

ANNEX F

SUPPLEMENTAL MAJOR REHABILITATION
EVALUATION REPORT
COST ESTIMATES

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9 February 2005

Herbert Hoover Dike Reach 1 Major Rehabilitation Evaluation Report
Revised Costs and Explanations Summary

Purpose:

This Revised Costs and Explanations Summary is intended to identify Herbert Hoover Dike Reach 1 Major Rehabilitation Evaluation Report (MRR) project costs as identified and estimated from the November 2000 report, and compare these costs to three specific progressions in the project's development through the present. The initial plan and compared project development and design progressions are identified as:

- Base Cost MRR Recommended Plan (In 1999 Dollars), Issued November 2000
- 1st Revision MRR Recommended Plan (In 1999 Dollars and revised Escalation with Civil Works Construction Cost Index System), Updated December 2004
- 2nd Revision MRR Recommended Plan (In 1999 Dollars with Revised Quantities and Escalation with Civil Works Construction Cost Index System), Issued with Value Engineering study recommendations and subsequent DDR, July 2002
- Current Design Revision (In 2005 Dollars and Based on Reach 1, Subreach A Unit Costs Applied for 22.35 Miles in 2005 Dollars and Escalation with Civil Works Construction Cost Index System), Issued October 2004

To compare different estimated costs over several years of development, estimated costs for the 1st and 2nd Revised Plans were further updated to 1st Quarter 2005 Dollars. The 1999 costs are updated by various interest rates or indices for escalation, inflation, or discount rates for equal comparison in 2005 dollars.

Comparing Developing Estimates:

The following descriptions represent developing progressions in the design and the respective estimate revisions. The Current Design Revision represents the Reach 1, Subreach A, final design dated October 2004. As these costs are in 1st Quarter 2005 dollars, the updating to 1st Quarter 2005 dollar levels for 1st and 2nd Revisions are also provided:

1. The November 2000 MRR recommended plan project costs are estimated in 1999 Dollars. The construction features cost was initially escalated applying 3% per annum for a three-year period. The costs for all project features are listed in Table 1 as Base Cost MRR Recommended Plan. All costs are in 2nd Quarter 1999 dollars.

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2. The first revised project estimate includes application of escalation for construction features indexed in accordance with ER 1110-2-1304 using the Civil Works Construction Cost Index System. Only construction features are revised by CWCCIS. The revision was made to support this summary comparison. The costs for all project features are listed in Table 1 as 1st Revision MRR Recommended Plan. All costs are in 2nd Quarter 1999 dollars.
3. The 1st Revision MRR Recommended Plan construction features are escalated to 2005, real estate is updated by 7% annually, and O&M is adjusted using 3.5%, for the 5 ½-year window. The costs for all project features are listed in Table 1 as 1st Revision MRR Recommended Plan (In 2005 Dollars with CWCCIS). All costs are in 1st Quarter 2005 dollars.
4. The 2nd Revision MRR Recommended Plan cost estimate revision reflects a correction in quantities from the November 2000 report. An error in materials quantities was discovered during the 2002 Value Engineering study. Quantities were corrected for the recommended plan for filter stone and filter sand and random fill, and were applied for the entire 22.35-mile Reach 1. Estimated costs for construction features and escalation increased by approximately \$20 million. The costs for all project features are listed in Table 1 as 2nd Revision MRR Recommended Plan. All costs are in 2nd Quarter 1999 dollars.
5. The 2nd Revision MRR Recommended Plan construction features are escalated to 2005 using the Civil Works Construction Cost Index System, real estate is updated by 7% annually, and O&M is adjusted using 3.5%, for the 5 ½-year period. The costs for all project features are listed in Table 1 as 2nd Revision MRR Recommended Plan (In 2005 Dollars with CWCCIS). All costs are in 1st Quarter 2005 dollars.
6. The Current Design Revision cost estimate reflects the current Reach 1, Subreach A design featuring a partial cut-off wall and inverted filter with relief trench that was developed following a Value Engineering study conducted in 2002. The VE recommendations replaced the culvert pipe system with the inverted filter with relief trench. Subsequent analysis determined the inverted filter with relief trench required the addition of a partial cut-off wall to control seepage. The current Reach 1, Subreach A design is reflected in the Final design submitted in October 2004. The October 2004, Reach 1, Subreach A, final design and estimated cost is applied to the entire 22.35 –mile length for estimated total cost for Reach 1. The costs for all project features are listed in Table 1 as Current Design Revision (Based on Subreach 1A applied for 22.35 Miles in 2005 Dollars w/ CWCCIS). All costs are in 1st Quarter 2005 dollars.

