019 Expansion 2 (from 1.3 to 2.3 mgd)
    - 2027/2028 Expansion 3 (from 2.3 to 3.3 mgd)
- Southland WWTF
  - 2009/2010 Expansion 1 (from 0.0 mgd to 2.0 mgd)
  - 2010/2011 Expansion 2 (from 2.0 mgd to 3.0 mgd)
  - 2012/2013 Expansion 3 (from 3.0 mgd to 4.0 mgd)
  - 2014/2015 Expansion 4 (from 4.0 mgd to 8.0 mgd)
  - 2022/2023 Expansion 5 (from 8.0 mgd to 12.0 mgd)

Outlying Facilities Projects, cont.

- South Region
  - Green Valley WWTF
    - 2011/2012 Expansion 1 (from 4.1 mgd to 6.1 mgd)
- Northwest Region
  - Marana WWTF
    - 2006/2007 Expansion 1 (from 0.5 to 1.5 mgd)
    - 2008/2009 Expansion 2 (from 1.5 to 3 mgd)
    - 2018/2019 Expansion 3 (from 3 to 4.5 mgd)
    - 2027/2028 Expansion 4 (from 4.5 to 6 mgd)
- Mt. Lemmon WWTF
  - No Change unless Changes in Area Restrictions

Financing Plan

1997 Bonds		**$**	**3,921,000**
	Other CIP	*$*	*3,921,000*
2004 Bonds		**$**	**147,505,613**
	ROMP Projects	*$*	*39,027,113*
	Other CIP	*$*	*108,478,500*
SDF's		**$**	**190,264,092**
	Other CIP	*$*	*190,264,092*
2008 Bonds		**$**	**564,812,417**
	ROMP Projects	*$*	*445,000,000*
	Other CIP	*$*	*119,812,417*
2012 Bonds		**$**	**373,765,658**
	ROMP Projects	*$*	*219,765,658*
	Other CIP	*$*	*154,000,000*
2016 Bonds		**$**	**130,644,408**
	ROMP Projects	*$*	*15,709,773*
	Other CIP	*$*	*114,934,635*
Total ROMP Projects		$	719,502,544
Total Other CIP Projects		$	691,410,644
Total Capital Plan		**$**	**1,410,913,188**

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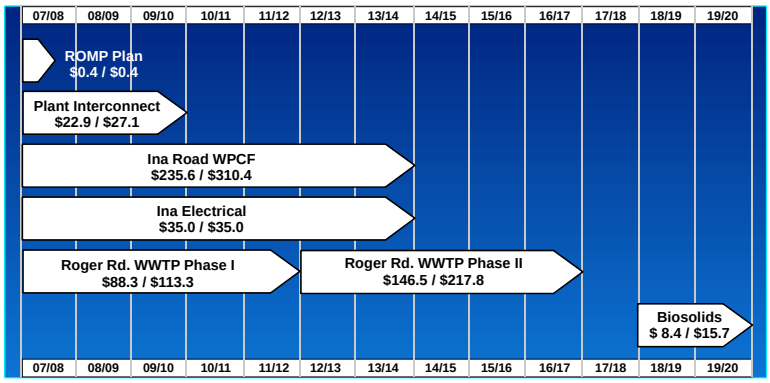
Long-Range CIP – ROMP

Dollar figures are in millions

2006 dollars / dollars based on 5% per year inflation



$501 (2006 dollars) / $684 (5% per year inflation)

Total Excluding Ina Electrical

$536.7 (2006 dollars) / $719.3 (5%/year inflation)

Total Including Ina Electrical

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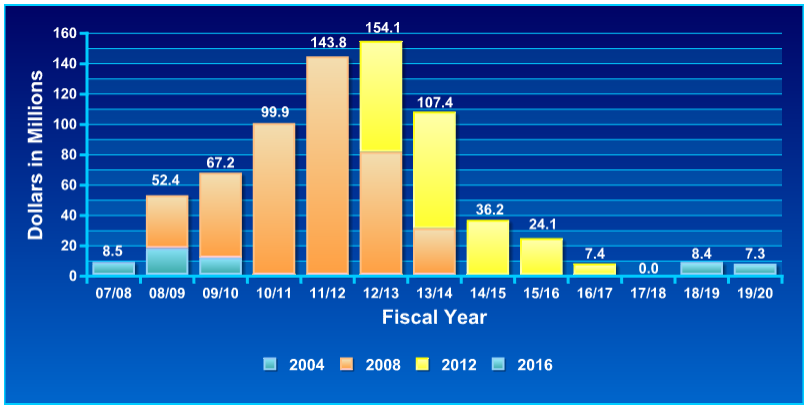
Long-Range CIP – ROMP



Projected Revenue Requirements

	2007	2008	2009	2010	2011	2012	2013	2014
Revenue Requirements ($ Mil.)								
Operating & Maintenance (1)	$ 75.4	$ 77.4	$ 80.1	$ 82.9	$ 85.8	$ 88.8	$ 92.0	$ 96.3
Capital								
Debt Service	$ 15.5	$ 24.6	$ 24.6	$ 38.1	$ 38.1	$ 63.7	$ 63.2	$ 92.7
SDF Funding	$ 18.4	$ 30.7	$ 46.5	$ 8.4	$ 14.1	$ 6.4	$ 3.2	$ 2.1
Add'l Revenue for Coverage (2)	$ -	$ -	$ -	$ 22.9	$ 23.5	$ 12.2	$ 24.9	$ 13.1
Total Revenue Requirements	**$ 109.3**	**$ 132.6**	**$ 151.2**	**$ 152.4**	**$ 161.5**	**$ 171.2**	**$ 183.2**	**$ 204.2**
% Change		*21.4%*	*14.0%*	*0.8%*	*6.0%*	*6.0%*	*7.0%*	*11.5%*