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The Total Present Worth Cost was developed for the respective MRR plan and revisions. Also, an Equivalent Uniform Annual Costs is provided for both the 50-year and 100-year service life. This conversion effectively identifies total project cost distributed over the project's service life in an annual amount for the initial MRR Recommended Plan and all revised plans.

See Table 1 for a comparative summary of costs of Herbert Hoover Dike Reach 1. Net differences (in million dollars or percentage) are provided outside the Table margin for the 2nd Revision MRR Recommended Plan (In 2005 Dollars with CWCCIS) and the Current Design Revision plan (In 2005 Dollars with CWCCIS applied from Subreach A through Subreach D).

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Table 1

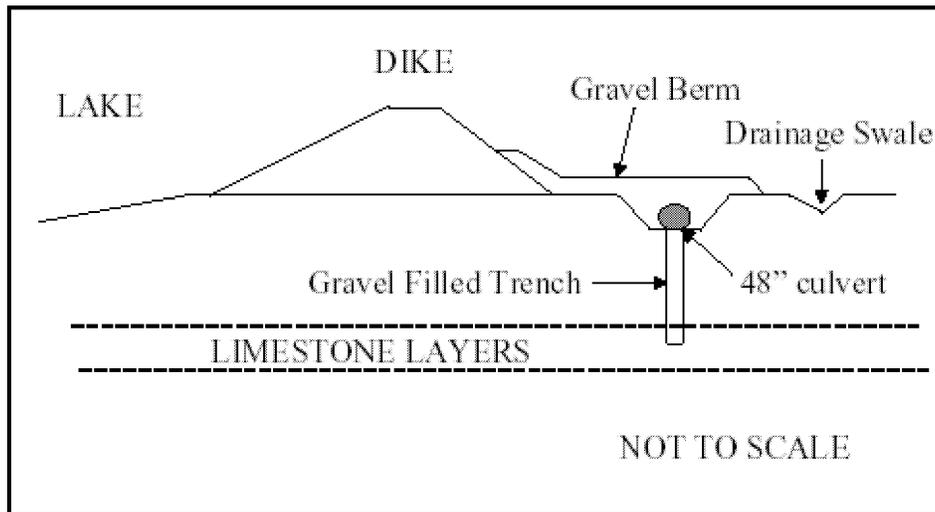
Herbert Hoover Dike Reach 1 Major Rehabilitation Comparative Cost Summary - Reach 1, Subreaches A Through D						
Cost Item	Base Costs MRR Recommended Plan (In 1999 Dollars w/ 3% Escalation for 3 Years)	1st Revision MRR Recommended Plan (In 1999 Dollars w/ CWCCIS)	1st Revision MRR Recommended Plan (In 2005 Dollars w/ CWCCIS)	2nd Revision MRR Recommended Plan (Revised Quantities in 1999 Dollars w/ CWCCIS)	2nd Revision MRR Recommended Plan (Revised Quantities in 2005 Dollars w/ CWCCIS)	Current Design Revision (Based on Subreach 1A applied for 22.35 Miles in 2005 Dollars w/ CWCCIS)
Total Investment (Construction, E&D and SIOH)	\$67,604,980	\$67,604,980	\$67,604,980	\$85,377,838	\$119,148,936	\$33.8
Escalation for Construction Features ¹	\$6,215,846	\$8,044,993	\$10,343,562	\$10,159,963	\$7,925,000	-\$5.1
Real Estate ²	\$6,200,625	\$6,200,625	\$9,001,075	\$6,200,625	\$9,001,075	-\$8.9
Subtotal	\$80,021,451	\$81,850,598	\$86,949,617	\$101,738,426	\$127,206,436	\$19.8
Operations & Maintenance ^{3 & 7}	\$50,547,431	\$50,547,431	\$61,085,559	\$50,547,431	\$59,742,592	-\$1.3
Total Present Worth Value for 50-Years	\$130,568,882	\$132,398,029	\$148,035,177	\$152,285,857	\$186,949,028	\$18.4
Total Annualized Value for 50-Years ⁴	\$7,571,689	\$7,677,762	\$8,584,560	\$8,831,057	\$9,772,897	10.9%
Total Present Worth Value for 100-Years ⁵	\$135,360,092	\$137,189,239	\$153,596,660	\$157,077,067	\$191,315,850	\$17.2
Total Annualized Value for 100-Years ⁶	\$7,314,859	\$7,413,706	\$8,300,364	\$8,488,445	\$9,407,757	9.9%
Notes: 1	3-Year Construction Period 3% for 3 Years (1.092)	Civil Works Construction Cost Index System (CWCCIS 1.119)	3-Year Construction Period Civil Works Construction Cost Index System (CWCCIS 1.153) 5.5-Years @ 7% Annual (1.45164)	3-Year Construction Period Civil Works Construction Cost Index System (CWCCIS 1.119)	3-Year Construction Period Civil Works Construction Cost Index System (CWCCIS 1.153) 5.5-Years @ 7% Annual (1.45164)	5.4-Year Construction Period Civil Works Construction Cost Index System (CWCCIS 1.067)
2	N/A	N/A	5.5-Years @ 3.5% Annual (1.20848)	N/A	5.5-Years @ 3.5% Annual (1.20848)	N/A
3	N/A	N/A	50-Year Service @ 5 3/8% Annual (0.05799)	50-Year Service @ 5 3/8% Annual (0.05799)	50-Year Service @ 5 3/8% Annual (0.05799)	5.5-Years @ 3.5% Annual (1.20848)
4	50-Year Service @ 5 3/8% Annual (0.05799)	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	50-Year Service @ 5 3/8% Annual (0.05799)
5	100-Year Service @ 5 3/8% Annual (0.05404)	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	Per ER 1110-2-8159: 100-Year Service and \$15,000,000 X (0.0731) Pipe Replacement at Year 50 and O&M for 100-Years	100-Year Service @ 5 3/8% Annual (0.05799)
6	N/A	N/A	N/A	N/A	N/A	100-Year Service @ 5 3/8% Annual (0.05404) O&M Discount for Pipe Line Inspection Services/SOW/ Procurement (50 - \$1,084,302 & 100 - \$1,163,557). Stop log Operations not Required (50-Yr -\$258,665) & 100-Yr (-\$277,572).
7	N/A	N/A	N/A	N/A	N/A	

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Chronology of the Herbert Hoover Dike Design:

Herbert Hoover Dike Major Rehabilitation Report (MRR) approved in 2000 contained a selected plan utilizing a covered pipe in the toe ditch with a seepage trench beneath the pipe for collection of water, as well as serving as a piping barrier (Alternative B from MRR). This plan addresses stability, seepage, and piping issues associated with Herbert Hoover Dike rehabilitation. In the alternatives for the MRR, a cutoff wall (Alternative C), and toe ditch weirs (Alternative A) were also considered and eliminated. Figure 1 below is a typical section of the selected plan found in the MRR. The solution from the MRR also requires the addition of a new drainage swale for conveyance of storm and irrigation water. This plan requires significant real estate acquisitions for implementation. A total construction period of 3-years was assumed.