	2015	2016	2017	2018	2019	2020	2021	2022
Revenue Requirements ($ Mil.)								
Operating & Maintenance (1)	$ 101.6	$ 105.4	$ 109.4	$ 113.5	$ 117.8	$ 122.2	$ 126.8	$ 131.6
Capital								
Debt Service	$ 93.4	$ 105.3	$ 97.1	$ 97.6	$ 97.6	$ 101.9	$ 101.9	$ 104.0
SDF Funding	$ 1.1	$ 1.1	$ 5.8	$ 25.8	$ 24.4	$ 1.1	$ 1.1	$ -
Add'l Revenue for Coverage (2)	$ 14.3	$ 15.3	$ 14.9	$ -	$ 0.0	$ 14.6	$ 14.8	$ 14.5
Total Revenue Requirements	$ 210.4	$ 227.2	$ 227.2	$ 236.9	$ 239.8	$ 239.8	$ 244.6	$ 250.1
% Change	*3.0%*	*8.0%*	*0.0%*	*4.3%*	*1.2%*	*0.0%*	*2.0%*	*2.2%*

(1) Includes departmental capital outlays that are backed out for debt service coverage purposes.
(2) Revenue requirement forecast assumes that the County will maintain total debt service coverage of at least 120%.

Impact On Bill

	2007	2008	2009	2010	2011	2012	2013	2014
Typical Customer Bill (1)	$ 18.22	$ 21.41	$ 25.15	$ 26.16	$ 27.21	$ 28.30	$ 29.71	$ 32.53
% Change		*17.5%*	*17.5%*	*4.0%*	*4.0%*	*4.0%*	*5.0%*	*9.5%*
Connection Fee (2)	$ 4,724	$ 5,952	$ 7,643	$ 8,140	$ 8,653	$ 9,172	$ 9,814	$ 10,844
% Change		*26.0%*	*28.4%*	*6.5%*	*6.3%*	*6.0%*	*7.0%*	*10.5%*

	2015	2016	2017	2018	2019	2020	2021	2022
Typical Customer Bill (1)	$ 32.86	$ 34.83	$ 34.83	$ 35.61	$ 35.61	$ 35.61	$ 35.61	$ 35.70
% Change	*1.0%*	*6.0%*	*0.0%*	*2.3%*	*0.0%*	*0.0%*	*0.0%*	*0.2%*
Connection Fee (2)	$ 11,061	$ 11,835	$ 11,835	$ 12,220	$ 12,250	$ 12,250	$ 12,373	$ 12,528
% Change	2.0%	*7.0%*	*0.0%*	*3.3%*	*0.2%*	*0.0%*	*1.0%*	*1.3%*

(1) Represents the monthly sewer bill for a 10ccf customer.
(2) Non-participating connection fees.

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Appendices

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Listing of Appendices

- A. Workshop Summaries
- B. Condition Assessment Data
- C. ADEQ Letters
- D. Conveyance Evaluation Data
- E. Interview Summary
- F. Enhanced Chlorination
- G. Request for Expression of Interest
- H. Reclaimed Water System Alternatives

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Other Topics

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Enhanced Chlorination Investigation/Study

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UV Disinfection vs. Enhanced Chlorination – Systems

- UV Requirements
  - Lift pump station
  - Filtration
  - High Intensity UV
- Enhanced Chlorination
  - Contact tank (longer retention)
  - Higher sodium hypochlorite dosages
  - Higher sodium bisulfite dosages

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UV Disinfection vs. Enhanced Chlorination – Cost Impacts

- UV Costs $91.0 million
  - Construction/Contingency/ Engineering
- Enhanced Chlorination $17.6 million
  - Construction/Contingency/ Engineering

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Enhanced Chlorination Study/Investigation

- Identify/list critical success factors
- Research
  - Literature review
  - Conduct a facility survey
  - BADCT standards evaluation
  - On-site investigations/performance

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Florida High-Level Disinfection Requirements

- Minimum design for the chlorine contact tank *(TSS < 5 mg/L)*

Influent to Chlorine Contact Tank (FC/100 ml)	Minimum CT, mg/L* minutes
1,000	At least 25
>1,000 – 10,000	At least 40
>10,000	At least 120

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Chlorination Issues

- California Std - 5 log removal of enteric virus = "essentially pathogen free"
- Contact time and dosage (CA CT= 450)
- Type of chlorine (free or combined)
- Impact on WET, THMs, CN, NDMA …

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Request for Expression of Interest

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RFEI - Status/Schedule

- RFEI posted April 23, 2007
- Pre-submittal meeting May 23, 2007
- Submittals June 22, 2007
- After receipt of submittals
  - Submittal Reviews
  - Assess ROMP report impacts

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RFEI - Objectives

- Engage the Marketplace
  - Solicit and receive private sector comment to inform public policy decisions
  - Gather perspectives from interested parties' on project delivery, private financing and related matters

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RFEI – Types of Projects

- Proposed Projects
  - New Roger Road WRF
  - Ina Road WPCF Expansion/Upgrade
  - Biogas/Power Facilities
  - Biosolids Disposal Services
  - Outlying Treatment Facilities

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RFEI – Procurement Approaches

- Alternative Project Delivery Methods
  - Design - Bid - Build
  - Construction-Manager-at-Risk
  - Design-Build and Related Project Delivery Methods
  - Design-Build-Operate

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RFEI Content

- Private Project Financing

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Summary

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