Figure 1

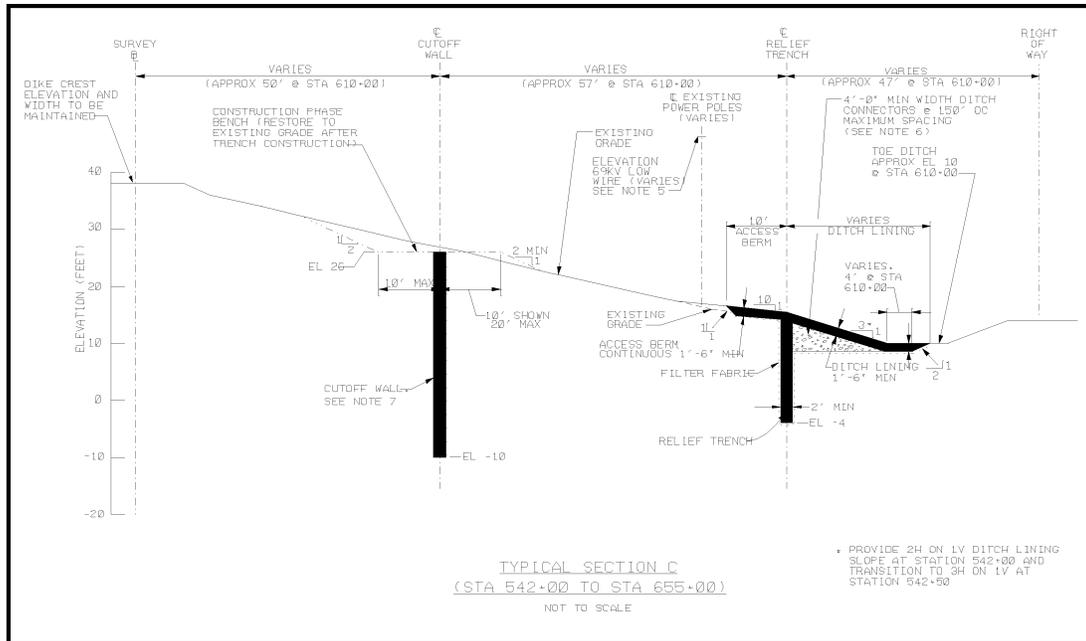


A VE study was initiated for the project in 2001 and completed in 2002. The VE study looked at alternatives to the MRR solution that may eliminate some of the costly real estate requirements and improve construction systems. The final selected plan utilized a gravel filter/seepage trench similar to the MRR, but relocated the trench lakeward to the toe berm of the dike. The VE study also utilized the existing drainage toe ditch for conveyance of water, but with no tailwater management. This solution satisfies the stability and piping problems, but does not address the additional water added to the toe ditch due to the seepage trench conveying ground water to the surface. The VE study also utilized a cutoff wall along two sections of Reach 1. During the DDR phase, the additional toe water issue was brought to light when a test section near South Bay (utilizing the VE design) proved additional water was being introduced onto private property. Discussions about additional water, no tailwater management, and real estate requirements led to modification the DDR contract to look at a combination of two alternatives from the MRR and VE study. The two features are a partial cutoff wall and seepage trench that would solve stability and piping problems, without increasing seepage rates (i.e., not effect the regional groundwater system).

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The final plan outlined by URS in the DDR utilized both the partial cutoff wall (elevation +26 to -10 ft-NGVD) and seepage trench (toe berm elevation down to -10 ft-NGVD) both located on the outside of the dike. See Figure 2 below for a typical section of the current final design for Reach 1, Subreach A.

Figure 2



The Plans and Specifications (for Reach 1, Subreach A) are currently developed in final design stage, and for this exercise the final design estimated cost for Reach 1, Subreach A, are applied for Subreaches B through D for a total estimated Reach 1 project cost. Table 2 provides the distributed estimated construction cost for each Subreach with CWCCIS indexed escalation. As the estimate was already in 2005 dollars, the escalation indices were applied to the estimated midpoint for each respective Subreach. A total construction period of 5-years and 5-months was assumed. While the current design provides improved solutions for the seepage problems, reduces or eliminates additional real estate acquisition cost and potentially reduces Operations & Maintenance; it does result in an increased cost for construction features of approximately \$19.8 million. Real estate and Operations & Maintenance cost are addressed and discussed further under their respective topic.

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Real Estate Cost Considerations:

The original MRR plan required real estate purchases involving approximately 300 parcels for construction and operations of the extended seepage trench and drainage swale. Real estate cost for lands required is a 100% local sponsor expense. This cost was unscheduled and was not budgeted for by the local sponsor. A major design objective during the development of the current design was the reduction of real estate impacts to the project. The current design reduces real estate acquisition and cost greatly; however, some expenses were incurred for two parcels (~3.5-acres in fee) and supporting temporary construction easements. Temporary construction easements are assumed for each construction Subreach contract.

After evaluation by SAJ-RE, a factor of 7% per year was used for escalation of MRR Plan 1999 real estate cost from the original MRR to 2005 dollars. Accordingly, real estate costs are shown in all plans in Table 1.

Project Service Life:

The initial MRR analyses for economic impacts were developed on a 50-year service life as is directed by ER 1105-2-100. Competing plans were compared on an equal basis. Cost and Benefits were determined to be 0.928 to 1 for the recommended plan. With identified likelihood of catastrophic dike failure due to piping, and subsequent potential for significant human suffering and loss of life, the MRR recommendation was made to implement rehabilitation of Reach 1 in the most efficient manner possible.

In accordance with ER 1110-2-8159 (addressing engineering and design for major Civil Works infrastructure projects such as locks, dams and levees), the HHD Reach 1 service life was further developed for 100-years to support comparisons under study in this summary. Both Total Present Worth Values and Total Annualized Value were developed in Table 1 for 50- and 100-years. The current 2005 discount rate of 5 3/8% was used.

Operations & Maintenance of Corrugated Metal Pipe Culvert System:

The original MRR recommended plan features a seepage/drainage berm with trench and filter fabric wrapped 48-Inch diameter corrugated metal pipe culvert with drop inlets spaced at 400-feet. Sixteen stop-log riser structures are also provided. Service life for the pipe system is considered as approximately 50 years for bituminous-coated 16 ga. galvanized steel culvert system. Estimated cost for replacement of 22.35-miles of pipe at year 50 is approximately \$15,000,000 (including costs for scope of work development, SIOH and solicitation of the contract package).

Maintenance requirements were reviewed and developed through interviews with the Construction Operations, South Florida Operations Office, and CO-OP in the district.

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The first activity identified was stop log operations for tailwater exercises for the MRR Plan. It was evaluated and averaged that one exercise would occur each year with an estimated cost of \$15,000. Present Worth for 50- and 100-Years was determined to be \$258,665 and \$277,572 respectively. These amounts were removed from the Current Plan O&M costs.

Routine cost for patrol, inspection and vegetation control, maintenance mowing, service road and crown maintenance/repair are required for all plans. Essentially, maintenance and replacement response activities would be nearly equal for the original alternative and the current design, but with the additional cost for stop log operations and periodic culvert pipe inspection, physical surveys and future replacement of culvert pipe at the end of the service life. Physical inspection of culvert systems is assumed to follow a five-year cycle, but may include physical inspection following significant weather events where the system has been stressed.

Professional services would be preferred for pipe inspection, and services would include mobilization, pipe line preparation (dewatering and venting for personnel access), closed circuit televised video of pipe systems, video defect coding reporting, system database management, and rehabilitation recommendations by formal report. Actual video inspection would have a per foot unit price ranging from \$1.40 to \$1.85 per foot. If inspection in the wet were required, sonar equipment and techniques would be used at \$4 per foot. Sonar is less reliable than CCTV and was not used in this analysis.

Estimated cost for the inspection service is approximately \$280,000 each 5-year period. District costs were also developed for preparing the contract package, SIOH and solicitation at \$70,000. Rounded total cost of \$350,000 was identified with a Present Worth value of \$1.084 million for 50-years and \$1.164 million for 100-years. As the current plan does not have the pipe systems, this amount was subtracted from the Current Design plan shown in Table 1.

Costs and Explanations Summary Conclusions:

The 2nd Revised MRR Plan (Revised Quantities in 2005 Dollars with CWCCIS) and the Current Design Revision (Based on Subreach 1A applied for 22.35 Miles in 2005 Dollars with CWCCIS) are now comparable in costs for equal estimating periods. The 2005 difference between Net Total Present Worth (50-Year) costs for two plans closed to approximately \$18.4 million from the \$19.8 million estimated construction difference; however, the economic impact for future pipe replacement and extended O&M are so distributed and discounted, the longer service life analysis does not significantly diminish the difference in total cost for construction and O&M. Note the 50- and 100-year service life difference in percentage is only 10.9% and 9.9% respectively for the two service life periods. The 100-year service life net is somewhat lower as \$17.2 million.

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Validation supporting the cost increases with the current design should recognize other measurable means than just the cost analysis deltas summarized in Table 1. The following items are to be considered:

- Applying unit cost from Subreach A to all Subreaches, the current estimate is a reasonable assumption. The major cost increase is the required partial cutoff wall. To encourage responsive and cost effective bids; three technical specifications are developed for the cutoff wall to offer maximum construction efficiency to potential bidders.
- Objectives to minimize real estate cost and encroachment beyond the original dike property boundaries were achieved. Approximately 300 real estate parcels were originally required. The funding resources for the South Florida Water Management District were not budgeted, and may not have come available to meet construction execution schedules. Delay of the for the original real estate requirements for the extended seepage design with drainage swell would have delayed the original MRR design execution. Elimination of potential schedule impacts from real estate assures recovery of schedule for construction with the Current Plan.
- The proposed current design will address and correct potential for failure of the dike caused by uncontrolled seepage and piping through the dike. The current design will perform for the extended 100-year life without a major replacement of seepage structure pipe systems in the future. Original piped seepage systems installed in the 1960's are now failing after some ~40 years of service. The expected service life for the Bentonite cutoff wall is 300-years.
- Finally, the current design more nearly achieves a single action solution without complicating O&M with frequent inspection of confined workspace pipe systems. Stop log operations for tailwater exercises during weather events are eliminated with the current plan. The requirement for future seepage drainpipe systems replacement is eliminated. When considering future O&M budget realities, it is not reasonable to obligate future O&M budget funding cycles to provide continued repair/replacement, maintenance and labor intensive actions when they can be eliminated by the current design solution.

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Table 2

Herbert Hoover Dike Reach 1 Major Rehabilitation					
Roll-Up Construction Estimate Based in Subreach 1A Final Design					
Subreach 1A Final Design In 1st Quarter 2005 Dollars					
	Reach 1A	Reach 1B	Reach 1C	Reach 1D	
Construction Cost:					
Seepage Berm with Partial Cut-off Wall	\$ 25,000,000	\$ 21,276,596	\$ 34,574,468	\$ 38,297,872	
Real Estate:	\$ -	\$ -	\$ -	\$ -	
Escalation:					
NTP Duration	6-May-2005 435	4-Oct-2006 370	3-Oct-2007 602	12-Nov-2008 666	
Completion Midpoint	15-Jul-06 09-Dec-05	09-Oct-07 07-Apr-07	26-May-09 29-Jul-08	09-Sep-10 11-Oct-09	
CWCCIS Indices					
CWBS 11 Est. Date	562.33	562.33	562.33	562.33	
Midpoint	574.93	589.26	603.46	618.72	
Total Escalation	\$ 560,169	\$ 1,018,937	\$ 2,528,849	\$ 3,840,480	
Subtotals:	\$ 25,560,169	\$ 22,295,533	\$ 37,103,317	\$ 42,138,352	
Total:	\$ 127,097,371	Use average of CWCCIS Indices: 1.067			